



# VCE PSYCHOLOGY

Units 3 & 4

**3RD EDITION**

Anna Lam, Bridie Goold, Dominic Marshall, Julia Ellul & Lucie Young

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**TYPESET BY** Kurt McCowen, Ellen Ortmann, Alex Ioan, David Hamra, Kyle Wilson, Sharni Fitzgerald, Matthew Calnan, Pamela Sicari

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# Science skills and research methods

01

**1A Aims, hypotheses and variables**

**1B Scientific research methodologies**

**1C Population, sample and sampling**

**1D Sources of error and prevention**

**1E Ethical considerations**

**1F Collection of data**

**1G Data organisation and interpretation**

**1H Evaluation of research**

This chapter will develop your knowledge of research methods, as well as the scientific skills you need to conduct and interpret research investigations in psychology. This will build the foundation of knowledge that you will use to conduct the practical investigation assessment for Unit 4 AOS 3. To do this, you will examine the key knowledge dot points related to research methods from Unit 4 AOS 3 in combination with the key science skills outlined in the study design.

## Key knowledge

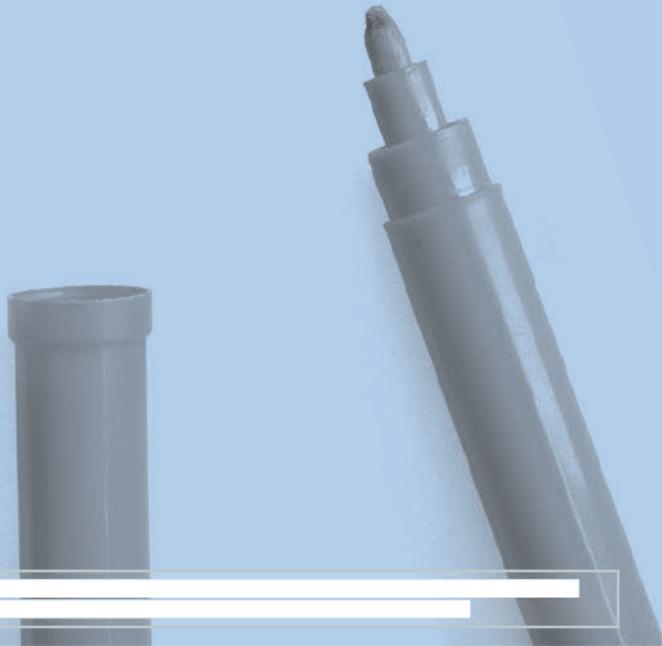
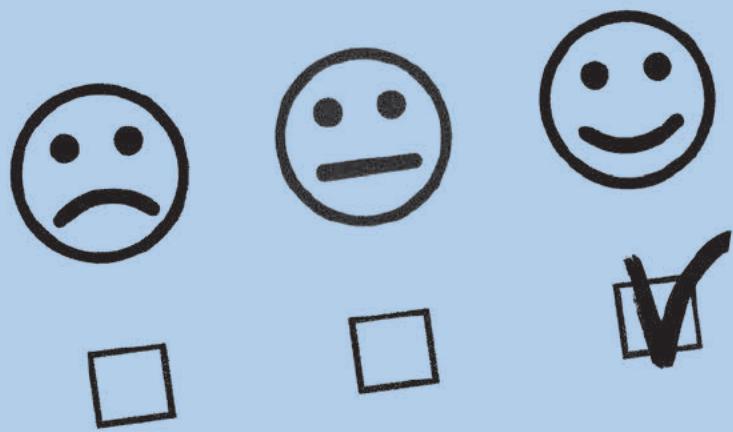
- independent and dependent variables and operationalisation of variables
- the psychological concepts specific to the investigation and their significance, including definitions of key terms, and psychological representations
- the characteristics of scientific research methodologies and techniques of primary qualitative and quantitative data collection relevant to the selected investigation: experiments, self-reports, questionnaires, interviews and/or use of rating scales; reliability and validity of data; and minimisation of experimental bias and confounding and extraneous variables
- ethics and issues of research including identification and application of relevant ethical, health and safety guidelines, and use of human subjects
- methods of organising, analysing and evaluating primary data to identify patterns and relationships including sources of error and limitations of data and methodologies
- models and theories, and their use in organising and understanding observed phenomena and psychological concepts including their limitations
- the nature of evidence that supports or refutes a hypothesis, model or theory
- generalisability of statistics from samples to the populations from which the sample was derived
- the key findings of the selected investigation and their relationship to psychological concepts and theories associated with neural function, consciousness, learning, memory and/or mental wellbeing
- conventions of psychological report writing and scientific poster presentation including psychological terminology and representations, standard abbreviations and acknowledgment of references



The development of a set of key science skills is a core component of the study of VCE Psychology and applies across Units 1 to 4 in all areas of study. In designing teaching and learning programs and in assessing student learning for each unit, teachers should ensure that students are given the opportunity to develop, use and demonstrate these skills in a variety of contexts when undertaking their own investigations and when evaluating the research of others.

#### Key science skills

- Develop aims and questions, formulate hypotheses and make predictions
- Plan and undertake investigations
- Comply with safety and ethical guidelines
- Conduct investigations to collect and record data
- Analyse and evaluate data, methods and scientific models
- Draw evidence-based conclusions
- Communicate and explain scientific ideas

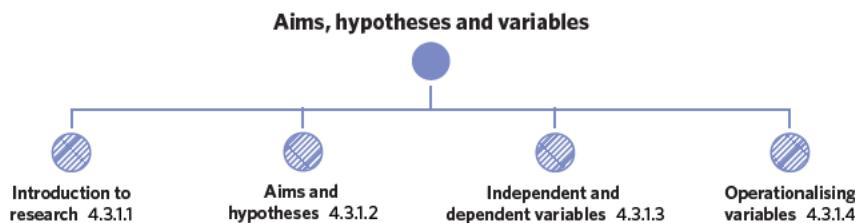


# 1A AIMS, HYPOTHESES AND VARIABLES

In this chapter, you will be learning about research methodology in psychology, and will begin to develop the scientific skills required to conduct your own experiment. You will continue to build upon these skills throughout the VCE Psychology course, and apply these skills to different psychological concepts.

1A. Aims, hypotheses and variables	1B. Scientific research methodologies	1C. Population, sample and sampling	1D. Sources of error and prevention	1E. Ethical considerations	1F. Collection of data	1G. Data organisation and interpretation	1H. Evaluation of research
<b>Study design dot point</b>							
<ul style="list-style-type: none"> <li>independent and dependent variables and operationalisation of variables</li> </ul>							
<b>Key science skills</b>							
<ul style="list-style-type: none"> <li>develop aims and questions, formulate hypotheses and make predictions: <ul style="list-style-type: none"> <li>determine aims, research hypotheses, questions and predictions that can be tested</li> <li>identify and operationalise independent and dependent variables</li> </ul> </li> <li>analyse and evaluate data, methods and scientific models: <ul style="list-style-type: none"> <li>distinguish between scientific and non-scientific ideas</li> </ul> </li> </ul>							
<b>Key knowledge units</b>							
Introduction to research							4.3.1.1
Aims and hypotheses							4.3.1.2
Independent and dependent variables							4.3.1.3
Operationalising variables							4.3.1.4

**In this lesson, you will start looking at research methods and the scientific skills** that you will need to conduct experiments. Specifically, looking at how to develop **aims and hypotheses**, with a focus on **identifying and operationalising variables**.



## Introduction to research 4.3.1.1

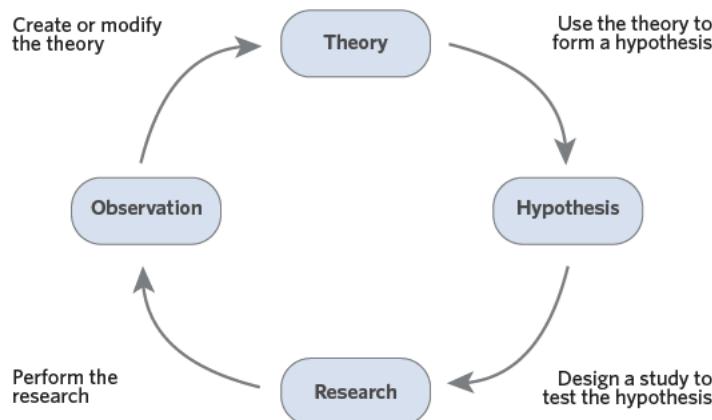
### OVERVIEW

Research in the field of psychology is conducted in line with the scientific method. This involves conducting experiments to test hypotheses in order to either validate or counter them.

### THEORY DETAILS

Modern psychology is studied as a science. This means that psychologists use the scientific method in order to study psychological phenomena. The scientific method involves developing testable predictions that scientists can test through carefully controlled and planned experiments in order to validate or invalidate them. Through these experiments, scientists collect empirical evidence and draw conclusions, contributing to the wider understanding of psychological phenomena.

In this chapter, you will learn about the research methods involved in psychological research in order to conduct your own experiment and apply this knowledge to different areas of the course. In this lesson, you will begin by looking at aims, hypotheses and variables: the foundations for conducting a research experiment.



**Figure 1** The scientific method involves testing a hypothesis in order to collect empirical evidence that informs a theory

## Aims and hypotheses 4.3.1.2

### OVERVIEW

When investigating a psychological concept, you must first develop an aim for your experiment and a hypothesis to test.

### THEORY DETAILS

When scientists conduct research, they start with a research question that they will try to answer through their study. The research question can be restated as an **aim**, which is a statement outlining the purpose of a study.

Some examples of research aims include:

- The aim of this study is to explore the differences in gender regarding the motivation to play team sports.
- The aim of this study is to establish a relationship between stress and the retrieval of episodic long term memory.

By outlining the purpose of an experiment in this way, researchers can clearly identify the scope of the experiment, and communicate this to their peers and colleagues.

From the aim of the experiment, researchers will develop a **hypothesis**, which is a testable prediction about the outcome of an experiment. There are two main components of a hypothesis that you need to be familiar with: the variables, which can be further broken down into the independent and dependent variables, and the population of interest to the research.

**Variables** are the components of the research that will be manipulated and measured, in order to test the hypothesis. You will learn more about the types of variables in research in the next part of this lesson. As psychology is the study of the human mind and behaviour, research is usually conducted on human participants. Research in psychology may focus on different groups of people, rather than all humans. The group of people who are of interest to the research is called the **population**.

Hypotheses are written as a statement and indicate the direction of the relationship between the variables in the experiment. Hypotheses need to be testable, that is, written in a way that can be supported or rejected through research.

**Aim** a statement outlining the purpose of the study

**Hypothesis** a testable prediction about the outcome of an experiment; it is written in the form of a statement and includes the variables that will be tested

**Variable** a factor or element of an experiment that may be manipulated or measured

**Population** the group of people of interest to an experiment, to which the results of the experiment are generalised to



It is often not possible to have an entire research population participate in an experiment. As such, researchers usually use a subset of the population, called a sample, to conduct their research on. The results of the experiment are then generalised to the population, even though not every member of the population took part in the experiment. You will learn more about this in lesson 1C: Population, sample and sampling.

Some examples of hypotheses include:

- It was hypothesised that males will report higher levels of motivation to play team sports than females.
- It was hypothesised that people who experience high levels of distress are less likely to be able to recall specific episodic long term memories than people with low levels of distress.

#### **Useful tip**

The things you need to include in your hypothesis are:

- The variables (independent and dependent)
- The direction of your hypothesis

Although it is not necessary to include the population of the study in your hypothesis, you won't lose marks if you choose to include it.

One way of remembering these components is with the acronym **iPaD** standing for:

- Independent variable
- Population
- and
- Dependent variable.

#### **Useful tip**

It is important to remember that hypotheses are written in the form of a statement. One way to structure your hypotheses is to start it with the following phrase "it was hypothesised that...". Using this phrase will ensure that your hypothesis is written as a statement, and not a question.

## **Independent and dependent variables** 4.3.1.3

### **OVERVIEW**

In scientific experiments, researchers try to establish a causal relationship between two variables. These variables are the independent variable and the dependent variable.

### **THEORY DETAILS**

A key component of the scientific method is that a theory is tested in a carefully controlled environment in order to collect empirical data, that is, data that has been collected through either observation or experimentation. One way of controlling the environment is through the manipulation and measurement of variables.

In an experiment,

- the **independent variable (IV)** is the variable that is manipulated in order to see the effects it has on the dependent variable.
- the **dependent variable (DV)** is the variable that is then measured, to see if it was affected by a change in the independent variable. That is, it is dependent (reliant upon) on the independent variable.

For example, a researcher wanting to test the effect of caffeine consumption on concentration may manipulate how much caffeine participants consume (the independent variable) and then measure if this affected participants' ability to concentrate (the dependent variable). By carefully controlling, manipulating and measuring variables in this way, researchers can either confirm or reject their hypothesis and contribute to the wider body of psychological knowledge and understanding.

**Independent variable (IV)** the variable that the experimenter manipulates in order to observe the effect it causes on the dependent variable

**Dependent variable (DV)** the variable that is being measured in an experiment for changes it experiences due to the independent variable

 **Memory device** Have you ever seen those big old TVs from the 80s and 90s? They have antennas on top of them that, when moved, affects what appears on the screen.

One way of remembering independent and dependent variables is by thinking of an "IV DV TV". The independent variable (IV) is like the antenna on top of the TV: experimenters modify the IV in order to see the effect that it has on the dependent variable (DV) (the image that appears on the TV screen).



 **Memory device** Another way of remembering the IV and DV is through **m&m**:

- IV is manipulated to cause an effect
- DV is measured for a change that has occurred



Image: Roman Samokhin/Shutterstock.com

## Operationalising variables 4.3.1.4

### OVERVIEW

Operationalising variables involves defining precisely how they will be manipulated and measured, specific to the experiment.

### THEORY DETAILS

When deciding upon the variables that need to be manipulated and measured, researchers also need to decide upon *how* this will be done. It is necessary for researchers to define the variables to this level of detail, as often the psychological concepts in research are broad and can be manipulated and measured in many different ways.

In the previous example, wherein the researcher wants to test the effects of caffeine consumption on concentration, there are many ways that the consumption of caffeine can be manipulated (number and types of coffees participants have consumed, number and types of soft drinks participants have consumed, a measure of caffeine concentration in participant's blood) and there are a number of ways that concentration can be measured (through the use of eye tracking on a task, reaction times).

Deciding on how these variables are manipulated and measured for a particular experiment is called **operationalisation**.

- The operationalised independent variable is then a statement of how the independent variable will be manipulated.
- The operationalised dependent variable is a statement of how the dependent variable will be measured.

**Operationalisation** the process of defining variables in terms of how they will be either manipulated or measured in the experiment

#### **Useful tip**

An operationalised hypothesis includes operationalised variables. Within this course, you need to be able to operationalise variables, but not write an operational hypothesis. However, if you write an operational hypothesis instead of a research hypothesis in the exam, you won't be penalised as long as the variables have been operationalised correctly.

#### **Want to know more?**

In this lesson, you have learned about two types of hypotheses: research hypotheses and operationalised hypotheses. There is a third type of hypothesis called a 'null hypothesis' which is a type of hypothesis where the prediction is that there will be no difference between the two groups.

### Theory summary

In this lesson, you have started to learn about scientific research in psychology, focussing on aims, hypotheses and variables. You should now be able to write both aims and hypotheses for experiments, specifically referring to the independent and dependent variables. You should also be able to operationalise variables. These are key scientific skills that you will build upon throughout this course in order to conduct your own scientific experiment and apply these skills to other psychological concepts.

## 1A Activities

- 1 Identify the IV and DV for the following studies.

Study	IV	DV
a It was hypothesised that smokers who underwent cognitive behavioural therapy were more likely to quit smoking than those who tried to quit using hypnosis		
b It was hypothesised that women over the age of 40 who reported having strong social connections would have a higher brain mass density than those who reported having weaker social connections		
c It was hypothesised that children who experience bullying will have poorer academic outcomes than children who are not bullied		

## 1A QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- Aim
- Variables
- Independent variable
- Operationalisation
- Hypothesis
- Population
- Dependent variable

- a The variable in an experiment that the researcher manipulates in order to determine its effect \_\_\_\_\_
- b A testable prediction concerning the outcome of an experiment \_\_\_\_\_
- c A process of defining how variables in a specific experiment will be manipulated and measured \_\_\_\_\_
- d The variable in an experiment that the researcher measures \_\_\_\_\_
- e The group of people of interest to an experiment, to which the results of the experiment are generalised to \_\_\_\_\_
- f A statement of the purpose of an experiment \_\_\_\_\_
- g A factor or element that may be manipulated or measured within an experiment \_\_\_\_\_

### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

In an experiment, the hypothesis is

- A a proposal that outlines the scope of a study.
- B a statement relating to the population of interest to the research.
- C a testable prediction of the relationship between the independent and dependent variables.
- D a statement outlining the purpose of the study.

#### Question 3 (1 MARK)

The dependent variable in an experiment is

- A the variable that is measured by the researcher.
- B the variable that is manipulated by the researcher.
- C the variable that is changed by the researcher.
- D the variable that has caused unwanted effects in the study.

**Question 4** (1 MARK)

What is an operationalised variable?

- A A variable that the researcher manipulates.
- B A variable that the researcher measures.
- C A variable that has defined how it will be either measured or manipulated.
- D A variable that determines the outcome of the study.

**Apply and analyse****Question 5** (1 MARK)

Dominic is a researcher who hypothesised that listening to music while studying would divide student's attention, and therefore result in poorer academic performance than those who did not listen to music.

The independent and dependent variables for this study are respectively,

- A IV: whether students listened to music while studying or not; DV: if students had divided attention
- B IV: whether students listened to music while studying or not; DV: a measure of students' academic performance
- C IV: a measure of students' academic performance; DV: if students had divided attention
- D IV: a measure of students' academic performance; DV: whether students listened to music while studying or not

**Question 6** (1 MARK)

Maria is a researcher who is interested in the use of mnemonics to increase students' ability to remember.

An operationalised dependent variable for this experiment would be

- A the type of mnemonic that students learned.
- B the number of mnemonics that students learned.
- C how much students remembered.
- D how many new terms students could recall on a memory test.

**Question 7** (2 MARKS)

Cameron is investigating the effect of diet on mood. He recruits participants from his local gym and asks them to record what they eat for a week in a food diary. At the end of the week, he asks participants to complete an online questionnaire about their mood throughout the week.

Identify the independent and dependent variables for this study.

IV: \_\_\_\_\_

DV: \_\_\_\_\_

**Question 8** (2 MARKS)

A researcher wanted to see if meditation affected students' test scores.

Operationalise possible independent and dependent variables for this study.

Operationalised IV: \_\_\_\_\_

Operationalised DV: \_\_\_\_\_

**Question 9** (3 MARKS)

Dr Samin wanted to investigate the effect of sleep deprivation on academic performance in high school students.

Write a research hypothesis for this investigation.

**Question 10** (3 MARKS)

Zion is a psychology PhD student and is currently conducting an investigation into the effect of stress on cognitive functioning.

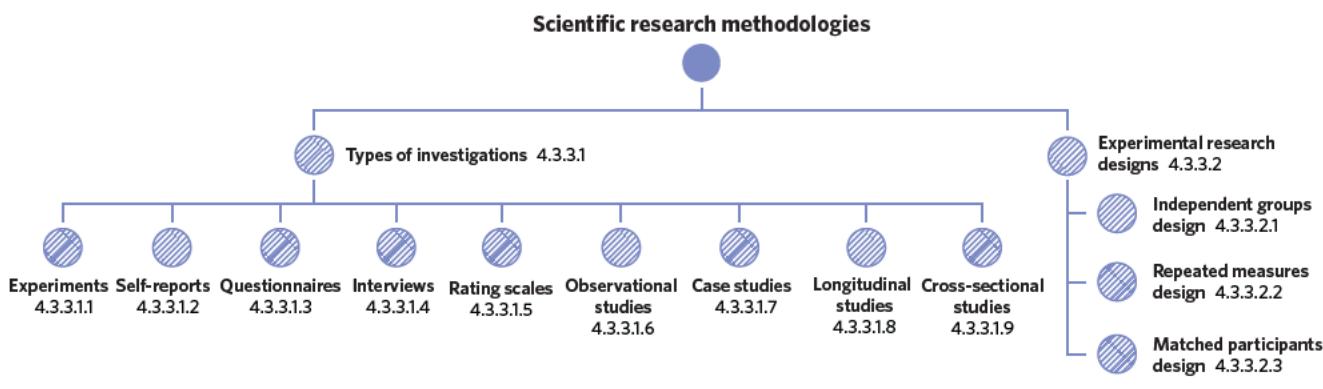
Write a research hypothesis for this investigation.

# 1B SCIENTIFIC RESEARCH METHODOLOGIES

So far in this chapter, you have learned about research aims, hypotheses and variables. Once a researcher knows what area of research they want to study, they must then decide how they will conduct their research in order to obtain the most accurate and useful results. In this lesson, you will learn about different scientific research methodologies that can be used, and how researchers weigh up the benefits and limitations of each in deciding which one to use.

1A. Aims, hypotheses and variables	1B. Scientific research methodologies	1C. Population, sample and sampling	1D. Sources of error and prevention	1E. Ethical considerations	1F. Collection of data	1G. Data organisation and interpretation	1H. Evaluation of research
<b>Study design dot point</b>							
<ul style="list-style-type: none"> <li>the characteristics of scientific research methodologies and techniques of primary qualitative and quantitative data collection relevant to the selected investigation: experiments; self-reports; questionnaires; interviews and/or use of rating scales; reliability and validity of data; and minimisation of experimental bias and confounding and extraneous variables</li> </ul>							
<b>Key science skills</b>							
<ul style="list-style-type: none"> <li>Plan and undertake investigations: <ul style="list-style-type: none"> <li>determine appropriate type of investigation: experiments (including use of control and experimental groups); case studies; observational studies; self-reports; questionnaires; interviews; rating scales; access secondary data, including data sourced through the internet that would otherwise be difficult to source as raw or primary data through fieldwork, a laboratory or a classroom</li> <li>use an appropriate experimental research design including independent groups, matched participants, repeated measures and cross-sectional studies</li> </ul> </li> </ul>							
<b>Key knowledge units</b>							
Experiments (Types of investigations) 4.3.3.1.1							
Self-reports (Types of investigations) 4.3.3.1.2							
Questionnaires (Types of investigations) 4.3.3.1.3							
Interviews (Types of investigations) 4.3.3.1.4							
Rating scales (Types of investigations) 4.3.3.1.5							
Observational studies (Types of investigations) 4.3.3.1.6							
Case studies (Types of investigations) 4.3.3.1.7							
Longitudinal studies (Types of investigations) 4.3.3.1.8							
Cross-sectional studies (Types of investigations) 4.3.3.1.9							
Independent group design (Experimental research designs) 4.3.3.2.1							
Repeated measures design (Experimental research designs) 4.3.3.2.2							
Matched participants design (Experimental research designs) 4.3.3.2.3							

In this lesson, you will be learning about different scientific research methodologies. You will be learning about different types of investigations that can be conducted, including **experiments, case studies, observational studies, self-reports, questionnaires, interviews and rating scales**. You will focus on experimental research designs, looking at the different ways in which a researcher can set up their experiments. You will also be looking at the **benefits and limitations** of each of these methodologies.



## Types of investigations 4.3.3.1

### OVERVIEW

There are many different types of investigations that a researcher can conduct in order to collect data for their study. In this section you will learn about the different types of scientific investigations researchers can choose from, as well as the benefits and limitations of each.

### THEORY DETAILS

In the previous lesson, you learned about how researchers formulate an aim and hypothesis for an area of research that they are interested in. Once these and the variables of interest are decided upon, researchers must then choose the type of investigation they want to conduct. You may have encountered different research methodology before, such as participating in an experiment yourself or filling out a questionnaire. Each form of investigation has its own strengths and limitations. Choosing what type of investigation you want to conduct depends on the hypothesis you are trying to test, and the type of data that you want to collect.

Table 1 outlines the scientific research methodologies (different types of scientific investigations) you need to be familiar with for this course. Each of these methodologies follow the scientific method in order to obtain empirical data.

**Table 1** Types of research methodologies

Research methodology	Description	Example
<b>Experiments</b> 4.3.3.1.1	An <b>experiment</b> measures a cause and effect relationship between variables within a controlled setting.	<ul style="list-style-type: none"> <li>A researcher is interested in the effect of dogs on self-reported happiness.</li> <li>They set up an experiment within a controlled setting, where one group of participants played with a dog for five minutes before completing a questionnaire assessing their level of happiness.</li> <li>Another group completed the questionnaire without playing with any dogs.</li> <li>The researcher then compared the results of the two groups.</li> </ul>
<b>Self-report</b> 4.3.3.1.2	<b>Self-report</b> methodologies involve participants providing their own account of an experience. Therefore the data collected is subjective. Self-report data can be collected through a variety of means, including questionnaires, interviews and rating scales.	<ul style="list-style-type: none"> <li>At the end of your semester, you may fill in a questionnaire about how you felt about the class, the assignments that were set and your teacher.</li> <li>These are subjective reports of your experience of the class and are an example of a self-report.</li> </ul>
<b>Questionnaires (self-report)</b> 4.3.3.1.3	<b>Questionnaires</b> are also known as surveys. They include a list of questions created by the researcher for participants to respond to. They can be administered in a variety of ways including paper-and-pencil questionnaires, electronic or online questionnaires. Questions can be open (in which participants write their response without constraints) or closed (in which participants choose from a predetermined list of responses).	<ul style="list-style-type: none"> <li>When you use a service online, you may be emailed a questionnaire afterwards asking for your response to questions about your experience.</li> <li>Open questions may include 'do you have any feedback that you'd like to share with us?'.</li> <li>Closed questions may include 'were you satisfied with the service provided?' to which you could choose either 'yes' or 'no'.</li> </ul>
<b>Interviews (self-report)</b> 4.3.3.1.4	<b>Interviews</b> are usually conducted verbally, with the researcher asking questions of the participants and recording their responses. Interviews may come in many forms, and can be structured (involving a set of predetermined questions) or free-form (wherein the researcher may change, adapt or add questions during the interview).	<ul style="list-style-type: none"> <li>A policeman asks an eye-witness a series of questions about the events in the lead up to a crime.</li> <li>The responses the eye-witness provides may change the next question the policeman asks, reflecting that interviews can be free-form.</li> </ul>

Table 1 Types of research methodologies

Research methodology	Description	Example	
<b>Rating scales (self-report)</b> 4.3.3.1.5	<b>Rating scales</b> are a form of self-report in which participants give a numerical score on a scale to indicate their response to a set of questions.	<ul style="list-style-type: none"> <li>The rating out of five stars that you give your Uber driver after completing a trip is an example of a rating scale.</li> </ul>	<b>Rating scale</b> a form of questionnaire collecting numerical data from participants' responses
<b>Observational studies</b> 4.3.3.1.6	An <b>observational study</b> is when behaviour is observed and recorded by the researcher. This can be preferable to using self-report when researching concepts in which there may be a discrepancy between participants' responses and their actions.	<ul style="list-style-type: none"> <li>A researcher is interested in whether people will help a distressed person in a public space.</li> <li>They set up a situation where a confederate (a person who is secretly a part of the experiment) falls and appears to be unconscious.</li> <li>The researcher observes the actions of the people around the confederate and records how many people attend to them.</li> <li>This may provide more accurate results than a self-report, wherein the participants response is influenced by how they believe or wish they would respond.</li> </ul>	<b>Observational study</b> a type of study in which data is collected through careful monitoring of participants
<b>Case studies</b> 4.3.3.1.7	<b>Case studies</b> involve focussing on one person or just a few individuals, looking at the variables relevant to the study in detail.  Data can be collected in many formats (subjective self-report data, objective quantitative data) and from many different sources (through interviews, medical records, observation).  Case studies are used when large sample sizes are not easily obtainable, or the phenomena being studied is rare or difficult to replicate. This is often the case when participants have a rare condition of interest to a researcher.	<ul style="list-style-type: none"> <li>The case study of Phineas Gage may be one that you are familiar with.</li> <li>Phineas was a railway worker who survived being impaled by a metal rod through his frontal lobe.</li> <li>His case study helped psychologists to understand the functions of the frontal lobe.</li> </ul>	<b>Case study</b> an in-depth study of an individual or a group of individuals
<b>Longitudinal studies</b> 4.3.3.1.8	<b>Longitudinal study</b> gathers data from the same participants over an extended time period in order to see differences or changes in specific variables over time.	<ul style="list-style-type: none"> <li>The 'Up' documentary series is an example of a longitudinal study in which data was collected from fourteen British children every seven years, beginning in 1964 when they were seven years old.</li> <li>The study followed up every seven years and the latest instalment in the series, <i>63 up</i>, was released in 2019.</li> </ul>	<b>Longitudinal study</b> a type of investigation in which data is gathered from participants over an extended period of time, and the participants are followed up after specific time intervals
<b>Cross-sectional studies</b> 4.3.3.1.9	<b>Cross-sectional studies</b> involve a researcher measuring different variables in a population at a single point in time. Often, this involves gathering data from groups of participants of different ages (called cohorts) in order to compare trends in different age groups in an efficient manner, rather than performing a longitudinal study spanning decades. This provides a 'snapshot' of data of a specific point in time.	<ul style="list-style-type: none"> <li>A researcher is interested in the dietary habits of different age groups.</li> <li>They study a group of people in their 20s and compare them to groups of people in their 30s and a group of 40 year-old individuals.</li> </ul>	<b>Cross-sectional study</b> when data is collected from participants from different segments of the population (pre-existing cohorts) to represent a 'snapshot' in time

Want to know more? \_\_\_\_\_

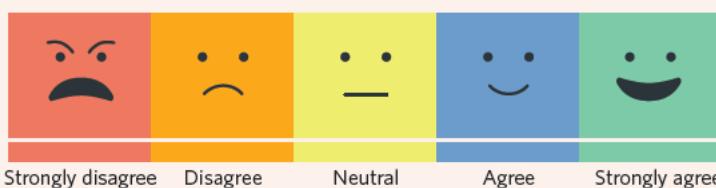


Figure 1 Example of a Likert scale

A common type of rating scale that you may have seen before is called the *Likert scale*.

The Likert scale asks participants to respond to statements with 'strongly disagree, disagree, neutral, agree or strongly agree' and assigns a numerical value (such as a value of 1-5) for each of these responses in order to obtain quantitative data that can be easily measured and compared.

**Table 2** Benefits and limitations of different research methodologies

<b>Research methodology</b>	<b>Benefits</b>	<b>Limitations</b>
<b>Experiments</b> 4.3.3.1.1	<ul style="list-style-type: none"> <li>Variables can be carefully controlled, manipulated and measured so that a cause-effect relationship can be determined.</li> <li>Experiments can also be replicated by other researchers in order to ensure the reliability of the results.</li> </ul>	<ul style="list-style-type: none"> <li>Despite being conducted in a carefully controlled environment, sometimes other variables (confounding variables) can still affect the dependent variable, invalidating the results.</li> <li>Depending on what is being studied, sometimes the variables aren't easily manipulated or measured, or there are too many variables to do so accurately.</li> <li>Some phenomena cannot be measured in a controlled environment.</li> </ul>
<b>Self-report</b> 4.3.3.1.2	<ul style="list-style-type: none"> <li>Self-reports are useful as some behaviours and opinions cannot be directly observed.</li> <li>Participant accounts of these through a self-report can allow researchers to obtain data they otherwise couldn't access.</li> </ul>	<ul style="list-style-type: none"> <li>The data collected is subjective data, which can be difficult to compare and analyse.</li> <li>People don't always provide accurate responses. They may instead respond with what they think researchers would want, and so the validity of responses is difficult to establish.</li> </ul>
<b>Questionnaires (self-report)</b> 4.3.3.1.3	<ul style="list-style-type: none"> <li>Questionnaires can often be completed in a short time frame and can administered in large numbers.</li> <li>Lots of data can be collected and can be easily compared between participants.</li> </ul>	<ul style="list-style-type: none"> <li>The data collected may not be as detailed as other forms of investigation, such as in an interview, especially if closed questions are used.</li> </ul>
<b>Interviews (self-report)</b> 4.3.3.1.4	<ul style="list-style-type: none"> <li>Researchers can obtain lots of qualitative data as responses are open.</li> <li>They can change/adapt questions as they go, dependent on the participants' responses, allowing for a more holistic understanding of the participants' experience.</li> </ul>	<ul style="list-style-type: none"> <li>Interviews can be time-consuming and costly to conduct for large samples.</li> <li>It is difficult to ensure standardised procedures for each participant, especially if there are multiple interviewers, and as such error in the data collected can make it difficult to compare across participants.</li> </ul>
<b>Rating scales (self-report)</b> 4.3.3.1.5	<ul style="list-style-type: none"> <li>Fixed responses on rating scales means that the data collected can be easily measured and compared.</li> </ul>	<ul style="list-style-type: none"> <li>Without qualitative data in participants' self-report, it is difficult for researchers to develop a holistic understanding of participants' responses, such as understanding the motivation behind specific responses.</li> </ul>
<b>Observational studies</b> 4.3.3.1.6	<ul style="list-style-type: none"> <li>Observational studies can allow researchers to collect data in a naturalistic setting so that the behaviours they observe are more representative of what would occur, rather than in a controlled experimental setting.</li> <li>Observational studies can also occur in controlled, laboratory settings, allowing the researcher to have an active involvement in the conditions of the setting and the procedures involved.</li> <li>Researchers are not required to manipulate variables or intervene with participant's behaviours.</li> </ul>	<ul style="list-style-type: none"> <li>It is difficult for researchers to establish a causal relationship between variables, because they are unable to intervene to manipulate variables.</li> <li>The interpretation and recording of data is subjective and therefore prone to experimenter bias.</li> </ul>
<b>Case studies</b> 4.3.3.1.7	<ul style="list-style-type: none"> <li>Very detailed data can be collected, and researchers can gain a lot of insight into specific cases.</li> <li>This allows researchers to have a deeper understanding of the individual/s and the particular phenomenon being studied.</li> </ul>	<ul style="list-style-type: none"> <li>Case studies only focus on an individual, or a small group of people, and as such it makes the findings of the case study difficult to generalise to a larger population.</li> <li>This is because the few people in the case study are not representative of a larger group of people.</li> </ul>
<b>Longitudinal studies</b> 4.3.3.1.8	<ul style="list-style-type: none"> <li>A lot of detailed data can be collected about individuals over a long period of time.</li> <li>Data about long-term change can be collected whilst minimising participant variables, as it is the same participants that are followed up over the period of the study.</li> </ul>	<ul style="list-style-type: none"> <li>Longitudinal studies can be expensive, as well as being difficult to conduct.</li> <li>Many extraneous variables are more difficult to control over the long period of the study.</li> </ul>
<b>Cross-sectional studies</b> 4.3.3.1.9	<ul style="list-style-type: none"> <li>Data on long-term trends and changes over time can be collected in the short term.</li> <li>This type of study is more efficient and less costly than conducting a longitudinal study.</li> </ul>	<ul style="list-style-type: none"> <li>There can be extraneous variables in the different cohorts (age groups) that aren't related to age, such as different social or cultural experiences.</li> <li>This makes it difficult to make comparisons across the cohorts and come to valid conclusions based on the data collected.</li> </ul>

Sometimes researchers use a range of different methods for one study. For example, a researcher may conduct a case study on migraines involving three individuals. As a part of this study, the researcher may conduct interviews with the participants, as well as asking participants to record a daily pain score using a rating scale. This rating scale may be a part of a larger questionnaire, in which participants also respond to questions about their subjective pain experience.

As seen in this example, researchers make decisions about what types of investigations they want to conduct based on the type of data they want to collect, and the benefits and limitations of each research method.

## Experimental research designs 4.3.3.2

### OVERVIEW

A common type of investigation that is conducted by researchers are experiments. There are three types of experimental designs with which you need to be familiar: independent groups design, repeated measures design and matched participants design.

### THEORY DETAILS

Experiments are commonly conducted as a means of research as researchers have more control over the variables and are more able to accurately manipulate and measure them when conducting the experiment. There are three types of experimental designs that you should be familiar with: independent groups design, repeated measures design and matched participants design. Each experimental design has its own strengths and limitations. Choosing the type of experimental design should depend on the phenomena you are interested in and the type of data you wish to collect. Table 3 outlines these different experimental designs.

In each of these experimental designs there are control and experimental groups:

- The **control group** serves as a baseline or ‘control’ for the experiment, as they are not exposed to the independent variable. The control group allows for the researcher to establish a causal relationship between the independent and dependent variable. It helps to validate that the changes to the dependent variable have resulted from the independent variable and not something else.
- The **experimental groups** are exposed to the independent variable in order to test the effect that it has. In experiments, there may be one or more experimental groups depending on the research that is being conducted.

The strengths and limitations of each experimental design are outlined in table 4.

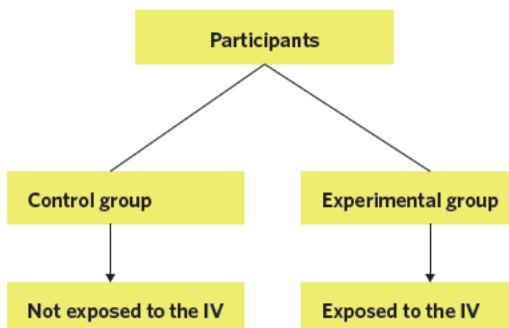


Figure 2 The control group are not exposed to the independent variable

Table 3 Experimental research designs

Experimental design	Description	Diagram	Example
<b>Independent group design (between-groups design) 4.3.3.2.1</b>	Participants in the study are split through random allocation into two or more groups, as either: <ul style="list-style-type: none"> <li>the control group (participants are not exposed to the IV) and one or more experimental groups (participants are exposed to the IV).</li> <li>two or more experimental groups (participants are exposed to variations of the IV).</li> </ul>	Condition A      Condition B 	<ul style="list-style-type: none"> <li>A researcher is investigating the effects of listening to music on concentration.</li> <li>A coin is flipped between all participants in the sample to decide who is allocated to the control group (don't listen to music while studying) and who is allocated to the experimental group (listen to music while studying).</li> </ul>
<b>Repeated measures design (within-groups design) 4.3.3.2.2</b>	The same participants are in both the control and experimental condition, or both/all experimental conditions. They will participate in one condition first, and then the other/s.	Condition A      Condition B 	<ul style="list-style-type: none"> <li>All participants study for one hour listening to music, and then study for another hour without music.</li> </ul>
<b>Matched participants design 4.3.3.2.3</b>	Participants are matched based upon key characteristics relevant to the investigation, such as age, gender or height. Each pair is split between the control and experimental group, or between either experimental condition to ensure an even distribution of the characteristics for which they have been matched.	Condition A      Condition B 	<ul style="list-style-type: none"> <li>Participants in the control and experimental conditions are matched based upon their age and previous SAC score before being allocated into either the music or non-music condition.</li> </ul>

**Control group** a group that is used as a basis for comparison; participants are not exposed to the experimental condition/s (the IV)

**Experimental group** the group within an experiment that are exposed to experimental conditions (the IV)

**Independent groups design (also known as between groups design)** an experimental design in which participants are split into two or more groups; typically a control group and an experimental group/s

**Repeated measures design (also known as within groups design)** an experimental design in which the same participants are in every condition of the experiment

**Matched participants design** an experimental design in which participants are paired based upon relevant characteristics, whereupon one member of the pair is tested in one condition, and the other member is tested in the other

**Useful tip**

For each research scenario, it is important to read the information provided carefully in order to understand the experimental design.

**Want to know more?**

Although all experiments require a control group, some research studies do not use them. This research is a quasi-experimental study as it is a method of investigation which lacks the power to reveal a cause-effect relationship between variables. For example, in an independent groups experimental design researching the effects of caffeine, there may be three experimental groups who are consuming different quantities of caffeine but no control group who aren't consuming any caffeine.

**Table 4** Strengths and limitations of different experimental design

Experimental design	Strengths	Limitations
<b>Independent group design (between-groups design)</b> 4.3.3.2.1	<ul style="list-style-type: none"> <li>Efficient and cost effective, as participants do not need to be matched on relevant characteristics (matched participants) and the experiment does not need to be repeated (repeated measures).</li> </ul>	<ul style="list-style-type: none"> <li>Participant differences can affect results, especially if it is a small sample.</li> </ul>
<b>Repeated measures design (within-groups design)</b> 4.3.3.2.2	<ul style="list-style-type: none"> <li>Requires fewer participants, as each participant is involved in multiple groups.</li> <li>Eliminates participant differences between the control and experimental groups, as the same participants are in both conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Order effects may occur, due to the order in which participants partake in either the control or experimental conditions.</li> </ul>
<b>Matched participants design</b> 4.3.3.2.3	<ul style="list-style-type: none"> <li>Decreases participant variables, as participants are matched upon relevant characteristics between the control and experimental groups.</li> </ul>	<ul style="list-style-type: none"> <li>More time-consuming as characteristics relevant to the study must first be identified, and participants must be matched according to them.</li> <li>Could be more expensive to conduct the experiment, as there is an added step of identifying the characteristic and matching participants.</li> </ul>

## Theory summary

In this lesson, you have learned about different scientific research methodologies that researchers could use when conducting a study. Each methodology has its benefits and limitations. Researchers must consider these, as well as the type of data they are trying to collect, when deciding which methodology to use. You should now be able to explain each of these methodologies, and be able to distinguish between them.



You will learn more about the limitations of the different experimental research designs in lesson **1D: Sources of error and prevention**, in which you will also learn about how the effects of these limitations can be minimised when designing an experiment.

# 1B QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |                 |                       |                             |                               |
|-----------------|-----------------------|-----------------------------|-------------------------------|
| • Experiment    | • Rating scale        | • Cross-sectional study     | • Repeated measures design    |
| • Self-report   | • Observational study | • Independent groups design | • Matched participants design |
| • Questionnaire | • Case study          | • Experimental group        |                               |
| • Interview     | • Longitudinal study  | • Control group             |                               |
- a An experimental design in which all participants participate in both the control and experimental conditions \_\_\_\_\_
- b A type of questionnaire and self-report method in which participants respond to questions on a numerical scale \_\_\_\_\_
- c An investigation method in which researchers control, manipulate and measure variables in order to establish a cause and effect relationship \_\_\_\_\_
- d Within an experiment, the group of participants who are exposed to the independent variable \_\_\_\_\_
- e A type of investigation in which researchers closely watch participants and record data based on what they see \_\_\_\_\_
- f A type of study that is conducted over an extended period of time, wherein the same participants are followed up periodically throughout the length of the study \_\_\_\_\_

- g An experimental design in which participants are split by random allocation into two groups: one that is exposed to the IV, and one that is not \_\_\_\_\_
- h Within an experiment, the group of participants who are not exposed to the independent variable \_\_\_\_\_
- i Usually conducted verbally, this type of investigation requires researchers to ask participants a series of questions and record their responses \_\_\_\_\_
- j A method of collecting data that involves participants' subjective experience \_\_\_\_\_
- k An in-depth and detailed study about an individual or a small group of individuals \_\_\_\_\_
- l A type of experimental research design in which participants are matched based upon characteristics relevant to the study, and one of each pair are allocated to the control and experimental groups \_\_\_\_\_
- m A type of investigation that gathers data from different groups of participants (usually based on age groups) to collect data that represents a specific point in time \_\_\_\_\_
- n A type of investigation that involves administering a list of questions for participants to respond to \_\_\_\_\_

### Exam-style questions

#### Remember and understand

##### Question 2 (1 MARK)

The purpose of a control group is to

- A provide a baseline against which the effects of the independent variable are measured.
- B provide a baseline against which the effects of the dependent variable are measured.
- C ensure that a causal relationship between the independent and control variables can be established.
- D none of the above.

##### Question 3 (1 MARK)

An advantage of using a matched-participants research design is that

- A the results are easily generalised.
- B it produces highly detailed results.
- C participant variables are more controlled for than in the independent groups design.
- D conclusions can easily be drawn about the effect of the IV on the DV.

##### Question 4 (1 MARK)

In a matched-participants design

- A all participants are used in the control and experimental conditions.
- B the same participants are used in both the control and experimental conditions.
- C the same participants are used in one trial of both the control and experimental conditions, and different participants are used in subsequent trials.
- D participants are put into pairs and one member of each pair is placed in the control condition, and the other member is placed in the experimental condition.

Adapted from VCAA 2013 exam MCQ10

##### Question 5 (1 MARK)

Outline one limitation of using interviews as the only method to collect data for a study.

##### Question 6 (2 MARKS)

Outline one strength and one limitation of using case studies.

**Apply and analyse****Question 7** (1 MARK)

In an experiment studying the impact of exercise on stress, the control group should

- A not exercise at all.
- B exercise as often as the experimental group.
- C be able to choose whether to exercise or not.
- D exercise more often than the experimental group.

*Adapted from VCAA 2013 exam MCQ22*

**Question 8** (1 MARK)

Dr Moeller is researching language aphasia. She asks Lukas, one of her stroke patients, to undertake a series of tasks involving language comprehension so that she can observe the possible changes to language functioning as a result of his stroke.

Dr Moeller's study is an example of

- A single-participant experimental design.
- B case study.
- C independent-groups experiment.
- D repeated-measures experiment.

*Adapted from VCAA 2015 exam MCQ38*

**Question 9** (2 MARKS)

Dr Garfield is researching the effect of sleep deprivation on weight gain. She recruits 50 participants between the ages of 30 and 50 to participate. Based on their responses to a survey, she allocates them to three groups:

- Group 1: individuals who sleep less than 5 hours on average a night
- Group 2: individuals who sleep between 5 and 7 hours on average a night
- Group 3: individuals who sleep for more than 7 hours on average a night

She asks participants to track their weight on a daily basis for 6 months.

Name the experimental research design Dr Garfield is using and describe one advantage of this design.

**Question 10** (2 MARKS)

Emilia wanted to test the effect of exercise on self-reported wellbeing. She hypothesised that participants who had not routinely exercised for the past month would report having an increased level of wellbeing after exercising consistently for 3 months.

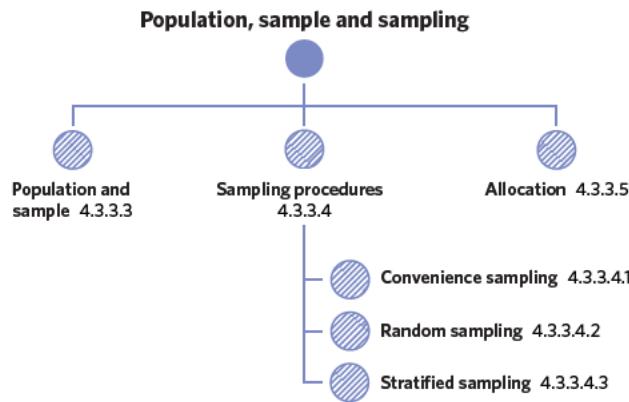
Describe how Emilia could use one experimental research design to investigate her hypothesis.

# 1C POPULATION, SAMPLE AND SAMPLING

So far in this chapter, you have started to learn about research methodology in psychology. You have learned about the scientific method and how to write aims and hypotheses, and decide what type of study to conduct. Now, you will learn about how researchers can recruit participants for psychological studies and the methods they use to ensure their results can be applied to the population of interest.

1A. Aims, hypothesis and variables	1B. Scientific research methodologies	1C. Population, sample and samplings	1D. Sources of error and prevention	1E. Ethical considerations	1F. Collection of data	1G. Data organisation and interpretation	1H. Evaluation of research										
<b>Study design dot point</b>																	
<ul style="list-style-type: none"> <li>the characteristics of scientific research methodologies and techniques of primary qualitative and quantitative data collection relevant to the selected investigation: experiments, self-reports, questionnaires, interviews and/or use of rating scales; reliability and validity of data; and minimisation of experimental bias and confounding and extraneous variables</li> </ul>																	
<b>Key science skills</b>																	
<ul style="list-style-type: none"> <li>Plan and undertake investigations: <ul style="list-style-type: none"> <li>select appropriate sampling procedures for selection and allocation of participants including random sampling, stratified sampling, convenience sampling and random allocation of participants to groups</li> </ul> </li> </ul>																	
<b>Key knowledge units</b>																	
<table> <tbody> <tr> <td>Population and sample</td> <td>4.3.3.3</td> </tr> <tr> <td>Convenience sampling (Sampling procedures)</td> <td>4.3.3.4.1</td> </tr> <tr> <td>Random sampling (Sampling procedures)</td> <td>4.3.3.4.2</td> </tr> <tr> <td>Stratified sampling (Sampling procedures)</td> <td>4.3.3.4.3</td> </tr> <tr> <td>Allocation</td> <td>4.3.3.5</td> </tr> </tbody> </table>								Population and sample	4.3.3.3	Convenience sampling (Sampling procedures)	4.3.3.4.1	Random sampling (Sampling procedures)	4.3.3.4.2	Stratified sampling (Sampling procedures)	4.3.3.4.3	Allocation	4.3.3.5
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**In this lesson, you will be learning about** how researchers choose a sample from a population and the sampling techniques they can use. Specifically, you will learn about what ensures a representative sample is obtained, the sampling methods of **random sampling, convenience sampling** and **stratified sampling**, as well as the benefits and limitations of each.



## Population and sample 4.3.3.3

### OVERVIEW

The field of psychology focuses on the human mind and behaviour. As such, studies in psychology differ from the other sciences in that most use human participants to investigate psychological phenomena. When conducting experiments with people, the concepts of population, sampling and samples are important to consider to ensure that the extent to which the results of the experiment can be applied to the research population can be established.

## THEORY DETAILS

In an experiment, researchers try to discover trends or learn new information about a group of people. This group of people who are of interest to the study is called the **population**. However, it is not possible for everyone within the population that you are interested in to participate in the experiment. For example, you might be interested in studying trends in the Australian population, or the population of a specific high school. In both of these examples, the number of people in the population would exceed a researcher's ability to conduct an experiment involving the entire population. As such, researchers work with a smaller group of people that are meant to represent the population. This subset of people is called the **sample**. An ideal sample of people should reflect the population in regards to characteristics that are relevant to the study, so that the results of the experiment can be generalised back to the population. This is called a representative sample, because the sample of participants *represents* the population accurately.

A representative sample is dependent on:

- The size of the sample: the larger the sample, the more likely it is to be representative of the population.
- Whether the sample is biased or unbiased.
- Whether the characteristics of participants relevant to the particular study (such as their age, gender and level of education) are represented in the sample in proportion to how they appear in the population.

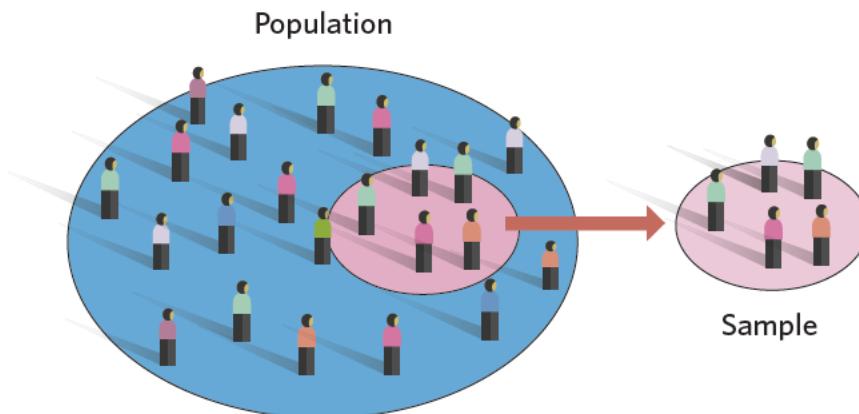


Image: Bakhtiar Zein/Shutterstock.com

Figure 1 The sample is a subset of the population of interest

## Sampling procedures 4.3.3.4

### OVERVIEW

There are different procedures through which the sample for an experiment can be chosen. Each of these procedures has its own strengths and limitations, which should be weighed up when deciding which procedure to use for a particular experiment.

### THEORY DETAILS

**Sampling** is the process of choosing the sample of people from the population for an experiment.

There are different methods of choosing these participants:

- Convenience sampling
- Random sampling
- Stratified sampling

These sampling procedures are summarised in table 1, and the benefits and limitations of each are summarised in table 2.

**Population** (also known as the **research population**) the group of interest to the study, from which the sample is drawn

**Sample** a subset of the population, commonly referred to as the research participants

**Sampling** the process through which the participants for a study are selected from the population of interest

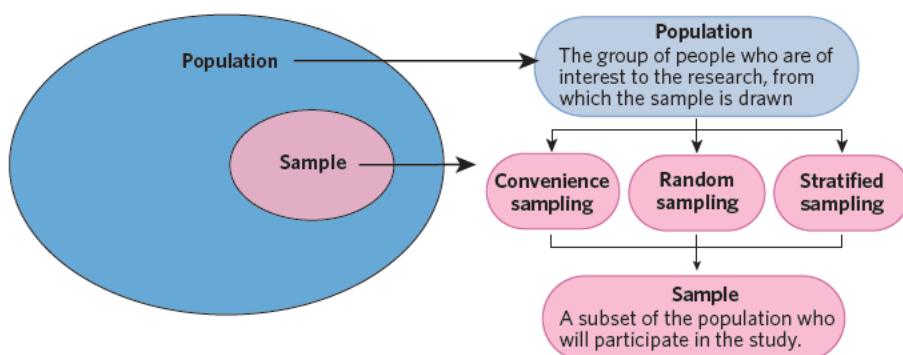


Figure 2 There are three different methods to select the sample from the population

**Table 1** Types of sampling methods

Sampling method	Description	Example
<b>Convenience sampling</b> 4.3.3.4.1	<ul style="list-style-type: none"> <li>A sample is selected in the quickest and easiest way possible by recruiting the most readily available people from the population.</li> </ul>	<ul style="list-style-type: none"> <li>A researcher using her class of students as participants for a study.</li> <li>In this case, the participants were readily available and it was efficient and simple for her to recruit participants.</li> </ul>
<b>Random sampling</b> 4.3.3.4.2	<ul style="list-style-type: none"> <li>A method of sampling in which every member of the population has an <i>equal chance</i> of being selected for the sample.</li> </ul>	<ul style="list-style-type: none"> <li>A researcher is interested in conducting a study in which the population is all of the students at the local high school.</li> <li>She generates a list of all student names, based on enrolment records, and puts them through a random number generator in order to select 50 to participate in her experiment.</li> </ul>
<b>Stratified sampling</b> 4.3.3.4.3	<ul style="list-style-type: none"> <li>This sampling method involves dividing the population into groups based on characteristics relevant to the study, such as gender, age or year level.</li> <li>These groups are called <i>strata</i>, and each group is called a <i>stratum</i>.</li> <li>The researcher then selects a sample from each of the strata in the same proportion that they occur in the population.</li> </ul>	<ul style="list-style-type: none"> <li>A highschool population is divided into year levels.</li> <li>Participants are selected from each year level proportionate to the population.</li> <li>For example, if there are 100 year 12 students, but only 50 year 7 students, the number of participants from year 12 would be double that of the number of participants in year 7.</li> </ul>

**Table 2** Benefits and limitations of sampling methods

Sampling method	Benefits	Limitations
<b>Convenience sampling</b>	<ul style="list-style-type: none"> <li>This method is time-efficient and cost-saving.</li> </ul>	<ul style="list-style-type: none"> <li>It is likely that the sample selected is not representative of the population, which compromises the ability of a valid generalisation to the population about the results.</li> </ul>
<b>Random sampling</b>	<ul style="list-style-type: none"> <li>For very large samples, it reduces bias and therefore it is more likely to be representative of the population.</li> </ul>	<ul style="list-style-type: none"> <li>It can be time-consuming and difficult to identify every member of the population in order to ensure everyone has an equal chance of participating.</li> <li>For smaller samples, it may not produce a representative sample.</li> </ul>
<b>Stratified sampling</b>	<ul style="list-style-type: none"> <li>It is more likely that the sample is representative of the population, as compared to convenience or random sampling.</li> </ul>	<ul style="list-style-type: none"> <li>Strata (the groups within the population) can be difficult to define, depending on the research being conducted.</li> <li>It can be time-consuming and expensive to ensure the strata are defined accurately and that participants are selected in the correct proportions.</li> </ul>

#### Useful tip

A common type of sampling in question scenarios is when the researcher puts an advertisement in a newspaper. This is an example of convenience sampling because not everyone in the population has an equal chance of being a part of the study; the people who are more likely to read the newspaper have a higher chance.

**Random sampling** when every member of the population has an equal chance of being selected for the sample

**Stratified sampling** when the population is divided into groups based upon relevant characteristics, and participants are selected from each group in proportion to how they appear in the population

**Convenience sampling** when a sample is selected using the quickest and easiest means possible, selecting people who are readily available from the population

#### Useful tip

It is important to be careful with the terminology: convenience sampling is the correct term, you will not be awarded any marks for using the term "convenient sampling".

## Allocation 4.3.3.5

### OVERVIEW

Once the participants for the experiment are selected, researchers must assign them to the different conditions within the study. This process is called allocation.

### THEORY DETAILS

Once you have the sample of participants for the experiment, they need to be assigned to the conditions within the experiment. This process is called **allocation**. The ideal type of allocation is **random allocation**, in which every member of the sample has an equal chance of being assigned to each experiment condition. An example of random allocation is when participants are allocated to the conditions of an experiment through the flip of a coin. Without random allocation, the conditions may be biased with some characteristics being over-represented in one condition over another.

#### Example:

In a study of highschool students and sleeping patterns, the year 8 and year 12 class were selected to participate using convenience sampling. All students in the year 8 class were allocated to one condition, and all students in the year 12 class were allocated to another condition. These groups are biased, as participant's age may affect the results. In random allocation, all students (both year 8 and year 12) would have an equal chance of being allocated to each condition, increasing the likelihood that the distribution of participant characteristics are evenly spread across the experimental and control condition. Using random allocation, the first condition comprised of 10 year 8 students and 12 year 12 students, and the second condition comprised of 14 year 8 students and 9 year 12 students.

### Theory summary

In this lesson, you have learned about how experimenters select participants for their studies, and the methods they use to do this. You should be able to identify populations and samples of research and explain the processes of convenience sampling, random sampling and stratified sampling.

You should also be able to describe the benefits and limitations of each of these methods. You have learned about allocation, specifically about random allocation, and you should be able to describe this process. So far you have learned about how researchers set up their experiments, in regards to the aim, hypothesis, population and sampling. The relationship between these is outlined in figure 3.

**Allocation** the process of assigning participants to conditions in the experiment for the research

**Random allocation** when every member of the sample has an equal chance of being assigned to each condition in an experiment

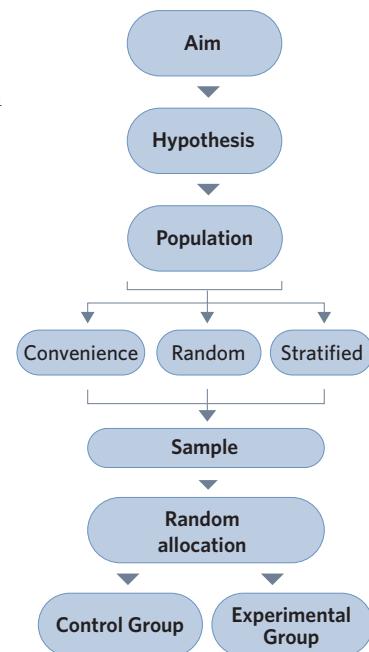


Figure 3 The process of designing an experiment.

## 1C Activities

### 1 Random sampling and m&ms

#### Instructions:

Open a bag of m&ms and count how many m&ms there are in the packet, let's say this is the population of your study.

**Population:** How many m&ms do you have in your packet? \_\_\_\_\_

Use the following sampling procedures to select a sample of m&ms from your packet and compare the differences between each sample you choose, dependent on the sampling procedure you used.

Sampling method	Description of a sampling procedure	Description of a sample obtained
Convenience sampling	1. Grab the first 20 m&ms that fall into your hand.	E.g. 12 brown m&ms, 5 red, 3 blue
Random sampling	1. Pour out all of the m&ms into a dish to make sure that you have access to them all. 2. Pick out 20 m&ms from the dish with your eyes closed.	
Stratified sampling	1. Divide the packet of m&ms into the colours that are in the packet. 2. Count how many m&ms there are in each colour category. 3. Pick out 20 m&ms in the proportion of colours in which they appear in the bag.	

- a What would a representative sample of the m&ms look like?
- b Which sampling procedure produced the most representative sample?
- c Which sampling procedure produced the least representative sample?

# 1C QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |              |                        |                       |
|--------------|------------------------|-----------------------|
| • Population | • Convenience sampling | • Stratified sampling |
| • Sample     | • Random sampling      | • Random allocation   |
- a A process in which every participant has an equal chance of being assigned to each of the experiment's conditions \_\_\_\_\_
- b A process in which the population is divided into relevant strata and participants are selected from the strata in proportion to how they appear in the population \_\_\_\_\_
- c A process in which participants for an experiment are selected because they are the most readily available \_\_\_\_\_
- d A process in which every member of the population have an equal chance of being a participant in the experiment \_\_\_\_\_
- e A subset of people from the population of interest who will participate in the experiment, they are also referred to as participants \_\_\_\_\_
- f The group of people of interest to an experiment, to which the results of the experiment are generalised \_\_\_\_\_

## Exam-style questions

### *Remember and understand*

### Question 2 (1 MARK)

Random sampling involves

- A every member of the sample having an equal chance of being allocated to either the control or experimental conditions.
- B every member of the population having an equal chance to participate in the study.
- C people being selected from the population to participate in the study.
- D participants being selected in the most efficient and cost-effective means possible.

### Question 3 (1 MARK)

What is one limitation of using convenience sampling?

- A It can be time-consuming to conduct.
- B It is costly to conduct properly.
- C It is difficult to define the relevant groups of the population and to select participants proportionately.
- D There is more likely to be bias in the sample, as compared to other sampling procedures.

### Question 4 (1 MARK)

Outline one limitation of random sampling.

### Question 5 (1 MARK)

Outline one advantage of convenience sampling.

## Apply and analyse

**Use the following information for questions 6 and 7.**

Dr Sosanto is a psychologist interested in investigating the effect of age on the driving ability of Western Australians. He recruits 85 participants who have their driver's license by putting an advertisement in the local newspaper.

*Adapted from VCAA 2015 exam MCQ63-65*

**Question 6** (1 MARK)

The population and sample for this experiment are, respectively,

- A Western Australians, 85 drivers.
- B 85 Western Australian drivers, Western Australians.
- C 85 Western Australian drivers, Western Australian drivers.
- D Western Australians who responded to the advertisement, 85 Western Australian drivers.

**Question 7** (1 MARK)

In this study, the sampling method used was

- A random.
- B stratified.
- C convenience.
- D random-stratified.

**Question 8** (1 MARK)

There are 80 staff at the Edrolo headquarters office.

Explain how a researcher could design a random sampling procedure to investigate the motivations of female employees at Edrolo.

**Question 9** (2 MARKS)

Rosalie wanted to test whether different scents supported memory consolidation for primary school students from her local primary school, Merryville primary. She used random sampling to select 30 students from Merryville primary to participate.

Explain why random sampling is more appropriate for this investigation than convenience sampling.

**Question 10** (4 MARKS)

Hallie wanted to investigate whether sight influences taste perception. Her target population was primary school students at her local primary school.

The method she used was:

- She recruited the year five class at her local primary school to participate.
  - In all conditions, students were asked to taste gummy bears and determine the flavour of the gummy bear. The flavour of all gummy bears in the study was strawberry.
  - In the control condition, participants were presented with a clear gummy bear (no colour).
  - In the first experimental condition, participants were presented with a red gummy bear.
  - In the second experimental condition, participants were presented with a yellow gummy bear.
- a Identify the sampling procedure used and one possible limitation of this sampling procedure for Hallie's conclusion. (2 MARKS)
- b Identify an alternative sampling procedure and outline how Hallie could have used it in her study. (2 MARKS)

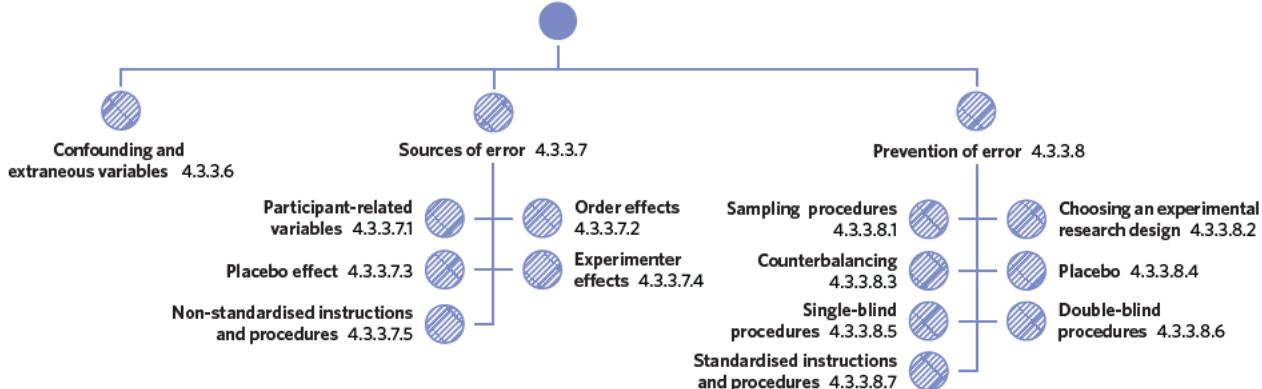
# 1D SOURCES OF ERROR AND PREVENTION

So far in this chapter, you have been learning about how researchers begin to plan their research. A key component of planning scientific studies in a rigorous manner is to identify possible sources of error and proactively design ways to prevent or control these errors. In this lesson, you will learn about common sources of error in psychological studies, as well as ways to prevent them.

1A. Aims, hypotheses and variables	1B. Scientific research methodologies	1C. Population, sample and sampling	1D. Sources of error and prevention	1E. Ethical considerations	1F. Collection of data	1G. Data organisation and interpretation	1H. Evaluation of research
<b>Study design dot point</b>							
<ul style="list-style-type: none"> <li>the characteristics of scientific research methodologies and techniques of primary qualitative and quantitative data collection relevant to the selected investigation: experiments, self-reports, questionnaires, interviews and/or use of rating scales; reliability and validity of data; and minimisation of experimental bias and confounding and extraneous variables</li> </ul>							
<b>Key science skills</b>							
<ul style="list-style-type: none"> <li>Plan and undertake investigations: <ul style="list-style-type: none"> <li>minimise confounding and extraneous variables by considering type of sampling procedures, type of experiment, counterbalancing, single and double blind procedures, placebos, and standardised instructions and procedures</li> </ul> </li> <li>Analyse and evaluate data, methods and scientific models <ul style="list-style-type: none"> <li>evaluate investigative procedures and possible sources of bias, and suggest improvements, with reference to identification of potential extraneous and confounding variables including individual participant differences, non-standardised instructions and procedures, order effects, experimenter effect and placebo effects</li> </ul> </li> </ul>							
<b>Key knowledge units</b>							
Confounding and extraneous variables 4.3.3.6							
Participant-related variables (Sources of error) 4.3.3.7.1							
Order effects (Sources of error) 4.3.3.7.2							
Placebo effect (Sources of error) 4.3.3.7.3							
Experimenter effects (Sources of error) 4.3.3.7.4							
Non-standardised instructions and procedures (Sources of error) 4.3.3.7.5							
Sampling procedures (Prevention of error) 4.3.3.8.1							
Choosing an experimental research design (Prevention of error) 4.3.3.8.2							
Counterbalancing (Prevention of error) 4.3.3.8.3							
Placebo (Prevention of error) 4.3.3.8.4							
Single-blind procedures (Prevention of error) 4.3.3.8.5							
Double-blind procedures (Prevention of error) 4.3.3.8.6							
Standardised instructions and procedures (Prevention of error) 4.3.3.8.7							

In this lesson, you will be learning about errors that can occur in psychological studies; these are referred to as **extraneous and confounding variables**. You will learn about common sources of error that may arise, and methods that researchers can use in order to identify and prevent them.

## Sources of error and prevention



## Confounding and extraneous variables 4.3.3.6

### OVERVIEW

The purpose of a scientific experiment is to establish a causal relationship between the independent and dependent variables. In order to do this, other variables that might affect the dependent variable must be controlled. These variables are referred to as either confounding or extraneous variables.

### THEORY DETAILS

Despite scientific experiments being conducted in a carefully controlled environment, it is not possible to control for all variables that might have an effect on the dependent variable. **Extraneous variables** are variables other than the independent variable, that have the potential to cause an effect on the dependent variable. In designing investigations, researchers want to identify as many of these extraneous variables as they can and control for them if possible, in order to minimise the effect they have on the results.

For example, in a study on the effect of class attendance on test scores, extraneous variables would be any factor other than attendance that could affect test performance. These might include: how much the student has studied in the lead up to the test, whether they had learned the material before, their level of motivation and if they enjoy the subject. A researcher may control for some of these variables by studying students in the same class who had not learned the topic before, and getting students to complete a questionnaire prior to the test on how many hours of study they did, their level of motivation and enjoyment of the class. Researchers may then only compare students who had similar responses on the questionnaire.

If the variables were not controlled for and did have an effect on the dependent variable, these variables have become **confounding variables** because they have *confounded* the results. In the above example, a confounding variable may be students' age, as older students may have developed more cognitively and therefore performed better on the test. If the researcher did not take this into account, students' age would be a confounding variable in this experiment.

Researchers want to control for extraneous variables so that confounding variables don't cause errors in the research, and a cause and effect relationship between the independent and dependent variables can be established.

**Extraneous variables** variables other than the independent variable that may produce unwanted results in an experiment

**Confounding variables** variables other than the independent variable that have directly and systematically had an effect on the dependent variable

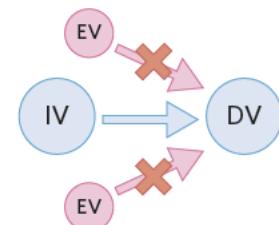


Figure 1 Extraneous variables are any variables that have the potential to impact the dependent variable other than the independent variable. In designing an experiment, researchers want to control for their effects.

### Useful tip

Extraneous and confounding variables may refer to the same variables. However, while all *confounding variables* are *extraneous variables* in that they refer to uncontrolled for and unwanted variables in an experiment, not all *extraneous variables* are *confounding*.

An extraneous variable may be identified as confounding only if it can be shown that it systematically affected the dependent variable in an unwanted way. For example, if a fire alarm went off in the first trial of a test this would be an extraneous variable. However, if it did not go off for all trials of that same test, it could not be considered confounding, as it has not systematically (repeatedly or consistently) affected the dependent variable (e.g. test performance).

## Sources of error 4.3.3.7, Prevention of error 4.3.3.8

### OVERVIEW

There are a number of potential sources of error in which variables other than the independent variable can affect the dependent variable. In designing an experiment, researchers must identify and control as many as possible in order to ensure a valid conclusion can be made.

### THEORY DETAILS

Extraneous and confounding variables can also be thought of as sources of error, as they may affect the results, making it difficult for researchers to establish a cause and effect relationship between the independent and dependent variables.

Sources of error and the corresponding method to prevent the error are outlined in table 1.

**Table 1** Sources and prevention of error

Source of error	Prevention of error	Example
<b>Participant-related variables</b> 4.3.3.7.1 <ul style="list-style-type: none"> <li>Participant-related variables can be understood as individual participant differences that can affect the results.</li> <li>In a large sample size, these participant differences reflect the differences in the population but if a sample is biased or too small, individual participant differences can introduce a source of error, as they are not representative of the population.</li> <li>Participant-related errors can also be introduced due to the sampling technique; convenience sampling is likely to produce a biased sample.</li> </ul>	<p><b>Sampling procedures</b> 4.3.3.8.1</p> <ul style="list-style-type: none"> <li>One way to reduce a biased sample is to choose an appropriate sampling procedure that will select a representative sample.</li> <li>Random sampling and stratified sampling will produce less bias in samples as compared to the use of convenience sampling.</li> <li>Using a large sample size will also help to reduce participant-related variables affecting the investigation.</li> </ul> <p><b>Choosing an experimental research design</b> 4.3.3.8.2</p> <ul style="list-style-type: none"> <li>Another way of minimising the confounding effects of participant variables is through choosing an appropriate experimental research design.</li> <li>In a repeated measures design, the same participants are used in both conditions and this eliminates participant differences between conditions.</li> <li>In a matched participants design, participants are matched on relevant characteristics to the study, therefore minimising the effect of participant differences between conditions.</li> </ul>	<ul style="list-style-type: none"> <li>A researcher is studying the effects of a new concentration medication in young adults aged 18 to 25.</li> <li>Participant-related variables in this study may include participants' baseline level of concentration, any existing medical conditions related to concentration such as attention-deficit disorder, and how much familiarity they have had with the experimental concentration task prior to the experiment.</li> <li>If the researcher had used convenience sampling to select 20 participants, the sample may be biased. For example, the number of 18 year olds in the study may be overrepresented, as well as an overrepresentation of people who had an abnormally high baseline of concentration ability.</li> <li>In order to control for this, the researcher may instead use stratified sampling to select a sample of 500 participants.</li> <li>This larger sample size selected through stratified sampling is less likely to be biased due to participant-related variables.</li> <li>Another way to control for this may involve the researcher choosing to use a matched participants design instead of an independent group design, matching participants based on the relevant characteristic of baseline concentration levels to reduce this as a participant related confounding variable.</li> </ul>
<b>Order effects</b> 4.3.3.7.2 <ul style="list-style-type: none"> <li>Order effects are a type of confounding variable relevant to repeated-measures experimental designs, and occur due to the order in which participants participate in the control and experimental conditions.</li> <li>They are also known as practice effects because they are errors due to the participants having 'practised' the condition or task before.</li> </ul>	<p><b>Choosing an experimental research design</b> 4.3.3.8.2</p> <ul style="list-style-type: none"> <li>Instead of using a repeated measures design, choosing another experimental research design, such as matched-participants, would have the same benefits of reducing participant variables, without order effects.</li> </ul> <p><b>Counterbalancing</b> 4.3.3.8.3</p> <ul style="list-style-type: none"> <li>If conducting a matched-participants design is not possible due to costs or other constraints, counterbalancing in a repeated-measures design can also reduce order effects.</li> <li>Counterbalancing involves half of the participants participating in the experimental condition first and then the control condition, and the other half of the participants doing it in the reverse order.</li> <li>This controls for order effects as the two halves of participants participate in the conditions in alternating orders, cancelling out this effect.</li> <li>It is easier, more convenient and cheaper than designing a matched-participants experiment.</li> </ul>	<ul style="list-style-type: none"> <li>If the researcher used a repeated-measures design for this study, this would involve all of the 500 participants completing the concentration task first without being administered the concentration medication (condition 1), and then completing the task again with the medication (condition 2).</li> <li>In this instance, order effects may occur as participants' improved concentration scores in the second condition may be due to them having already completed the task, rather than the medication itself.</li> <li>One way of addressing this is to use a matched-participants experimental design instead.</li> <li>This would involve the researcher matching participants on key relevant characteristics such as age, baseline levels of concentration, and existing medical conditions, and allocating one of each matched pair to the experimental or control condition.</li> <li>If the researcher is unable to conduct a matched-participants design, they could instead use counterbalancing in the repeated-measures design.</li> <li>This would involve half (250) of the participants completing condition 1 followed by condition 2, while the other half complete condition 2 followed by condition 1.</li> <li>This would 'balance out' or negate any practise effects that may occur.</li> </ul>

**Table 1** Sources and prevention of error

Source of error	Prevention of error	Example
<b>Placebo effect</b> 4.3.3.7.3	<p><b>Placebo</b> 4.3.3.8.4</p> <ul style="list-style-type: none"> <li>The placebo effect occurs when a participant's expectations of something actually makes it happen.</li> <li>Participant expectations can affect their behaviour and mental processes, resulting in them behaving differently or reporting different mental processes than they otherwise would as a consequence of their expectations.</li> </ul>	<ul style="list-style-type: none"> <li>The placebo effect might occur if participants knew that they would be receiving treatment for concentration, as their expectation of having increased concentration due to the medication may in turn actually improve their concentration.</li> <li>In order to control for this, the researcher can use a single-blind procedure so that participants are unaware if they have been allocated to the control or experimental group.</li> <li>The control group receives a placebo and the experimental group receives the concentration medication.</li> </ul>
<b>Experimenter effects</b> 4.3.3.7.4	<p><b>Single-blind procedures</b> 4.3.3.8.5</p> <ul style="list-style-type: none"> <li>One way to reduce participant expectations is to use a single-blind procedure.</li> <li>This involves the participant being unaware of what condition they have been allocated to; that is, they don't know whether they are receiving the placebo or the active treatment.</li> <li>This decreases the likelihood of participant expectations affecting results.</li> </ul>	
	<p><b>Double-blind procedures</b> 4.3.3.8.6</p> <ul style="list-style-type: none"> <li>In order to address experimenter bias, a double-blind procedure can be used, which addresses both the participant and experimenter bias.</li> <li>This involves neither the participants nor the conductor of the experiment knowing the condition that participants are allocated to, ensuring their expectations don't affect their behaviour or interpretation of the results.</li> </ul>	<ul style="list-style-type: none"> <li>Experimenter bias may occur if the experimenter treats participants differently based on their knowledge of if they are receiving an active medication or not.</li> <li>For example, when asking participants to report on their levels of concentration, the experimenter may inadvertently ask more leading questions to the experimental group than the control group, affecting the results.</li> <li>In order to control for this, a double-blind procedure may be used.</li> <li>This could involve a research assistant administering the medication and placebo, without knowledge of which is which.</li> <li>The research assistant may then do the follow up testing, and without knowledge of which condition each participant is in, it is less likely that errors will be introduced due to their expectation bias.</li> </ul>

Table 1 Sources and prevention of error

Source of error	Prevention of error	Example
<b>Non-standardised instructions and procedures</b> 4.3.3.7.5 <ul style="list-style-type: none"> <li>Errors can be introduced when procedures and instructions are not standardised for each participant.</li> <li>If there are multiple experimenters each conducting the experiment with varying procedures and instructions, it can affect the participant's behaviour and the results.</li> </ul>	<b>Standardised instructions and procedures</b> 4.3.3.8.7 <ul style="list-style-type: none"> <li>Standardised instructions and procedures involve having clear and methodical instructions to ensure that the testing conditions and procedures are the same for all participants in each group in order to reduce confounding variables.</li> </ul>	<ul style="list-style-type: none"> <li>Non-standardised testing and procedures may mean that some participants receive the medication in the morning, and others receive it in the evening.</li> <li>This can affect the results as participants' baseline level of concentration may differ throughout the day and so a valid comparison between participants cannot be made.</li> <li>In order to standardise the instructions and procedures, researchers may administer the medication at a specific time to participants each morning.</li> <li>When following up with participants, researchers may also standardise the questions they ask, following an exact script and not asking any further follow-up questions.</li> </ul>

## Theory summary

In this lesson, you have learned about extraneous and confounding variables, and the need for researchers to control for them when designing an experiment. You should be able to identify and explain a range of sources of error, as well as suggest appropriate measures to control for them. You should also be able to identify these in a given scenario and describe each source of error.

Table 2 Summary of sources of error and corresponding prevention method

Source of error	Corresponding method to minimise error
• Participant-related variables (individual participant differences)	<ul style="list-style-type: none"> <li>Selecting an appropriate sampling procedure</li> <li>Choosing an experimental research design</li> </ul>
• Order (practice) effects	<ul style="list-style-type: none"> <li>Choosing another experimental research design</li> <li>Counterbalancing</li> </ul>
• Participant expectations (placebo effect)	<ul style="list-style-type: none"> <li>Using a placebo</li> <li>Single-blind procedures</li> </ul>
• Experimenter effects (experimenter bias)	<ul style="list-style-type: none"> <li>Double-blind procedures</li> </ul>
• Non-standardised instructions and procedures	<ul style="list-style-type: none"> <li>Standardised instructions and procedures</li> </ul>

**Non-standardised testing procedures** when instructions and procedures in an experiment are not consistent for all participants, therefore affecting the results obtained

**Standardised instructions and procedures** the consistent use of instructions and procedures for all participants

### Useful tip

It is important to distinguish between a placebo and the placebo effect. A placebo is an inactive treatment, such as a sugar pill, whereas the placebo effect is an effect that occurs due to participants' expectations.



Image: rzstudio/Shutterstock.com

**Figure 2** A placebo involves the use of an inactive treatment, such as a sugar pill

# 1D QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |                                 |  |  |
|---------------------------------|--|--|
| • Extraneous variable           | • Experimenter effects                         | • Single-blind procedures                  |
| • Confounding variable          | • Non-standardised instructions and procedures | • Double-blind procedures                  |
| • Participant-related variables | • Sampling procedures                          | • Counterbalancing                         |
| • Order effects                 | • Choosing an experimental research design     | • Standardised instructions and procedures |
| • Placebo                       |  |  |

- a a variable other than the independent variable that has already had an effect on the dependent variable \_\_\_\_\_
- b an inactive medication or treatment, usually administered in the form of a sugar pill \_\_\_\_\_
- c occurring in repeated-measures experimental designs, this confounding variable is due to the order in which participants partake in the experimental and control conditions \_\_\_\_\_
- d when experimenter expectations affect the results \_\_\_\_\_
- e a variable other than the independent variable that has the potential to have an effect on the dependent variable \_\_\_\_\_
- f when the inconsistent administration of an experiment causes errors \_\_\_\_\_
- g choosing an appropriate method to select a sample from the population in order to reduce errors \_\_\_\_\_

- h** individual participant differences that may cause confounding variables to occur \_\_\_\_\_
- i** a procedure used to control for order effects in repeated-measures experimental designs \_\_\_\_\_
- j** when participants are unaware if they are taking a placebo or active medication \_\_\_\_\_
- k** the consistent administration of an experiment in order to prevent errors occurring in the results \_\_\_\_\_
- l** choosing either repeated-measures, independent groups, or matched participants design in order to reduce errors \_\_\_\_\_
- m** when both the participant and experimenter are unaware of which participants are receiving a placebo treatment \_\_\_\_\_

### Exam-style questions

#### Remember and understand

##### Question 2 (1 MARK)

Order effects are

- A** extraneous variables that can occur due to the use of single-blind procedures.
- B** extraneous variables that can occur due to the use of placebo.
- C** confounding variables that can occur in matched-design experiments.
- D** confounding variables that can occur in repeated-measures experiments.

##### Question 3 (1 MARK)

What research methodology can be used to minimise order effects?

- A** the use of standardised instructions
- B** counterbalancing
- C** single-blind procedures
- D** double-blind procedures

##### Question 4 (1 MARK)

Single-blind procedures are used to control for

- A** the placebo effect.
- B** order effects.
- C** all extraneous variables.
- D** the placebo effect and the experimenter effect.

Adapted from VCAA 2013 exam MCQ13

### Apply and analyse

#### Use the following scenario for questions 5 and 6.

A researcher was conducting a trial for a new medication that enhances mood. Group A, the experimental group, received the medication, while Group B, the control group, received a placebo. Concerned about experimenter bias, a double-blind procedure was used.

##### Question 5 (1 MARK)

Which of the following identifies the double-blind procedure used in this investigation?

- A** Only the researcher knew who would receive the placebo.
- B** Only the research assistant knew who would receive the mood enhancing medication.
- C** Only the researcher and the control group knew who would receive the placebo.
- D** Only the researcher and the research assistant knew who was in the experimental and control group.

Adapted from VCAA 2018 exam MCQ36

**Question 6** (1 MARK)

What is the purpose of using the placebo in this experiment?

- A To control for participant error.
- B To control for experimenter bias.
- C To control for participant expectations.
- D To eliminate all confounding variables.

**Question 7** (1 MARK)

Dr Samira is studying the effects of stress on self-reported levels of happiness and sent out an information package, including a consent form, to 800 randomly generated postal addresses in Australia.

Dr Samira's consent form also asked about the participant's age. Why might Dr Samira want to know this information?

Adapted from VCAA 2014 exam SAQ9c

**Question 8** (2 MARKS)

Justin wants to research if there is a relationship between the number of hours someone studies and their ATAR score at the end of year 12. He asks his year 12 cohort to participate in his research.

Identify one relevant extraneous variable that Justin should consider in designing his investigation. Justify your response.

**Question 9** (3 MARKS)

Dr Romish is studying colour perception in young children. Participants were healthy 10-year-olds who had no visual impairments. Condition 1 required the participants to identify a purple square amongst 10 pink squares. Condition 2 required participants to identify a blue square amongst 10 green squares. The squares were on 5x5cm cardboard and were presented to participants one at a time. Half of the participants completed condition 1 and then 2, the other half of the participants completed condition 2 and then 1.

Dr Romish conducted the experiment over three weeks, however, on the last day of the experiment, Dr Romish's research assistant was unable to find the green squares. To conduct the experiment that day he cut up more coloured paper into 5x5cm squares and asked participants to identify a purple square amongst orange squares instead.

Participants' accuracy and speed were recorded.

- a What research methodology/technique did Dr Romish use to minimise potential confounding variables in the experiment? (1 MARK)
- b Identify and explain one potential confounding variable that may have affected the results. (2 MARKS)

**Questions from multiple lessons****Question 10** (1 MARK)

Which of the following would most assist researchers with minimising extraneous variables in an experiment?

- A single-blind procedures to reduce experimenter bias
- B convenience sampling and the use of double-blind procedures
- C random sampling and standardised procedures
- D standardised instructions and the use of placebo

Adapted from VCAA 2018 exam MCQ35

**Question 11** (2 MARKS)

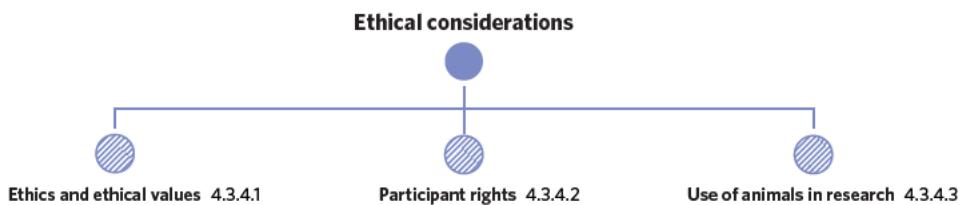
What ethical consideration can be breached when an investigation uses a placebo? Explain why.

# 1E ETHICAL CONSIDERATIONS

So far in this chapter, you have been learning about how researchers design scientific investigations and the different components that they need to consider when doing so. An important aspect in designing psychological experiments is the ethical considerations regarding working with human participants and animals. In this lesson, you will learn about these different considerations and how researchers must take them into account when designing an investigation.

1A. Aims, hypotheses and variables	1B. Scientific research methodologies	1C. Population, sample and sampling	1D. Sources of error and prevention	1E. Ethical considerations	1F. Collection of data	1G. Data organisation and interpretation	1H. Evaluation of research
<b>Study design dot point</b>							
▪ ethics and issues of research including identification and application of relevant ethical, health and safety guidelines, and use of human subjects							
<b>Key science skills</b>							
▪ Comply with safety and ethical guidelines: <ul style="list-style-type: none"> <li>- understand the role of ethics committees in approving research</li> <li>- apply ethical principles when undertaking and reporting investigations, including consideration of the role of the experimenter, protection and security of participants' information, confidentiality, voluntary participation, withdrawal rights, informed consent procedures, use of deception in research, debriefing and use of animals in research</li> </ul>							
<b>Key knowledge units</b>							
Ethics and ethical values 4.3.4.1							
Participant rights 4.3.4.2							
Use of animals in research 4.3.4.3							

In this lesson, you will be learning about the **ethical considerations** that researchers must address when designing an investigation. Specifically, you will be learning about the **ethical values** that guide psychological research, as well as **participants' rights** and the ethics involved in **using animals in research**.



## Ethics and ethical values 4.3.4.1

### OVERVIEW

All research in modern psychology must adhere to the ethical guidelines in designing and conducting investigations in order to ensure the safety of all participants.

### THEORY DETAILS

It is particularly important for researchers to consider the role of ethics in psychological research due to the use of human participants. Ethical guidelines are established by codes of ethics that all researchers must abide by in order to ensure the safety and wellbeing of participants.

In Australia, the Australian Psychological Society (APS) have set a code of ethics, by which all psychologists in Australia need to abide by. They draw from a range of sources, including the National Health and Medical Research Council (NHMRC) to create a code of ethics. This code of ethics outlines the guiding values for research, as well as the ethical standards that researchers must adhere to. The NHMRC are an Australian government

body that develop and maintain health standards in research. The NHMRC outlines four key guiding values for ethical research, summarised in table 1.

**Table 1** Ethical values in research

Ethical value	Description
<b>Research merit and integrity</b>	Research that has merit includes the following characteristics: <ul style="list-style-type: none"> <li>• It is justifiable by its potential benefit.</li> <li>• It is designed and developed based upon thorough study of current literature and previous studies concerning the intended research area.</li> <li>• It is designed to ensure that respect for participants is not compromised.</li> <li>• It is conducted and supervised by qualified and experienced researchers.</li> </ul>
<b>Justice</b>	The value of justice refers to fairness within the investigation. This means that: <ul style="list-style-type: none"> <li>• the process of recruiting participants is fair.</li> <li>• there is no unfair burden of participation in research on particular groups; that is, the risks and benefits of the research should be fairly spread amongst groups.</li> <li>• there is no exploitation of participants.</li> <li>• there is fair access to the benefits of the research.</li> </ul>
<b>Beneficence</b>	With some psychological research, there may be potential risks for the participants. Beneficence refers to when the potential benefit of the research findings outweighs any potential risks for the participants. This makes the research justified. With regard to beneficence, researchers are responsible for: <ul style="list-style-type: none"> <li>• designing research to minimise the risk of participant harm or discomfort.</li> <li>• ensuring participants understand both the potential benefits and risks of the research.</li> <li>• the welfare of the participants in the research context.</li> </ul>
<b>Respect for human beings</b>	Respect for human beings is at the core of all research involving participants. It requires that the researchers have regard for participants' welfare, beliefs, perceptions, customs and cultural heritage.

Source: NHMRC, 2019

When designing a psychological investigation, researchers must show how they have incorporated these ethical considerations, and submit their proposal to an ethics committee for approval before conducting their research. The **ethics committee** is a group of people who consider the details of the investigation and use the ethical values to deem whether the research is ethical to conduct or not. Often, decisions have to be made about the associated risks, and whether the risks are outweighed by the potential benefits of the investigation.

For example, when trialling new medication, there are potential risks involved for participants as the effects of the medication are unknown at this point. However, the benefits of trialling the medication, and the potential benefits it may have for a wider population of people, means that the ethics committee might deem the research as ethical and approve it to proceed, despite the associated risks.

An ethical consideration that researchers must always keep in mind is the no-harm principle. The **no-harm principle** stipulates that participants must not experience any harm, whether physical or psychological. This is applicable in both the short-term (eg. during the experimental trial), as well as in the long-term (eg. participants shouldn't have any lasting negative effects due to the investigation). It is the role of the experimenter to ensure this principle is upheld, in line with the other guiding values of research, when designing and conducting psychological experiments.

## Participant rights 4.3.4.2

### OVERVIEW

There are specific ethical considerations related to the participants and their rights within a psychological investigation. These are referred to as participant rights and include: voluntary participation, informed consent, withdrawal rights, confidentiality and debriefing.

### THEORY DETAILS

When participating in an experiment, participants have rights that they can exercise. These are referred to as participants' rights and are outlined in table 2. Along with ensuring their research is in line with the ethical values and guidelines, the experimenters must also ensure that participants are aware of and are able to exercise their rights in research.

**Ethics committee** a group of people who review research proposals, consider the potential risks, benefits and implications in order to either approve or disapprove them for research

**No-harm principle** the role of the researcher to ensure that all participants within an investigation do not experience mental or physical harm

Table 2 Participants' rights

Ethical consideration	Description
<b>Voluntary participation</b>	<ul style="list-style-type: none"> <li>Participants should freely choose to participate in research and not be coerced or put under pressure in any way to do so.</li> </ul>
<b>Informed consent</b>	<ul style="list-style-type: none"> <li>Informed consent involves participants having a thorough understanding of the scope and details of the experiment, including potential risks, research implications and benefits and their rights as participants before agreeing to participate.</li> <li>Often informed consent is given through signing a form, in which a written description of the experiment is provided for participants prior to the commencement of the study.</li> <li>For participants under the age of 18, their parents or legal guardians are able to give informed consent on their behalf.</li> <li>For participants who are unable to give consent for other reasons, guardians are also able to give informed consent on their behalf.</li> <li>For example, a person who has a mental illness that interferes with their ability to understand what they are consenting to may have their guardian provide consent on their behalf.</li> </ul>
<b>Withdrawal rights</b>	<ul style="list-style-type: none"> <li>Participation in an experiment can be discontinued at any time without penalty.</li> <li>Participants should be aware of this right, and feel that they are able to withdraw from the study at any point.</li> <li>Withdrawal rights can also occur after the conclusion of an experiment, and can involve participants removing their results from the study if they choose.</li> </ul>
<b>Confidentiality</b>	<ul style="list-style-type: none"> <li>Participant details should be kept private (confidential) in all research.</li> <li>This may involve ensuring participants' anonymity when publishing research, or ensuring that the results of the experiment and the data collected are de-identified.</li> <li>This also includes keeping individual results or data about a participant private, and ensuring that the data collected is stored in a safe and secure manner.</li> </ul>
<b>Deception</b>	<ul style="list-style-type: none"> <li>Deception involves purposefully misleading the participants in regards to some aspects related to the investigation.</li> <li>This is used when participants' knowledge of the true purpose or details of the experiment may affect their behaviour, and therefore the validity of the results.</li> <li>In most experiments, the use of deception is deemed unethical as it breaches the participants' right of informed consent.</li> <li>However, if the potential benefits of the research outweigh the potential associated risks, an ethics committee may deem that it is ethical to conduct.</li> <li>For all studies involving deception, thorough debriefing must occur afterwards.</li> </ul>
<b>Debriefing</b>	<ul style="list-style-type: none"> <li>Debriefing occurs at the conclusion of a study and involves the researcher outlining the details of the experiment to the participants.</li> <li>It may also involve researchers sharing any relevant findings or results from the study with participants, and allowing participants to obtain additional information about the study if they wish.</li> <li>Thorough debriefing must occur in an experiment that involves deception. In these cases, this involves revealing the true nature and purpose of the experiment to participants and explaining why the use of deception was necessary.</li> <li>Debriefing can involve follow up over a period of time, rather than just a once off at the conclusion of an experiment.</li> <li>Debriefing ensures that participants do not leave the experiment with lasting harm due to their experiences. If there is any unforeseen harm experienced by participants, this is addressed as a component of debriefing.</li> </ul>

**Voluntary participation** the right of the participant to freely choose to willingly participate

**Informed consent** the right of the participant to have a thorough understanding of the nature of the experiment, before agreeing to participate

**Withdrawal rights** the right of the participant to leave the study at any point, without fear of consequence

**Confidentiality** the right of the participant for their personal details to remain private

**Deception** when the participant is unaware of the true nature of the experiment

**Debriefing** occurs at the conclusion of an experiment and involves the researcher outlining the nature of the experiment to participants and includes ensuring that participants do not leave the experiment with lasting harm

 In lesson 11C: Mental health and ethics, you will learn about the ethical considerations regarding working with participants who have a mental health disorder. In particular, you will learn about how this may affect the ability of participants to give informed consent and the extra precautions researchers must take when researching mental health.

## Use of animals in research 4.3.4.3

### OVERVIEW

There are some instances in which it may be more appropriate to use animals for psychological research, rather than human participants. Ethical considerations must also be taken into account when researchers conduct research using animals.

### THEORY DETAILS

Although the majority of psychological research is conducted with people, there are some instances when it is conducted using animals instead. There are many reasons why researchers may choose to use animals in investigations, rather than humans:

- It may be that human participants are unavailable for the research, or the risks posed to human participants are too high.

- When researching the effects of ageing, animals generally have a shorter life span and as such the effects of ageing can be studied more effectively than with human participants.
- When researching genetics, it may be better to use animals as they have shorter gestation periods, allowing for genetic studies to be conducted more efficiently.
- Due to the similarities that some animals have to humans in their mental processes and behaviours, research on animals can be a starting point for the initial research before testing with human participants.

Some advantages of working with animals rather than people include:

- For large sample sizes, it is generally more efficient to test using animals rather than humans as it can be costly and time-consuming to accurately select an appropriate large sample of human participants.
- Generally, the behaviours of animals can be more controlled than working with people, which can be beneficial depending on the study.

However, some disadvantages of working with animals include:

- Only behaviours can be studied, as animals are unable to report on their mental processes.
- The generalisability of results from studies using animals to humans is relatively low as animals are different to humans in many ways.

When using animals in research, experimenters must still take ethics into consideration. Similarly to studies with people, the value of beneficence must be considered. Researchers need to weigh up the potential benefits of the study and the potential harm it can cause the animal in order to decide whether the study is justified. Likewise, harm to animals must be minimised and research should be conducted with research merit and integrity.

## Theory summary

In this lesson, you have learned about the ethical considerations of psychological research. You should be able to outline the role of the experimenter in designing research that complies with ethical guidelines. You should also be able to explain participants' rights, and be able to identify when they have been upheld or breached in a given scenario. You have also learned about using animals in research and should be able to explain the advantages and disadvantages of using animals, as well as the ethical considerations researchers must take into account.

### Want to know more? —

The NHRMC also have a code of conduct that guide research using animals. You can find the *Australian Code for the Care and Use of Animals for Scientific Purposes* on the NHRMC website at: [www.nhmrc.gov.au](http://www.nhmrc.gov.au).

## 1E Activities

- Create a mnemonic that will help you to remember the participants' rights in psychological research. You can create an acronym or an acrostic.
  - An example of an acronym is EFTPOS, which stands for Electronic Funds Transfer at Point Of Sale
  - An example of an acrostic is Never Eat Soggy Weetbix, where the first letter of each word stands for the directions of a compass: North East South West

## 1E QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                     |                           |                     |              |
|---------------------|---------------------------|---------------------|--------------|
| • Ethics committee  | • Voluntary participation | • Withdrawal rights | • Deception  |
| • No-harm principle | • Informed consent        | • Confidentiality   | • Debriefing |
- a The right of the participant to leave the experiment at any time without consequences \_\_\_\_\_
- b The right of participants to not have their personal details or individual results known to others \_\_\_\_\_
- c Participants should be able to freely choose to participate in an experiment \_\_\_\_\_
- d At the conclusion of an experiment, researchers should explain the nature of the investigation to participants, including their individual results \_\_\_\_\_

- e Participants understand the nature of the research, including any potential benefits and risks, before agreeing to participate \_\_\_\_\_
- f This may be used when participants' knowledge of the nature of the experiment could jeopardise the results; thorough debriefing must occur afterwards \_\_\_\_\_
- g Participants within an investigation should not experience any physical or psychological harm \_\_\_\_\_
- h A group of people whose role it is to review and approve research proposals, taking into account ethical considerations \_\_\_\_\_

### Exam-style questions

#### Remember and understand

##### Question 2 (1 MARK)

Which of the following statements is true regarding informed consent when working with participants under the age of 18?

- A Informed consent can be gained by informing both the participant and their legal guardians of the nature of the study, and allowing the participant to sign the consent form.
- B Informed consent can be gained by informing both the participant and their legal guardians of the nature of the study, and allowing the legal guardian to sign the consent form on the participant's behalf.
- C Only the participant is able to give informed consent.
- D Participants under the age of 18 are not allowed to partake in psychological experiments.

##### Question 3 (1 MARK)

In psychological research, confidentiality is ensured so that

- A only the experimenter is aware of what condition the participants are assigned to.
- B participants are not harmed.
- C the privacy of participants is protected.
- D important data about participant variables can be published in scientific journals.

*Adapted from VCAA 2013 exam MCQ15*

##### Question 4 (1 MARK)

In an experiment, debriefing of participants most likely includes information about

- A each participant's own results in the study.
- B details about the experiment, including the potential risks involved.
- C the tasks that participants will undertake as a part of the experiment.
- D the individual results of other participants in the study.

*Adapted from VCAA 2012 exam 1 MCQ45*

### Apply and analyse

#### Use the following information for questions 5 and 6.

Xenia agreed to participate in an experiment in which the researcher wanted to investigate the relationship between visual perception and pain. When she came into the experiment room, the researcher explained to her that she would be blindfolded and pricked with a needle on her finger.

Xenia put on the blindfold but before the researcher could prick her finger, she got scared and ran out of the room. She did not come back and did not hear anything from the researcher afterwards.

##### Question 5 (1 MARK)

What ethical consideration was potentially compromised due to Xenia leaving the experiment before it had finished?

- A debriefing
- B confidentiality
- C informed consent
- D withdrawal rights

*Adapted from VCAA 2018 exam MCQ7*

**Question 6** (1 MARK)

What ethical consideration was potentially breached due to the nature of the variables tested in the experiment?

- A voluntary participation
- B informed consent
- C no-harm principle
- D confidentiality

**Question 7** (1 MARK)

Dr Sheriff conducted a study with third-year psychology students. She explained the nature and purpose of the tasks to them before they agreed to participate in the research.

The ethical principle Dr Sheriff followed was

- A debriefing.
- B withdrawal rights.
- C informed consent.
- D voluntary participation.

**Question 8** (1 MARK)

A university's research institution is investigating the effects of meditation on wellbeing in early childhood centres. They recruited three early childhood centres to participate and gained consent from parents or legal guardians of the participants to run tests on the children through a written form.

Why did the researchers seek informed consent from the legal guardians instead of the participants?

**Question 9** (2 MARKS)

Mr Kirra is a psychology teacher and is conducting an investigation on memory. He uses students in his class and ensures their participation by stating that in order to get a passing grade at the end of the semester, they must partake in all of his experiments. He has a 90% participation rate from his class of 28 students.

In terms of participant's rights, describe which specific ethical consideration Mr Kirra breached when he used his own class to conduct the investigation.

**Question 10** (2 MARKS)

Dr Kemei is a first-year psychology lecturer. He is interested in researching students' coping strategies when an unexpected event arises. He collects student data from the university administration and records all of his first-year students' phone numbers. One week before their final exam, he sends them all a text message that there has been an error in the university's system and that all of their grades have been lost. The exam will now be worth 100% of their semester grade. He then records how many students proactively reach out to him regarding this issue.

What ethical principle is Dr Kemei breaching by sending the fake text message, and what would he need to do to ensure that this principle is not breached?

**Questions from multiple lessons****Question 11** (5 MARKS)

Dr Bronte is interested in people's internet usage habits. She recruits participants by putting an advertisement as a sponsored post on a popular social media website. When participants sign up to participate, they are emailed a PDF outlining the purpose of the study and their required involvement. If they agree, they can electronically sign the document and return it to Dr Bronte. For two months, participants track their internet usage by filling in a questionnaire at the end of each day, responding to questions regarding their internet usage and types of websites they visited.

- a Identify the sampling procedure used by Dr Bronte. (1 MARK)
- b Outline one limitation of the use of questionnaires in this study, and describe the implications of this for the study. (2 MARKS)
- c Describe the process of debriefing and how it may be undertaken for this study. (2 MARKS)

# 1F COLLECTION OF DATA

So far in this chapter, you have been learning about how researchers design investigations and the factors they take into consideration; including sampling procedures, ethical considerations and the identification and prevention of errors. When conducting an investigation, researchers must also make decisions concerning the type of data they will collect and whether the type of data will allow them to answer their research question. In this lesson, you will learn about the different types of data that researchers can collect.

1A. Aims, hypotheses and variables	1B. Scientific research methodologies	1C. Population, sample and sampling	1D. Sources of error and prevention	1E. Ethical considerations	1F. Collection of data	1G. Data organisation and interpretation	1H. Evaluation of research
<b>Study design dot point</b>							
<ul style="list-style-type: none"> <li>the characteristics of scientific research methodologies and techniques of primary qualitative and quantitative data collection relevant to the selected investigation: experiments, self-reports, questionnaires, interviews and/or use of rating scales; reliability and validity of data; and minimisation of experimental bias and confounding and extraneous variables</li> </ul>							
<b>Key science skills</b>							
<ul style="list-style-type: none"> <li>Conduct investigations to collect and record data: <ul style="list-style-type: none"> <li>systematically generate, collect, record and summarise both qualitative and quantitative data</li> </ul> </li> </ul>							
<b>Key knowledge units</b>							
Types of data 4.3.3.9							

In this lesson, you will be learning about techniques of primary data collection and the different types of data. You will learn to distinguish between **qualitative and quantitative data**, as well as **subjective and objective data**.

## Collection of data



Types of data 4.3.3.9

## Types of data 4.3.3.9

### OVERVIEW

When collecting data for an investigation, researchers must decide what type of data will best help them test their hypothesis. The types of data you should be familiar with include qualitative and quantitative data, as well as subjective and objective data.

### THEORY DETAILS

In research, data refers to the information collected for a study. There are different ways in which researchers can collect this data. The main method of data collection that you need to be familiar with is **primary data collection**, which involves the experimenter directly collecting the data for an investigation. This data may be collected through various means of investigation, including experimentation, questionnaires, cross-sectional studies and so on, as explored in lesson 1B: Scientific research methodologies.

**Primary data collection** a method of data collection involving data being collected directly by the experimenter

**Want to know more?**

Primary data collection involves the experimenter directly collecting the data. Secondary data collection involves the researcher using data collected elsewhere, or by someone else, for their research. Examples of this would be a meta-analysis, in which the researcher would analyse the findings of other experimenter's research. You do not need to know secondary data collection methods for the VCAA Psychology study design, but it may be useful to deepen your understanding of primary data.

Through investigations, researchers can collect many different types of data. When designing their investigations, researchers must make a decision about what type of data will be the most useful in their research. Types of data and examples of each are summarised in table 1. The strengths and limitations of these types of data are outlined in table 2.

**Table 1** Types of data

Data type	Description	Example
<b>Quantitative data</b>	<ul style="list-style-type: none"> <li><b>Quantitative data</b> concerns quantities and is therefore measurable.</li> <li>It is data that can be represented in numbers.</li> </ul>	<ul style="list-style-type: none"> <li>Data collected from a rating scale or closed questions on a questionnaire.</li> <li>Data collected through an experiment in which the experimenter counts each time a behaviour is observed.</li> </ul>
<b>Qualitative data</b>	<ul style="list-style-type: none"> <li><b>Qualitative data</b> concerns concepts that are not expressed numerically.</li> <li>This data is often collected through descriptions, or through the use of language.</li> </ul>	<ul style="list-style-type: none"> <li>Data collected from open-ended questions on questionnaires.</li> <li>Responses to interview questions.</li> <li>Descriptions of the experimenter's observations written down in a log.</li> </ul>
<b>Subjective data</b>	<ul style="list-style-type: none"> <li><b>Subjective data</b> concerns the individual or personal experience of participants.</li> <li>In this way, it cannot be directly observed and is often collected through self-report.</li> <li>This data is based on a person's opinion.</li> </ul>	<ul style="list-style-type: none"> <li>Data collected through a participant's self-report on a questionnaire about their experience of an event.</li> <li>It can be data collected about a participant's experience, their perspective, feelings, beliefs or attitudes.</li> </ul>
<b>Objective data</b>	<ul style="list-style-type: none"> <li><b>Objective data</b> is data that is collected through direct observation or measurement and should obtain the same results regardless of who is conducting the measurement.</li> <li>It does not rely on the interpretation of the experimenter.</li> <li>It is often understood as 'facts', that is, this data doesn't change based on the person viewing the data.</li> </ul>	<ul style="list-style-type: none"> <li>Data that can be collected the same way by multiple researchers, such as the measurement of a person's height in centimeters.</li> </ul>

**Table 2** Strengths and limitations of different types of data

Data type	Strengths	Limitations
<b>Quantitative data</b>	<ul style="list-style-type: none"> <li>Quantitative data can be manipulated through statistical analysis, allowing for comparisons to be made, trends to be seen and conclusions to be more readily drawn.</li> </ul>	<ul style="list-style-type: none"> <li>Only analysing quantitative data means that researchers may not have a holistic or very detailed understanding of the phenomenon they are researching.</li> </ul>
<b>Qualitative data</b>	<ul style="list-style-type: none"> <li>Qualitative data can give researchers a more thorough and holistic understanding of the context in which the quantitative, or other, data was collected.</li> <li>It can provide background information, or context to the quantitative data.</li> </ul>	<ul style="list-style-type: none"> <li>Qualitative data is difficult to statistically analyse (though it is not impossible).</li> <li>This makes it difficult to manipulate the data in order to compare findings across groups and participants.</li> <li>Qualitative data can be more difficult to obtain as it is often more time-consuming.</li> </ul>
<b>Subjective data</b>	<ul style="list-style-type: none"> <li>Subjective data allows for experimenters to better understand the perspective of participants.</li> <li>It provides researchers with an insight into unobservable phenomena such as motivation, perception, interpretation etc.</li> </ul>	<ul style="list-style-type: none"> <li>Subjective data is difficult to validate and can be unreliable.</li> <li>Sometimes participants may respond with what they think experimenters want to hear, rather than what they truly believe.</li> <li>Subjective data is more difficult to systematically analyse and compare compared to objective data.</li> </ul>
<b>Objective data</b>	<ul style="list-style-type: none"> <li>Objective data does not rely on experimenter interpretation, and so there is more chance that the data is valid.</li> </ul>	<ul style="list-style-type: none"> <li>Using only objective data doesn't allow researchers to understand the perspectives of the participants, which might provide more insight into the research area they are trying to understand.</li> </ul>

Researchers may collect a range of different data types in order to answer their research question in an investigation. For example, in a study on people's exercise habits, a researcher may ask participants to fill in a questionnaire asking participants to report the number of times they have exercised in the last week (subjective quantitative data), as well as asking

**Quantitative data** data concerning numerical amounts; expressed numerically

**Qualitative data** data that describes the characteristics of something; data of concepts that can be measured non-numerically

**Subjective data** data that relies on personal opinion or self-report

**Objective data** data that can be observed or measured by multiple people and obtain the same results

them to describe how they feel about their exercise routine (subjective qualitative data). They may also collect sign-in data from the gym that they attend (objective quantitative data) in order to compare the participant's self-reported number of exercise and the number of times they actually attended. Often, having a range of different data types helps experimenters to gain a more holistic understanding of their topic of research.

### Theory summary

In this lesson, you have learned about different data types that researchers can collect through primary data collection methods. You should be able to distinguish between qualitative and quantitative data, as well as between subjective and objective data. You should also be able to describe the strengths and limitations of each data type in supporting researchers to answer their research question. In a given scenario, you should be able to identify what type of data has been used, and suggest types of data relevant for specific investigations.

## 1F Activities

- 1 Decide if each of the following descriptions are an example of quantitative or qualitative data, and whether it is objective or subjective.

Data	Quantitative/Qualitative	Objective/Subjective
A participant fills in a sleep diary recording how many hours of sleep they think they had each night over the previous week.		
A participant records their sleep data for a week, using a phone app that monitors their movement throughout the night.		
A teacher writes a report for each of his students at the end of each semester, describing their progress and areas for growth.		
A student fills in an anonymous questionnaire on a Google form about a class they took last semester. Each question requires students to indicate how strongly they either agree or disagree with a statement.		

## 1F QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                           |                     |                  |
|---------------------------|---------------------|------------------|
| • Primary data collection | • Quantitative data | • Objective data |
| • Qualitative data        | • Subjective data   |                  |
- a Data that does not rely on interpretation \_\_\_\_\_
- b Data that can be expressed in numbers \_\_\_\_\_
- c A method of data collection in which the researcher directly obtains the data \_\_\_\_\_
- d Data that can rely on self-report \_\_\_\_\_
- e Data of the characteristics of concepts that can be measured non-numerically \_\_\_\_\_

### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

Participants' responses to closed questions in a questionnaire is an example of

- A subjective, qualitative data.
- B objective, qualitative data.
- C subjective, quantitative data.
- D objective, quantitative data.

**Question 3** (1 MARK)

Which of the following is an example of objective data?

- A A person's online review of a product
- B A video interview with an athlete regarding their training schedule
- C A patient's account of how a new trial medication affected their symptoms
- D Brainwave measurements during a counting task

**Apply and analyse**

**Use the following information for questions 4 and 5.**

Angelica and Kaira are two healthy 18 year old students who participated in a study researching social media use. They had to install an app on their phone that monitored how much time they spent on social media apps. This information was sent directly to the researchers via the app at the end of each day.

**Question 4** (1 MARK)

The type of data collected in this study was

- A qualitative only.
- B quantitative only.
- C neither qualitative or quantitative.
- D both qualitative and quantitative.

**Question 5** (1 MARK)

The type of data was

- A subjective only.
- B objective only.
- C neither subjective or objective.
- D both subjective and objective.

**Question 6** (2 MARKS)

Dr Suman conducted a study on the number of errors people make in their first driving test, and their perception of these errors. As participants completed their driving test, the instructor recorded the number and type of errors that were made. Afterwards, participants were interviewed by the researcher who asked them to describe how they felt about the driving test.

- a What type of data does the number of errors represent? (1 MARK)
- b What type of data is collected through the interviews after the driving test? (1 MARK)

**Questions from multiple lessons****Question 7** (5 MARKS)

A researcher studied the effects of sleep deprivation on healthy adult men aged 35 to 50 years old. Participants were recruited through the local YMCA. All participants signed a consent form prior to participating. The study took place in a sleep lab, in which video monitoring was set up in each room to observe the participants' actions throughout the night. Each night, participants were permitted to fall asleep naturally.

- For the first night, all participants were allowed to sleep for 3 hours before being woken up and asked to complete a mathematical task.
- On the second night, participants were woken up after 4 hours and asked to complete the same mathematical task.
- On the third night, participants were woken up after 5 hours and asked to complete the same mathematical task.

Each time participants were woken up, their physiological measures of heart rate and blood pressure were recorded.

- a Identify and describe one potential confounding variable in this experiment. (2 MARKS)
- b What type of data does the readings of the physiological measures represent? (1 MARK)
- c Outline one ethical consideration the researcher would need to consider when conducting this experiment. (2 MARKS)

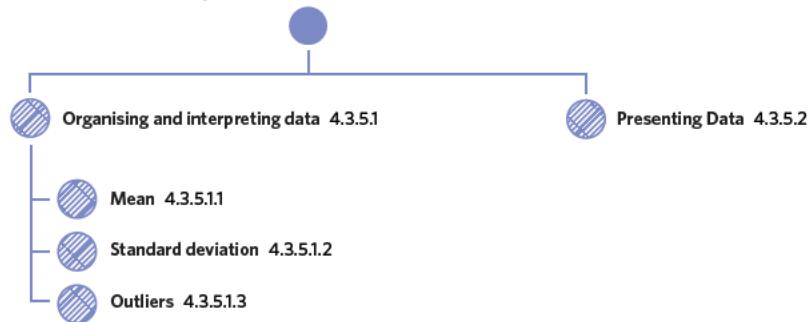
# 1G DATA ORGANISATION AND INTERPRETATION

So far in this chapter, you have learned about the scientific skills and research methods of psychology. You have learned how researchers design and conduct experiments, and the different considerations they must take into account when doing so. Once a researcher has conducted their experiment and collected data, they then organise and interpret this data in order to draw a meaningful conclusion about their study.

1A. Aims, hypotheses and variables	1B. Scientific research methodologies	1C. Population, sample and sampling	1D. Sources of error and prevention	1E. Ethical considerations	1F. Collection of data	1G. Data organisation and interpretation	1H. Evaluation of research
<b>Study design dot point</b>							
▪ methods of organising, analysing and evaluating primary data to identify patterns and relationships including sources of error and limitations of data and methodologies							
<b>Key science skills</b>							
▪ Analyse and evaluate data, methods and scientific models <ul style="list-style-type: none"> <li>- recognise the difference between statistics that describe a specific sample and the use of statistics to make inferences about the population from which the data were drawn</li> <li>- process quantitative data using appropriate mathematical relationships and units</li> <li>- organise, present and interpret data using tables, bar charts, line graphs, percentages, calculations of mean as a measure of central tendency and understanding of standard deviation as a measure of variation around the mean</li> </ul>							
<b>Key knowledge units</b>							
Mean (Organising and interpreting data) 4.3.5.1							
Standard deviation (Organising and interpreting data) 4.3.5.2							
Outliers (Organising and interpreting data) 4.3.5.13							
Presenting data 4.3.5.2							

**In this lesson, you will be learning about the methods through which researchers can organise and interpret data.** You will learn about how data can be organised, presented and interpreted using a range of methods, and how data can be used to describe a specific sample and make inferences about the research population.

## Data organisation and interpretation



## Organising and interpreting data 4.3.5.1

### OVERVIEW

Once a researcher has collected the raw data during an investigation, they must organise and present the data in order to construct meaningful interpretations.

### THEORY DETAILS

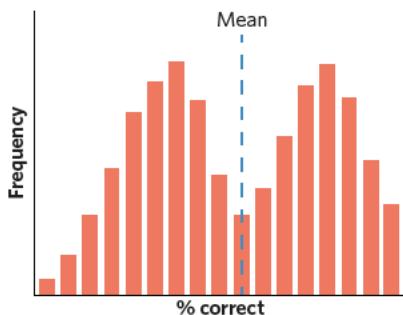
Researchers must make decisions about how to organise and manipulate data collected

during a study in order to identify meaningful trends or relationships within the data set. The researcher would begin by analysing the data collected in the study to derive **descriptive statistics**, which are statistics that describe the sample of the investigation. These statistics are presented in forms such as graphs and summary tables. This differs from **inferential statistics**, which assist researchers in making judgements regarding the extent to which the results of the experiment are meaningful and might apply to the population of research interest.

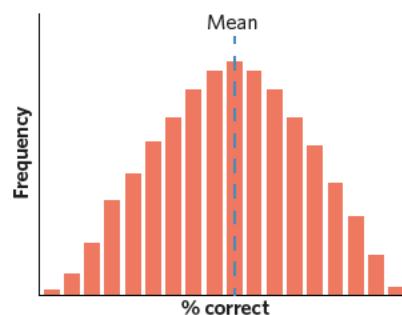
#### Mean 4.3.5.1.1

A common descriptive statistic that can give researchers information about the sample are measures of central tendency, which give information about what the ‘centre’ of the data set looks like. The centre is of interest to researchers because it demonstrates the trend of a data set and therefore represents a typical response. One measure of central tendency with which you should be familiar with is the mean.

The **mean** of a data set is calculated by adding up all of the data points and dividing it by the number of total data points. The mean is useful when the data points are clustered around a central score, so that this measure of central tendency can help researchers understand what the ‘average’ result is. If the data points are too widely or unevenly distributed, the mean could be a poor indicator of central tendency as it doesn’t accurately reflect the ‘central’ score of the data set.



**Figure 1** When the data is unevenly distributed or clustered around extreme values, the mean is not an accurate measure of central tendency



**Figure 2** When the data points are clustered around a central score, the mean provides a more accurate measure of central tendency

#### Standard deviation 4.3.5.1.2

Another descriptive statistic that researchers can use to interpret data is **standard deviation**. The standard deviation of a data set is a measure of variation around the mean that shows the spread of data values around the average. The standard deviation shows how much the data ‘deviates’ (differs from) the mean.

**Descriptive statistics** statistics that are used to organise and summarise data

**Inferential statistics** statistics that provide information on the statistical significance of the results and suggest how they might apply to a wider population

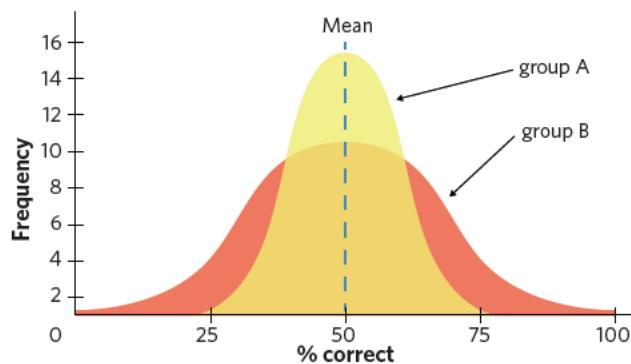
**Mean** a measure of central tendency that represents the average of a data set

#### Want to know more?

Two other common measures of central tendency are the mode and the median:

- The mode is a numerical value that appears most frequently within a data set.
- The median is the middle data point of a data set when data points are ordered from lowest to highest.

**Standard deviation** a measure of central tendency that represents the spread of data around the mean



**Figure 3** Two data sets with the same mean and differing standard deviations

Standard deviation can give researchers more information about the data set than the mean alone, as it shows the spread of results and how much variation there is in a data set. For example, figure 3 shows two data sets which have the same mean. If researchers were only to look at the mean, they might say that the results of the two groups are comparable. However, when researchers also look at the standard deviation, it can be seen that the data sets vary. In group A, the standard deviation is relatively small (that is, the results don’t deviate much from the mean), whereas the standard deviation of group B is larger (that is, the results deviate much more from the mean, so the results obtained in group B have a greater variance). In this way, using the standard deviation can allow researchers to more meaningfully compare two or more sets of data.

Standard deviations can also be represented numerically. The larger the standard deviation number, the more that the data in the set ‘deviates’ or differs from the mean, that is the data set has more variance.

#### Outliers 4.3.5.1.3

An important component that researchers must take into consideration when organising and interpreting data is the presence of outliers. Outliers are data points that differ or lie far away from the other results. Outliers may arise for a number of reasons. Often, the presence of outliers may affect how accurately a mean summarises data. If an outlier is included in the calculation of the mean, the mean may not be an accurate reflection of the average result. When looking at data sets, researchers must decide whether or not to include outliers in their statistical analysis. This may require a deeper analysis of why the outlier occurred, what it represents and how it may affect the validity of the results.

**Outlier** a value that differs from the other values in a data set

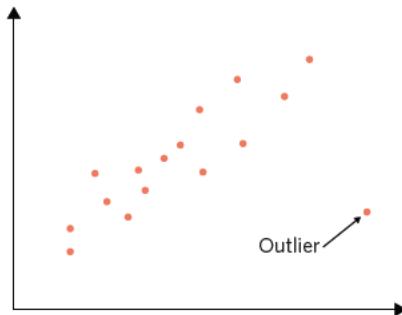


Figure 4 Example of an outlier

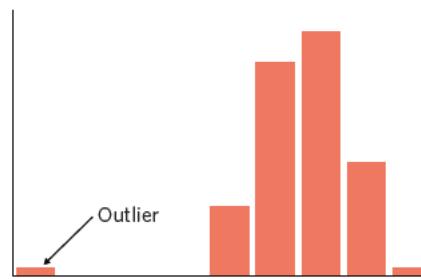


Figure 5 Example of an outlier

#### Presenting data 4.3.5.2

##### OVERVIEW

Visually presenting data can help researchers to interpret and share the data collected in an investigation. Common methods of data presentation include the use of a table, bar chart or line graph.

##### THEORY DETAILS

In analysing, organising and interpreting data, researchers may choose different ways of representing it visually. Representing data visually makes it easier to see the relationship between the variables being investigated, through making patterns or trends in the data set more evident.

The two main ways of representing data are in tables or graphs:

- A **table** displays information using columns and rows.
- A **graph** shows the relationship of variables using a vertical and horizontal axis.

**Table** a method of presenting data using columns and rows

Table 1 Example of a table used to display data (Australia Bureau of Statistics, 2018)

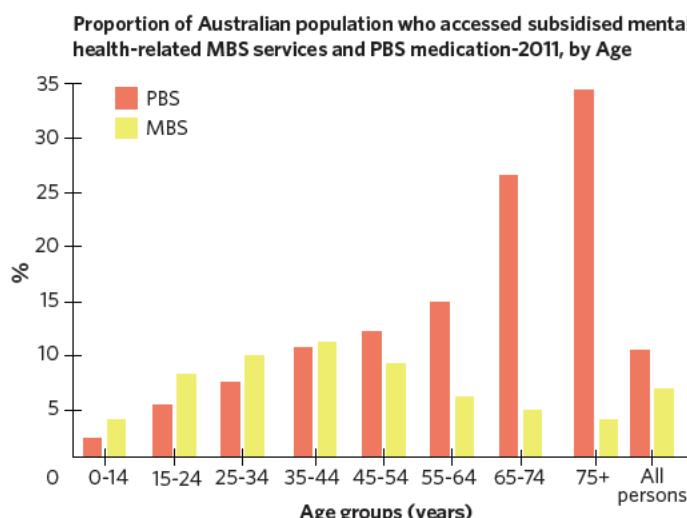
	Student enrolments by school affiliation, Australia, 2014-2018				
	2018	2017	2016	2015	2014
Government	2,558,169	2,524,865	2,483,802	2,445,130	2,406,495
Catholic	765,735	766,870	767,050	765,539	757,749
Independent	569,930	557,490	547,374	540,304	529,857
<b>TOTAL</b>	<b>3,893,834</b>	<b>3,849,225</b>	<b>3,798,226</b>	<b>3,750,973</b>	<b>3,694,101</b>

There are two main types of graphs with which you need to be familiar: line graphs and bar charts. Both types of graphs represent data along a vertical and horizontal axis to show the relationship between variables.

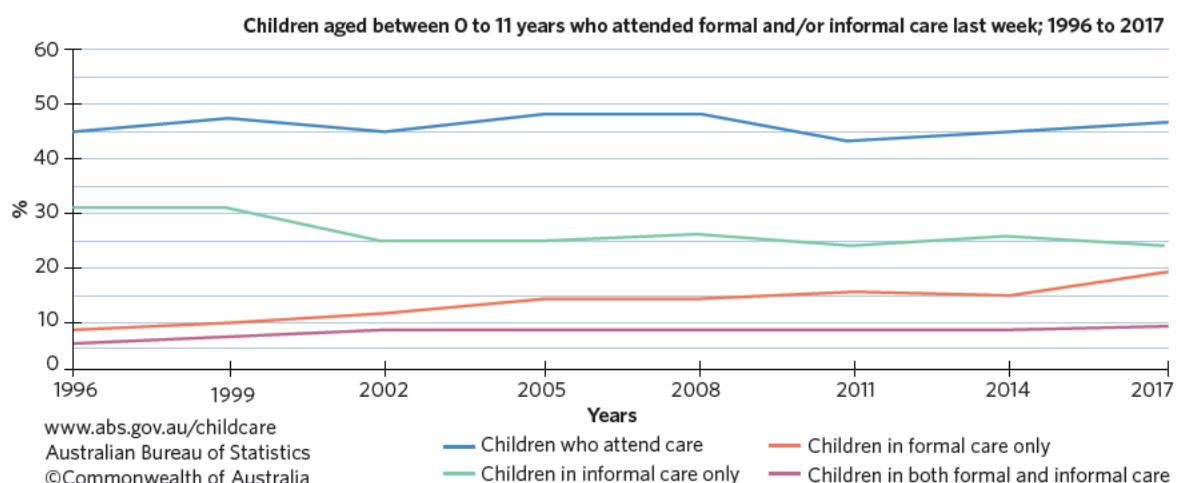
- A **bar chart** uses bars/columns that either sit horizontally or vertically and is used when one variable in the data represents categories.
- A **line graph** uses a line to connect the points of data along a graph, displaying the relationship between the variables.

**Bar chart** a graph that depicts the relationship between two variables using rectangular bars

**Line graph** a graph that depicts the relationship between two variables using a line that connects each data point



**Figure 6** Example of a vertical bar chart (Australian Bureau of Statistics, 2011)



**Figure 7** Example of a line graph (Australian Bureau of Statistics, 2018)

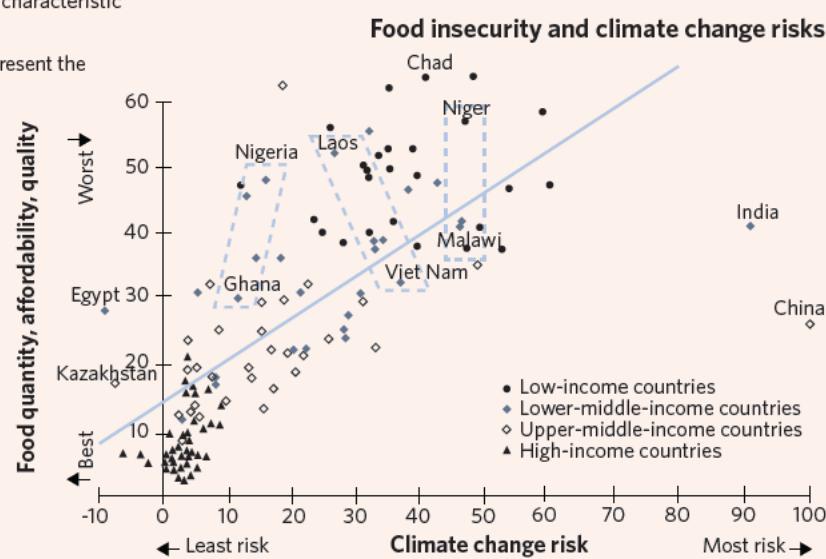
#### Want to know more?

You may have come across other methods of representing data.

- A pie chart displays the proportion of each key characteristic within the data.
- A scatterplot plots data points on a graph to represent the relationship between two variables.



**Figure 8** Example of a pie chart  
(Department of Foreign Affairs and Trade, 2017)



**Figure 9** Example of a scatterplot (Oxfam, 2014)

**Useful tips**

When drawing graphs, you should note that:

- The independent variable is represented on the horizontal (x) axis while the dependent variable is represented on the vertical (y) axis.

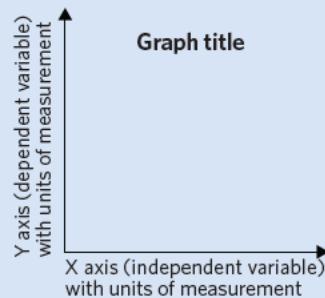
When interpreting graphs, you should note that:

- The presence of a correlation does not necessarily establish that there is a causal relationship between two variables, remember **correlation does not equal causation!**
- Not all experiments will show a correlation between variables.

**Useful tip**

When drawing a graph, it is important to make sure you have all the following components:

- A title
- A label for your horizontal (x) axis
- A label for your vertical (y) axis
- Units of measurements for both axes



## Theory summary

In this lesson, you have learned about how you can organise, present and interpret data collected from an investigation. You should be able to identify the mean and standard deviation as measures of central tendency and explain why they are examples of descriptive statistics. You should also be able to calculate the mean and explain how standard deviation can be used to interpret the spread of data in a data set. You should also be able to construct tables, bar graphs and line graphs and be able to interpret information when data is presented in these formats.

## 1G Activities

- 1 Calculate the means of the following sets of data.

	Data	Calculation	Mean
a	14, 16, 27, 11, 12, 15, 5	The mean = $\frac{14+16+27+11+12+15+5}{7}$	
b	272, 345, 324, 222		
c	1, 4, 2, 5, 7, 8, 10, 6, 3, 7, 9		
d	68, 67, 66, 68, 65, 62		

- 2 Describe the standard deviation of group 1 and group 2 in the following graph.

Group 1: \_\_\_\_\_

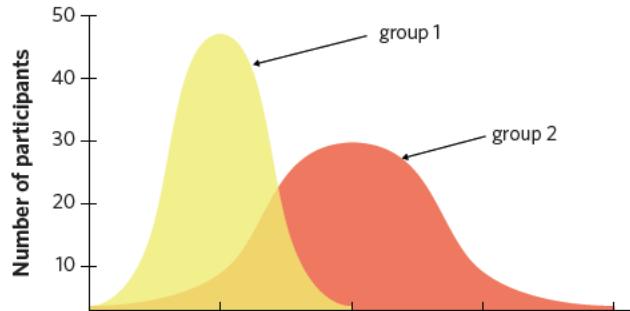
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Group 2: \_\_\_\_\_

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# 1G QUESTIONS

## Theory review questions

### Question 1

Match the key terms from the lesson to the corresponding definition.

- |                          |                      |           |              |
|--------------------------|----------------------|-----------|--------------|
| • Descriptive statistics | • Mean               | • Outlier | • Bar chart  |
| • Inferential statistics | • Standard deviation | • Table   | • Line graph |
- a A graph that uses columns to represent data about categories of data \_\_\_\_\_
  - b A way of representing data using columns and rows \_\_\_\_\_
  - c A measure of central tendency that communicates how the data is spread around the mean \_\_\_\_\_
  - d Statistics that organise and present the results of an investigation \_\_\_\_\_
  - e A measure of central tendency also referred to as the average \_\_\_\_\_
  - f A data point that lies outside most of the other data points \_\_\_\_\_
  - g Statistics that assist researchers to draw meaningful conclusions from the results of the sample to the population \_\_\_\_\_
  - h A type of graph that shows the relationship between two variables by connecting the plotted points on a graph with a line \_\_\_\_\_

## Exam-style questions

### Remember and understand

#### Question 2 (1 MARK)

The mean is most suitable to use as a measure of central tendency if results are

- A clustered around the extreme values.
- B clustered around a central score.
- C unevenly distributed.
- D widely spread.

*Adapted from VCAA 2017 sample exam MCQ2*

#### Question 3 (1 MARK)

When there is an outlier in the results, what should the researcher do?

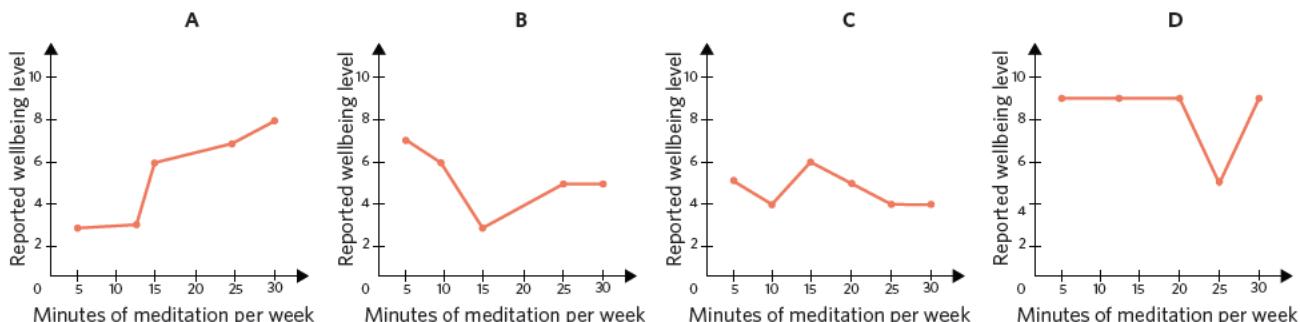
- A Disregard all results, and start the investigation again
- B In all instances, remove outliers as they will skew the data
- C Consider the causes behind the outlier in order to decide whether the data point should be included in the data or not
- D Ask another researcher to replicate the study

### Apply and analyse

#### Question 4 (1 MARK)

In an investigation on the effects of meditation on wellbeing, Lucinda found that participants who meditated more frequently reported higher levels of wellbeing.

Which graph is the most likely representation of these results?

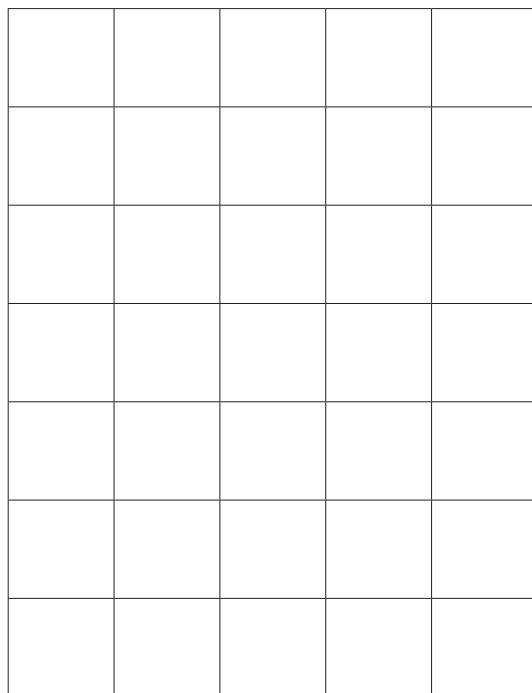


**Question 5** (2 MARKS)

The results of an investigation on the effectiveness of exercise in reducing stress are displayed below.

Hours of exercise each week	Self-reporting stress rating (1-10)
1	7
2	6.7
3	5.9
4	7.8
5	8

Represent these in a correctly labelled graphical representation using the grid provided.

**Question 6** (4 MARKS)

Matilda is a year 12 psychology student. For one of her assessments, she conducted an experiment looking at whether participants remembered more when they were asked to recall or to recognise words. All participants were presented with 10 word-pairs, such as 'plant-green'.

- In the recall condition, participants were presented with one word of the pair and were asked to recall the matching word.
- In the recognition condition, participants were presented with one word of the pair, and three options of the corresponding matching word that they could choose from.

The results of the experiment are provided below:

Recall condition

Participant	Number of word-pairs correctly identified (out of 10)
1	5
2	6
3	3
4	4
5	7

Recognition condition

Participant	Number of word-pairs correctly identified (out of 10)
1	9
2	10
3	8
4	9
5	7

- a Calculate the mean of each condition. (2 MARKS)

Recall condition: \_\_\_\_\_

Recognition condition: \_\_\_\_\_

- b Using the axes provided, construct a bar graph to represent the average results of Matilda's experiment. (2 MARKS)

### Questions from multiple lessons

#### Question 7 (4 MARKS)

Dr Tamsyn conducted an investigation into the effects of a new trial medication for anxiety. All participants in the study had been diagnosed with general anxiety disorder and completed an anxiety rating scale before and after the treatment. Half of the participants were allocated to the control condition, who received a placebo for three months, and the other half were allocated to the experimental condition and received the medication for three months.

Dr Tamsyn compared participants' self-reported anxiety scores before and after the investigation.

She calculated the mean and standard deviations for the two conditions, outlined in the table below.

	Control condition	Experimental condition
Mean anxiety score after treatment	6.2	5.6
Standard deviation	1.8	0.3

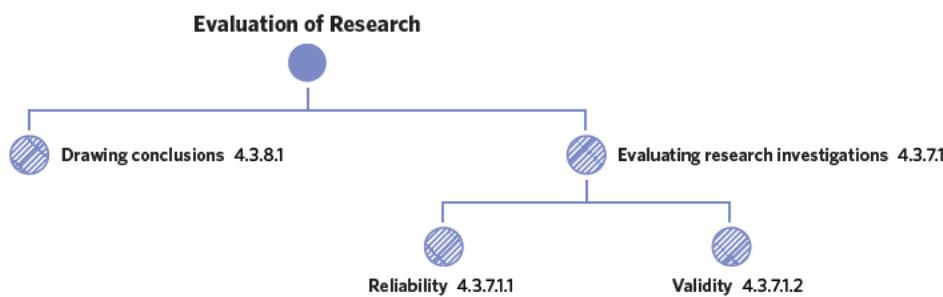
- a What do the standard deviations in Dr Tamsyn's investigation suggest about the data of the control condition as compared to the experimental condition? (1 MARK)
- b The placebo effect may have occurred in the control condition. Explain what is meant by the placebo effect and how it might have affected the results of this investigation. (2 MARKS)
- c Identify the experimental design Dr Tamsyn used. (1 MARK)

# 1H EVALUATION OF RESEARCH

In this chapter, you have learned about how researchers plan and undertake investigations. In order to draw conclusions about their findings, researchers must evaluate their investigation, both in terms of the research procedures involved and the data collected.

1A. Aims, hypotheses and variables	1B. Scientific research methodologies	1C. Population, sample and sampling	1D. Sources of error and prevention	1E. Ethical considerations	1F. Collection of data	1G. Data organisation and interpretation	1H. Evaluation of research						
<b>Study design dot point</b>													
<ul style="list-style-type: none"> <li>▪ the nature of evidence that supports or refutes a hypothesis, model or theory</li> <li>▪ generalisability of statistics from samples to the populations from which the sample was derived</li> </ul>													
<b>Key science skills</b>													
<ul style="list-style-type: none"> <li>▪ Analyse and evaluate data, methods and scientific models             <ul style="list-style-type: none"> <li>- use basic principles of reliability and validity in evaluating research investigations undertaken</li> <li>- explain the merit of replicating procedures and the effects of sample sizes in obtaining reliable data</li> </ul> </li> <li>▪ Draw evidence-based conclusions             <ul style="list-style-type: none"> <li>- determine to what extent evidence from an investigation supports the purpose of the investigation, and make recommendations, as appropriate, for modifying or extending the investigation</li> <li>- draw conclusions consistent with evidence and relevant to the question under investigation</li> <li>- identify, describe and explain the limitations of conclusions, including identification of further evidence required</li> </ul> </li> </ul>													
<b>Key knowledge units</b>													
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">Drawing conclusions</td> <td style="width: 20%; text-align: right;">4.3.8.1</td> </tr> <tr> <td>Reliability (Evaluating research investigations)</td> <td style="text-align: right;">4.3.7.1.1</td> </tr> <tr> <td>Validity (Evaluating research investigations)</td> <td style="text-align: right;">4.3.7.1.2</td> </tr> </table>								Drawing conclusions	4.3.8.1	Reliability (Evaluating research investigations)	4.3.7.1.1	Validity (Evaluating research investigations)	4.3.7.1.2
Drawing conclusions	4.3.8.1												
Reliability (Evaluating research investigations)	4.3.7.1.1												
Validity (Evaluating research investigations)	4.3.7.1.2												

**In this lesson, you will be learning about the factors that researchers consider when evaluating investigations; specifically the concepts of reliability and validity. Each of these must be considered in order for researchers to come to a conclusion and to generalise the results of the study to the research population.**



## Drawing conclusions 4.3.8.1

### OVERVIEW

Once a researcher has conducted their investigation and analysed the results obtained, they will attempt to draw conclusions in order to either support or refute their initial hypothesis. They will also consider whether they are able to generalise the results of the study back to the wider research population.

### THEORY DETAILS

At the end of an investigation the researcher will come to a **conclusion**, which is a statement regarding the results of the investigation. Specifically, it will relate back to

**Conclusion** a statement regarding the results of an investigation as to whether the hypothesis was supported or not

the hypothesis and state whether it has been supported or not, referring to the data or evidence that demonstrates this. Another key part of the conclusion is the extent to which the results of the investigation can be applied back to the research population, referred to as the **generalisability** of an investigation.

As you learned in lesson 1C: Population, sample and sampling, investigations are often conducted using a subset of the population called the sample. The purpose of using the sample is to be able to test a hypothesis in a practical manner. The results of the investigation should be able to be applied back to the wider population, that is, they should be able to be generalised. Factors that affect generalisability of results are outlined in table 1.

**Table 1** Factors affecting generalisability

Factor affecting generalisability	Explanation
If the sample is representative of the population	The more representative the sample, the higher the ability to generalise their results to the population.
The size of the sample	A larger sample size increases the likelihood that it is representative of the population, and therefore increases the generalisability of the results.
If the results are valid and reliable	Valid and reliable results mean that the investigation has measured what it set out to measure, and that the results can be replicated. You will learn more about this in the next part of this lesson.

Often, it is difficult to generalise the results from an experiment to the wider population. The constraints of time and cost often means that one or more of these factors are not met. Often, more research is required to build upon the data collected from one experiment, in order for scientists to have a more holistic understanding of the research area of interest.

In their conclusion, researchers may make recommendations for future research, including extending or modifying their investigation in some way. With this in mind, it is important that investigations are replicable (that is, can be conducted again, either by the researcher themselves, or by another researcher) to ensure the data collected isn't a 'one-off' and in order to be able to draw reasonable conclusions. Two ways an investigation can be replicated include repeating or reproducing an investigation:

- Repeatability refers to the closeness of agreement between independent results obtained with the same method on identical test material, under the same conditions (same operator, same apparatus and/or same laboratory) (VCAA, 2019).
- In other words, if the same tests are conducted again without change, the results will be the same or very similar.
- Reproducibility refers to the closeness of agreement between independent results obtained with the same method on identical test material but under different conditions (different operators, different apparatus and/or different laboratories). The purposes of reproducing experiments include checking of claimed precision and uncovering of any systematic errors that may affect accuracy from one or other experiments/groups. Reproducibility is often used as a test of the reliability of an experiment (VCAA, 2019).
- In other words, if the same tests are conducted but with a change to the participants, researcher or some slight testing condition, the results will be the same or very similar.

## Evaluating research investigations 4.3.7.1

### OVERVIEW

Validity and reliability are two important factors researchers must consider when evaluating the soundness of their conclusions and investigation.

### THEORY DETAILS

In order to reach a conclusion and assess the generalisability of the results of an investigation, a researcher must evaluate how the study was conducted and how the data was collected. Concepts that researchers must consider include the reliability and validity of the data collected and whether the investigation is replicable and accurate.

**Generalisability** the extent to which the results of an investigation can be applied to the wider research population

## Reliability 4.3.7.1.1

Experimental **reliability** refers to the consistency of results of an experiment. This involves the likelihood that another experimenter will perform exactly the same experiment under the same conditions and generate the same results (within a very narrow range of values). Experiments that use human judgment may not always produce reliable results, as different experimenters may judge and interpret data differently. Small sample sizes or insufficient trials may also produce results that are not reliable.

Results must be reliable for researchers to be able to generalise them to the wider research population. Unreliable results can indicate that there were errors in the investigation, whether through the design, through conducting the investigation or through the analysis of results.

Source: Adapted from VCAA Advice for teachers – Psychology

## Validity 4.3.7.1.2

A measurement is **valid** if it measures what it claims to be measuring; for example, a test of memory should measure memory and not something else (such as intelligence or emotional state). Both the experimental design and the implementation should be considered when evaluating validity.

A distinction can be made between internal and external validity; both types are relevant to evaluating the validity of a research investigation or procedure:

- **Internal validity** refers to whether there is a causal relationship between the independent and dependent variables or whether any observed effects of the investigation or procedure are due to some other factor. Internal validity can be improved by controlling for extraneous variables. This can be achieved through measures such as using a particular type of experimental research design, using standardised instructions and procedures, counterbalancing and eliminating experimenter effects.
- **External validity** refers to the extent to which the results of an investigation can be generalised to other settings, other people and over time. External validity can be improved through a number of methods including conducting experiments in settings natural to the research question of interest, increasing the size of the sample and using random sampling to select participants. Experimental data conclusions are said to be valid if the measurements that have been made are affected by a single independent variable only. They are not valid if the investigation is flawed and control variables have been allowed to change or there is experimenter bias.

Source: Adapted from VCAA Advice for teachers – Psychology

Similarly to reliability, an investigation must be valid in order for researchers to confidently generalise the results to the wider researcher population. If a measure is not valid, this means that the conclusion reached may be inaccurate and the effects seen in the dependent variable may actually be due to causes other than the independent variable.

**Reliability** how likely it is that the results are consistent and the same results would be obtained by another researcher

**Validity** the extent to which the investigation measures what it intends to measure

**Internal validity** the extent to which the changes in the dependent variable are caused by the independent variable, and not other variables

**External validity** the extent to which the results of an investigation can be applied to other settings, people and time

### Useful tip

For external validity to occur, it must first be internally valid.

**lesson link** One way to increase internal validity is by identifying and preventing extraneous variables in an investigation. In lesson **1D: Sources of error and prevention**, you learned about the different types of extraneous variables and how they may be controlled for.

### Analogy



One way to think about reliability and validity is looking at the analogy of archery. Let's say that validity in this case is being able to hit where the archer aims to hit, which is the centre point of a target.

- The first target shows that the archer has consistently hit the top right corner of the target. As they consistently do so, they are reliable. But as they haven't been able to hit the centre (which is what they aim to do), it is not valid.
- The second target shows that the archer has hit the target in a few different spots spread out around the target. This is neither

valid (as it hasn't hit the centre) nor reliable (as the results aren't consistent across separate trials).

- The third target shows that the archer has consistently hit the centre of the target. This is both reliable (as they are consistent) and valid (as they have been able to hit where they aimed to hit).

As you can see here, an investigation can be reliable without being valid. Conversely, it is possible for an investigation to also be valid but not reliable. It is important that researchers evaluate investigations looking for both validity and reliability in order to draw a conclusion.

**Want to know more?**

Another consideration when drawing conclusions is accuracy. Experimental accuracy refers to how close the experimental result obtained is to the accepted, or ‘true’, value of the particular quantity subject to measurement. The true value is the value that would be found if the quantity could be measured perfectly. For example, if an experiment is performed and it is determined that a given substance had a mass of 2.70 g, but the actual or known mass is 3.20 g, then the measurement is not accurate since it is not close to the known value. The difference between a measured value and the true value is known as the ‘measurement error’.

‘Accuracy’ is not a quantity and therefore cannot be given a numerical value. It is allowable for a measurement to be described as being ‘more accurate’ when its method and/or instruments clearly reduce measurement error, such as using a triggered electronic timer system compared to a hand-operated stopwatch.

Source: Adapted from VCAA Advice for teachers – Psychology

## Theory summary

In this lesson, you have learned about the factors in an investigation researchers must consider to form a conclusion. You should be able to describe the concepts of reliability and validity (both internal and external). You should be able to consider these factors when given a research scenario, and account for these when drawing a conclusion based on an investigation’s results. When analysing how an investigation was designed and conducted, you should also be able to comment on the generalisability of the results to the research population. Key questions to help you remember each concept are summarised in table 2.

**Table 2** Key questions for each concept

Concept	Key questions
Generalisability	To what extent can the results of an investigation be applied to the research population?
Reliability	How likely is it that another experimenter can replicate the results?
Validity	Is the experiment actually measuring what it aims to measure?
Repeatability	Can the same results be obtained under the same conditions?
Reproducibility	Can the same results be obtained under different conditions?

# 1H QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |                    |               |                     |
|--------------------|---------------|---------------------|
| • Conclusion       | • Reliability | • Internal validity |
| • Generalisability | • Validity    | • External validity |
- a The extent to which an investigation measures what it aims to measure \_\_\_\_\_  
 b The extent to which the results of an investigation can be applied to other settings, people and time \_\_\_\_\_  
 c The extent to which the results of an investigation can be applied to the target population \_\_\_\_\_  
 d The extent to which similar results can be obtained by another researcher \_\_\_\_\_  
 e The extent to which the independent variable has caused the changes in the dependent variable \_\_\_\_\_  
 f A statement summarising the results of an investigation and a comment as to whether or not the hypothesis was supported \_\_\_\_\_

## Exam-style questions

### Remember and understand

#### Question 2 (1 MARK)

Explain what is meant by validity.

**Question 3** (1 MARK)

Explain what is meant by reliability.

**Apply and analyse****Question 4** (1 MARK)

A researcher replicates an investigation that was published in a science magazine. She used a different group of participants with the same procedure as outlined in the journal and obtained similar results.

What do the similar results suggest?

- A** low validity
- B** high reliability
- C** no confounding variables
- D** few participant differences

Adapted from VCAA 2018 exam MCQ8

**Question 5** (2 MARKS)

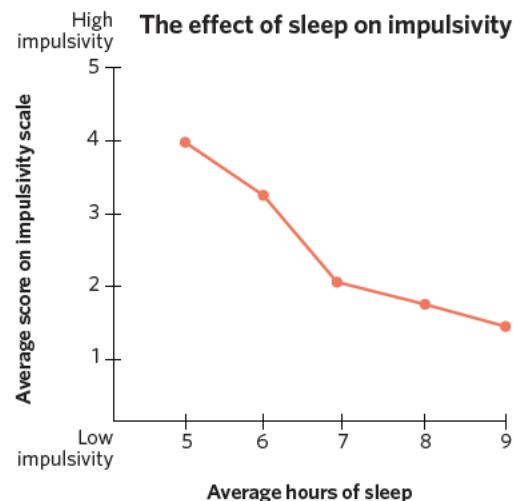
Dr Vinh conducted an investigation into the experiences of people living with depression. He interviewed ten participants as a part of a case study and found that a common theme that came up in his interviews is the stigma that participants faced when talking openly about their depression.

Dr Vinh was unable to generalise the results from his investigation to all people who live with depression. Why?

**Question 6** (2 MARKS)

Jensen, a PhD psychology student, wanted to examine the effect of sleep on impulsive tendencies. He advertised his study in the local newspaper and invited readers to complete a questionnaire online. He hypothesised that people who sleep more on average will score lower on the impulsivity rating scale. The results of the investigation are provided.

Based on these results what conclusion might Jensen draw?

**Questions from multiple lessons**

Use the following information for questions 7 and 8.

Rex is a lecturer at Edrolo University and is interested in whether people are able to retain more information when they listened to recorded lectures at five times speed as compared to listening to the lecture at regular speed. He recruited students from his first year psychology class to participate in his study.

**Question 7** (1 MARK)

The sampling procedure used in this experiment was

- A** convenience sampling.
- B** convenient sampling.
- C** random sampling.
- D** stratified sampling.

**Question 8** (1 MARK)

A limitation of using university students as participants is that it makes it difficult to

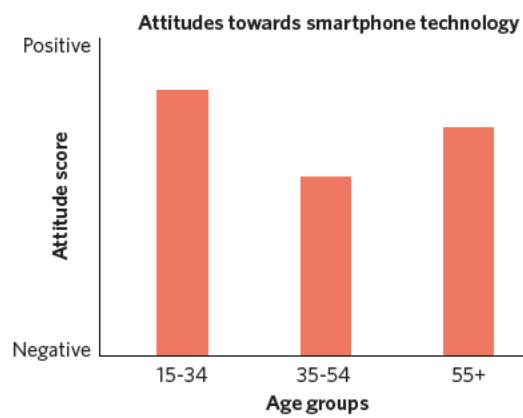
- A** ensure the results were valid.
- B** ensure the results were reliable.
- C** draw conclusions from the results.
- D** generalise to the wider population.

Adapted from VCAA 2018 exam MCQ50

**Question 9** (4 MARKS)

Dr Isla is a researcher studying people's attitude towards technology. She hypothesised that as people got older, they would have a more negative attitude towards smartphone technology. She split her participants into three groups:

- Group 1 comprised of individuals 15-34 years old
  - Group 2 comprised of individuals 35-54 years old
  - Group 3 comprised of individuals aged 55 and older
- a Identify the independent variable and dependent variable of this experiment. (2 MARKS)
- b The results of the experiment are graphed below. Was Dr Isla's hypothesis supported? In your response, refer to the results for each group shown in the graph. (2 MARKS)

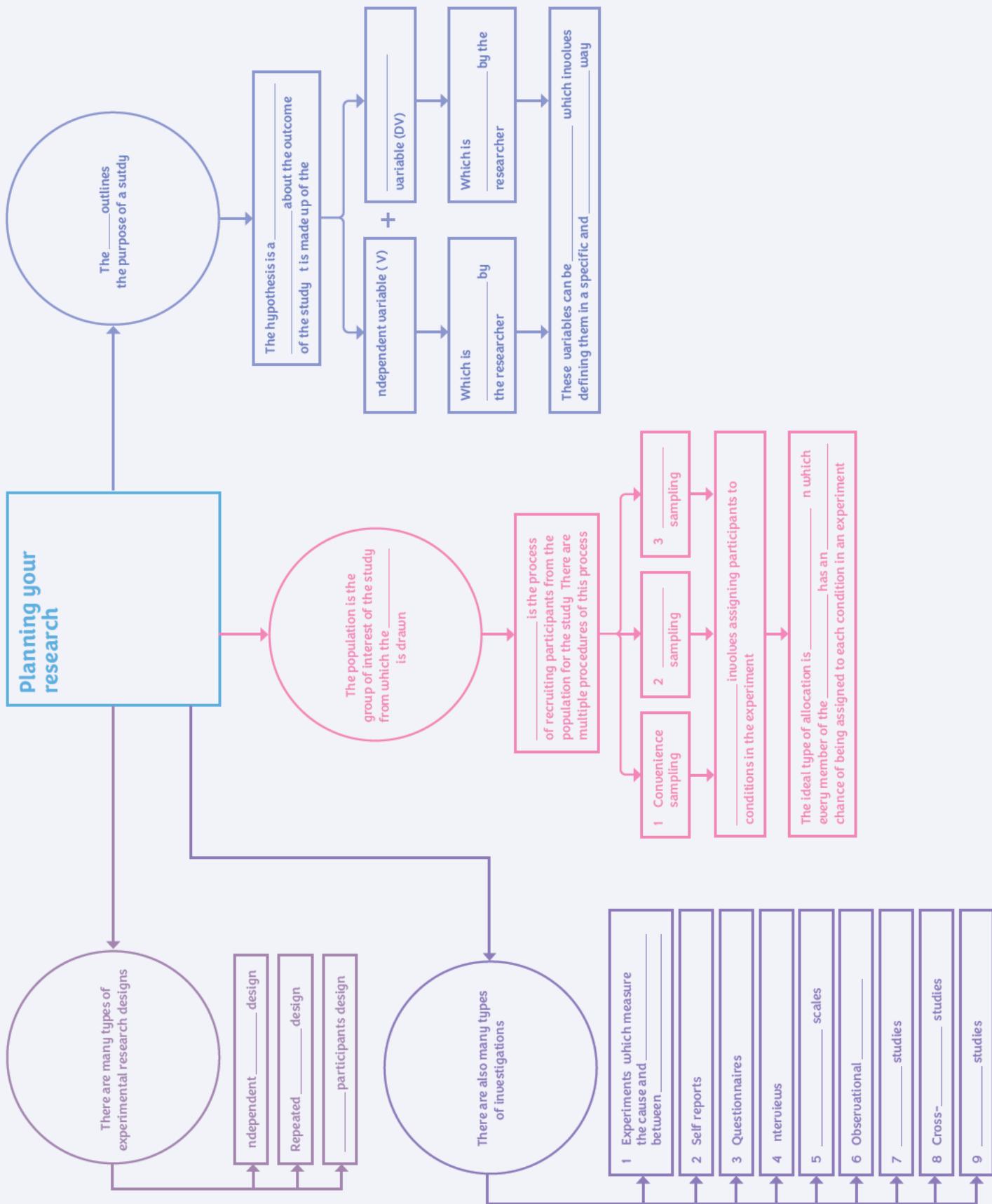


# CHAPTER REVIEW ACTIVITIES

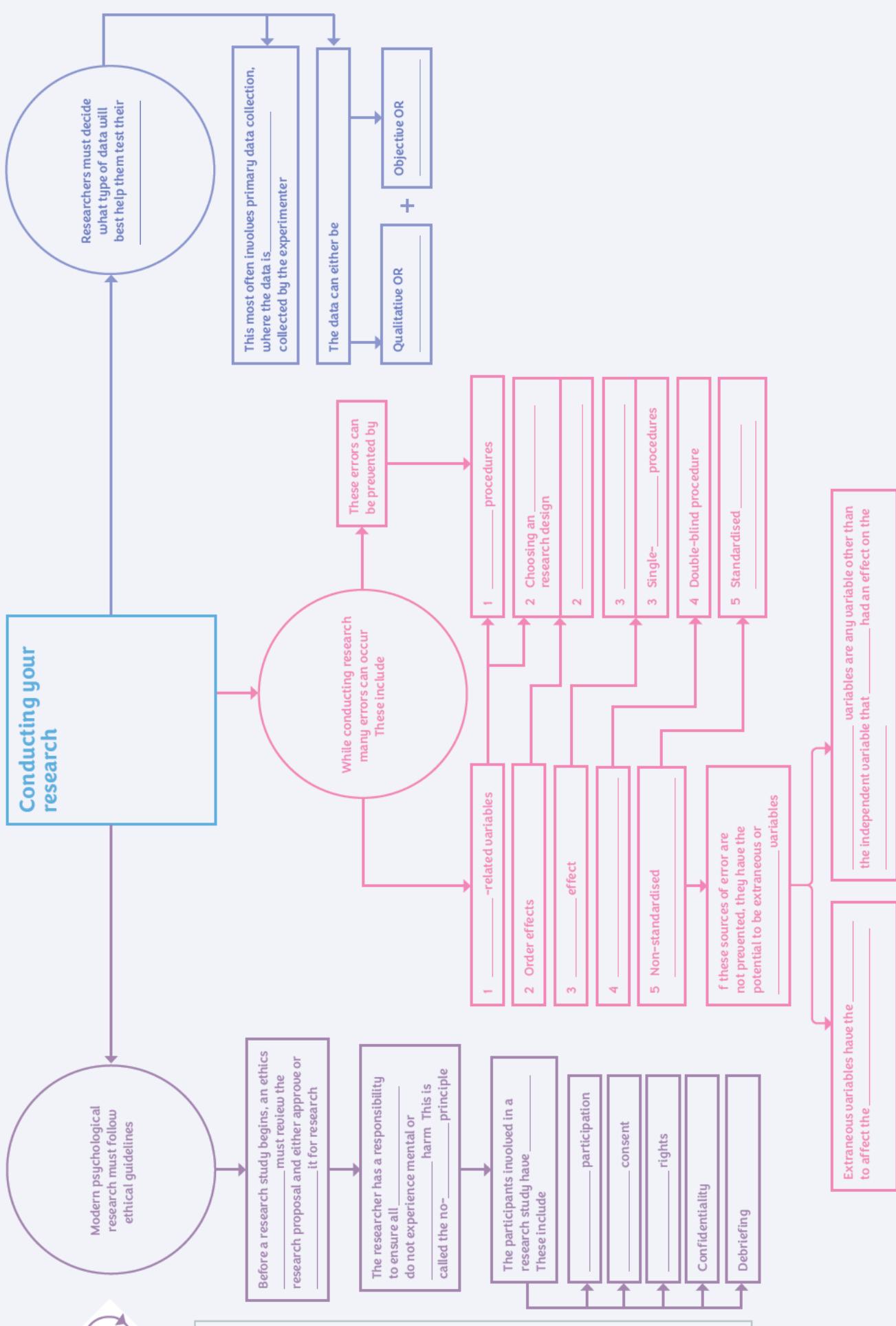
## Review activity 1: Mind map

Fill in the chapter summary mind maps, or create your own.

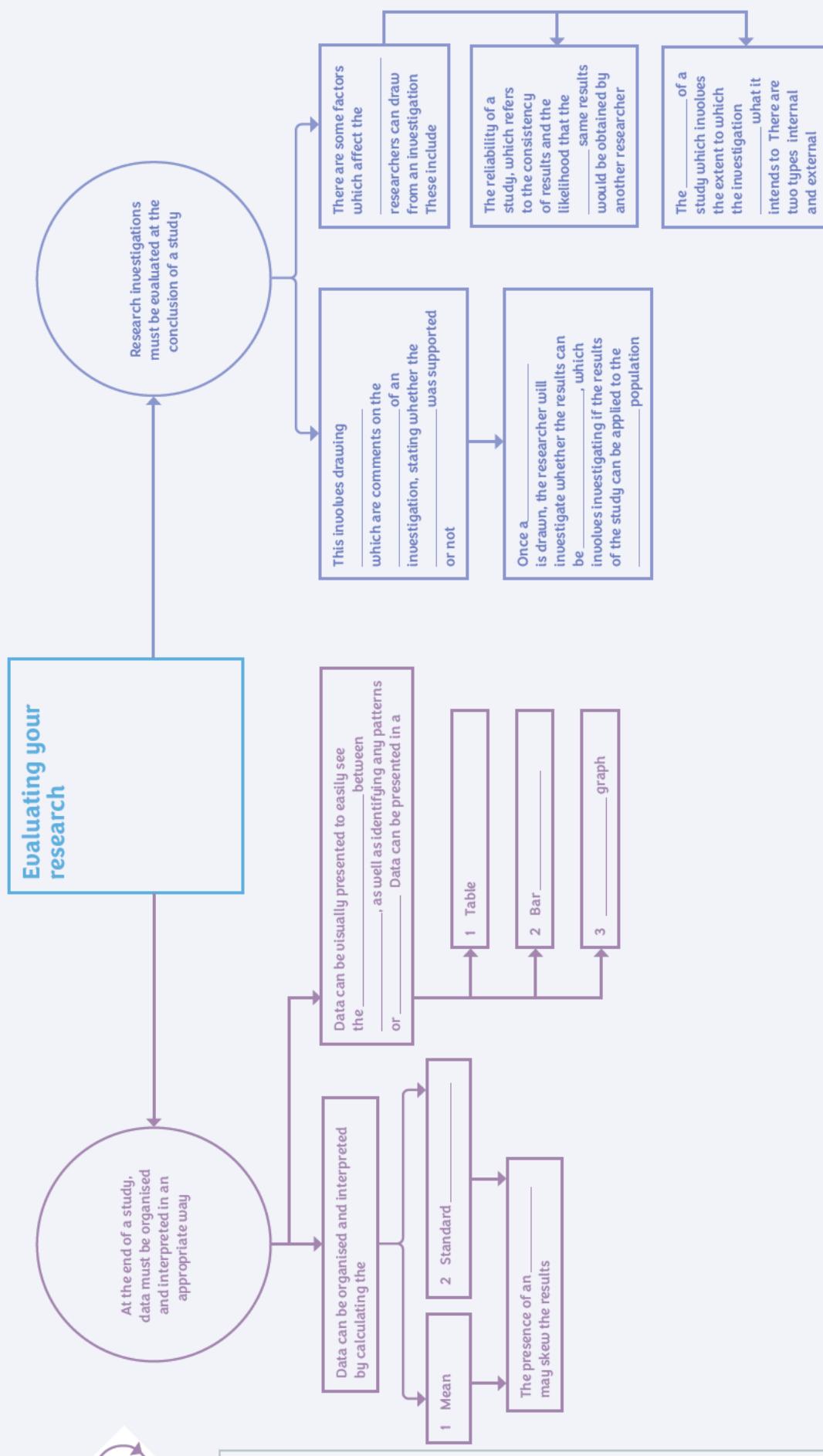
This mind map refers to planning your research and includes the concepts from lessons **1A: Aims, hypotheses and variables**, **1B: Scientific research methodologies** and **1C: Population, sample and sampling**.



This mind map refers to conducting your research and includes the concepts from lessons **1D: Sources of error and prevention**, **1E: Ethical considerations** and **1F: Collection of data**.



This mind map refers to evaluating your research and includes the concepts from lessons **1G: Data organisation and interpretation** and **1H: Evaluation of data**.



**Review activity 2: Example bank**

Fill in the table with your own notes.

Key terminology	Your own definition	Example
Independent variable (IV)		
Dependent variable (DV)		
Self-reports		
Observational studies		
Case studies		
Longitudinal studies		
Cross-sectional studies		
Independent groups design		
Repeated measures design		
Matched participants design		
Convenience sampling		
Random sampling		

Key terminology	Your own definition	Example
Stratified sampling		
Random allocation		
Extraneous variables		
Confounding variables		
Order effects		
Placebo effects		
Experimenter effects		
Non-standardised testing procedures		
Single-blind procedures		
Double-blind procedures		
Counterbalancing		
Placebo		
No-harm principle		

Key terminology	Your own definition	Example
Voluntary participation		
Informed consent		
Withdrawal rights		
Confidentiality		
Deception		
Debriefing		
Qualitative data		
Quantitative data		
Subjective data		
Objective data		
Reliability		
Validity		
Internal validity		

Key terminology	Your own definition	Example
External validity		
Conclusions		
Generalisations		

### Review activity 3: Evaluate a practical investigation

Read the practical investigation outlined below and complete the evaluation questions of the practical investigation.

Dr Dupe was interested in whether strenuous exercise was a useful strategy to reduce a person's stress levels. He decided to conduct an investigation using students from the local secondary school, where his wife was the principal. Dr Dupe was given access to one Year 12 Physical Education class and one Year 12 Art class at the school.

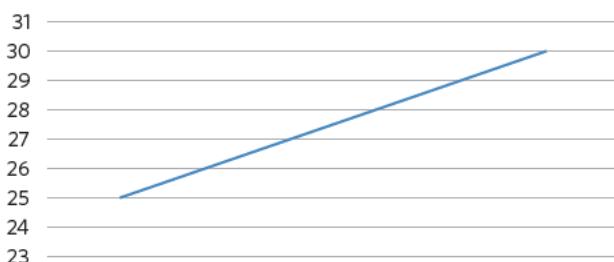
Mrs Dupe, the principal, told the students how important this research was, and requested that all students in the classes followed the instructions of Dr Dupe. They were informed that they would be given detentions if they did not participate or keep their heart rate high enough during the activity.

Dr Dupe asked the first class of students (Physical Education) to participate in a strenuous game of basketball on a Monday morning. All students were involved in the game. They wore heart rate monitors to make sure that they reached an adequate level of physical activity to be considered 'strenuous'. After the game, Dr Dupe got the students to complete a self-report stress questionnaire, which he used to calculate an overall stress rating for each student.

Dr Dupe notices that lots of students were giggling and did not take the questionnaire seriously, so he decided to change his method for the other class. Dr Dupe came back on Thursday afternoon and got the Art students to go for an interview with Mrs Dupe who answered the stress questionnaire for them. The Art students did not complete the basketball game. Following the collection of the data, Mrs Dupe requested that individual results, with names and scores, were posted in the school staff room so that all staff members could monitor the students.

Dr Dupe published the results below and made the following claims in the school newsletter.

"The graph below is able to prove that exercise is an effective way to reduce the stress levels of all Year 12 students, and all students should make sure they take part in a strenuous exercise regime to keep their stress levels low."



- a Discuss a possible problem with the sampling method used in this investigation and suggest an alternative technique that could be used.
- b Identify and describe an extraneous or confounding variable and provide a solution to minimise this problem.
- c Identify an ethical concern and explain why it is problematic. Suggest a more ethical approach that could be implemented in future research.
- d Identify an issue with the way the researchers have chosen to display their results, providing a suggestion for how this data could be displayed more appropriately.
- e Outline the issues with the claims that are made regarding how the results show support for the hypothesis.

*Reproduced from Edrolo and L.Young, 2017.*

# CHAPTER TEST

## Multiple choice questions

### Question 1 (1 MARK)

In a repeated-measures experimental design, all participants

- A are allocated to either the control or experimental group.
- B are allocated to both the control and experimental group.
- C are matched on characteristics relevant to the study.
- D are followed up at predetermined time intervals.

### Question 2 (1 MARK)

Which of the following statements covers all procedures involved in double-blind experiments?

- A Only the participant is unaware of which condition they have been assigned to.
- B Only the experimenter is unaware of which condition the participants have been assigned to.
- C Only the research assistant is unaware of which condition the participants have been assigned to.
- D The participant and the person conducting the experiment are unaware of which condition the participants have been assigned to.

### Question 3 (1 MARK)

The purpose of using a placebo is

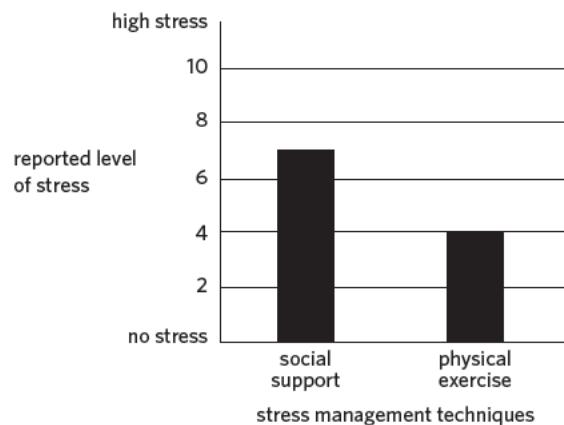
- A to decrease dependent variables related to participant expectations.
- B to ensure the reliability of the results of the experiment.
- C to help validate the effect of the independent variable on the dependent variable.
- D to decrease the confounding variable of experimenter bias.

**Use the following information for questions 4–6.**

A psychology PhD student wanted to examine the effectiveness of physical exercise or social support on a person's stress response. She advertised her study in the local newspaper and invited readers to complete an online questionnaire, in which participants rated their stress on a rating scale.

The results of her study are graphed below.

**Average stress rates indicated by readers**



Adapted from VCAA 2012 exam SAQ10

### Question 4 (1 MARK)

The sampling procedure that the researcher used in this experiment is

- A convenience sampling.
- B random sampling.
- C stratified sampling.
- D random-stratified sampling.

**Question 5** (1 MARK)

The type of data collected in this experiment is an example of

- A subjective data, because participants provided a self-report using a questionnaire.
- B subjective data, because participants provided a qualitative response to questions in the questionnaire.
- C objective data, because the data is collected in the form of numbers.
- D objective data, because the results can be represented in a graph.

**Question 6** (1 MARK)

Which of the following best operationalises the variables of this experiment?

- A IV: the stress management technique participants used; DV: the self-reported level of stress on a rating scale of 0-10.
- B IV: whether participants used social support or exercise as a stress management technique; DV: the level of stress participants experienced.
- C IV: whether participants used social support or physical exercise as a stress management technique; DV: the self-reported level of stress on a rating scale of 0-10.
- D IV: how participants managed their stress; DV: the self-reported stress level of participants, based on the results of an online questionnaire.

**Question 7** (1 MARK)

In an experiment, it is essential to control for extraneous variables so that

- A a valid conclusion can be made about the effect of the independent variable on the dependent variable.
- B a valid conclusion can be made about the effect of the dependent variable on the independent variable.
- C a reliable conclusion can be made about the effect of the independent variable on the dependent variable.
- D a reliable conclusion can be made about the effect of the dependent variable on the independent variable.

*Adapted from VCAA 2013 exam MCQ23*

**Question 8** (1 MARK)

To prevent a biased sample and control for order effects in an experiment, a researcher would respectively need to use

- A random sampling and stratified sampling.
- B random allocation and random sampling.
- C counterbalancing and random sampling.
- D random sampling and counterbalancing.

***Use the following information for questions 9 and 10.***

Henry is a researcher who wanted to test the effects of sugar on concentration. He recruited participants by handing out flyers at his local shopping centre. He conducted a repeated-measures design experiment. In the control condition, participants completed an online concentration task. They then completed the experimental condition, where they drank two cans of soft drink and then completed the same online concentration task.

**Question 9** (1 MARK)

What is one advantage of using a repeated-measures experimental design?

- A It eliminates confounding variables due to experimenter bias.
- B It eliminates confounding variables due to participant differences.
- C It allows for experimenters to see differences and trends amongst different groups.
- D It ensures that participants are matched on relevant characteristics.

**Question 10** (1 MARK)

A potential confounding variable in this experiment could be

- A order effects, due to the order of allocation into either the control or experimental groups.
- B order effects, due to participants having already completed the concentration task in the control condition before the experimental condition.
- C a large sample size, making it difficult to generalise the results.
- D a large sample size that is therefore not representative of the population.

**Short answer questions****Question 11** (4 MARKS)

Kate signed up to participate in an experiment on visual perception. In the experiment task, she was asked to identify whether line A or line B was longer. She was confused when all the other participants consistently chose a different option to hers. Afterwards, Kate left without being told that the experiment was actually about social influence, and that the other participants were confederates and were part of the experiment.

- a Identify and explain one ethical consideration that was not upheld in this experiment. (2 MARKS)
- b With reference to the scenario, explain the role of deception and debriefing. (2 MARKS)

**Question 12** (2 MARKS)

A researcher was interested in the psychological symptoms of stroke patients. She conducted an intensive study of five individuals, collecting data from their medical records.

- a Identify the type of study the researcher conducted. (1 MARK)
- b Outline one limitation of this method of research. (1 MARK)

**Question 13** (6 MARKS)

Dr Tran wanted to test the effects of stimulants on reaction times. She recruited 100 first year students from the University of Melbourne to participate. Participants completed a reaction time task, in which they clicked a button as quickly as possible when a circle appeared on the screen in front of them. Participants in the experimental condition consumed two cups of coffee before completing the reaction task, while the control condition completed the task without consuming any caffeine.

- a Write a research hypothesis for this experiment. (3 MARKS)
- b Outline one ethical consideration Dr Tran needed to consider before conducting this experiment. (2 MARKS)
- c Explain one advantage of using an independent-groups design. (1 MARK)

**Question 14** (3 MARKS)

A national study was conducted on predominant attitudes and values amongst different age groups. Every household in Australia was mailed a questionnaire of 50 questions relating to their views on social and political issues. Participants could fill out the questionnaire and send it back via post. 20 percent of households completed the questionnaire and the results were analysed for trends.

- a Identify the sampling technique used for this study. Justify your response (2 MARKS)
- b Outline one limitation of the use of questionnaires. (1 MARK)

**Question 15** (4 MARKS)

A researcher wanted to test the impact of stress on the recall of memory. To do this, the experimental group learned word pairs in a room where the sound of sirens was played loudly and consistently over a speaker, while the control condition learned the same word pairs in a silent room. Three days after the first phase of the experiment, participants returned to do a memory test, where one of the word pairs was presented to them and they were to recall the corresponding word.

Identify and operationalise the independent and dependent variables for this experiment.



# UNIT 3

## How does experience affect behaviour and mental processes?

The nervous system influences behaviour and the way people experience the world. In this unit students examine both macro-level and micro-level functioning of the nervous system to explain how the human nervous system enables a person to interact with the world around them. They explore how stress may affect a person's psychological functioning and consider the causes and management of stress. Students investigate how mechanisms of memory and learning lead to the acquisition of knowledge, the development of new capacities and changed behaviours. They consider the limitations and fallibility of memory and how memory can be improved.

Students examine the contribution that classical and contemporary research has made to the understanding of the structure and function of the nervous system, and to the understanding of biological, psychological and social factors that influence learning and memory.

A student practical investigation related to mental processes and psychological functioning is undertaken in either Unit 3 or Unit 4, or across both Units 3 and 4, and is assessed in Unit 4, Outcome 3.



# UNIT 3

# AOS1

## How does the nervous system enable psychological functioning?

In this area of study, students explore the role of different branches of the nervous system in enabling a person to integrate, coordinate and respond to internal and external sensory stimuli. They explore the specialised structures and functioning of neurons that allow the nervous system to transmit neural information. Students evaluate how biological, psychological and social factors can influence a person's nervous system functioning. In particular, they consider the ways in which stress can affect the mind and body, the role that the nervous system plays in these processes and how stress can be managed.

### Outcome 1

On completion of this unit the student should be able to explain how the structure and function of the human nervous system enables a person to interact with the external world and analyse the different ways in which stress can affect nervous system functioning.



UNIT 3 AOS 1, CHAPTER 2

# 02

## Nervous system functioning

### 2A Central and peripheral nervous systems

- the roles of different divisions of the nervous system (central and peripheral nervous systems and their associated subdivisions) in responding to, and integrating and coordinating with, sensory stimuli received by the body

### 2B The spinal reflex

- the distinction between conscious and unconscious responses by the nervous system to sensory stimuli, including the role of the spinal reflex

### 2C The neuron

- the role of the neuron (dendrites, axon, myelin and axon terminals) as the primary cell involved in the reception and transmission of information across the synapse (excluding details related to signal transduction)

### 2D Neurotransmitters

- the role of neurotransmitters in the transmission of neural information between neurons (lock-and-key process) to produce excitatory effects (as with glutamate) or inhibitory effects (as with gamma-amino butyric acid [GABA])

### 2E Chronic nervous system changes due to neurotransmitter dysfunction

- the effects of chronic changes to the functioning of the nervous system due to interference to neurotransmitter function, as illustrated by the role of dopamine in Parkinson's disease



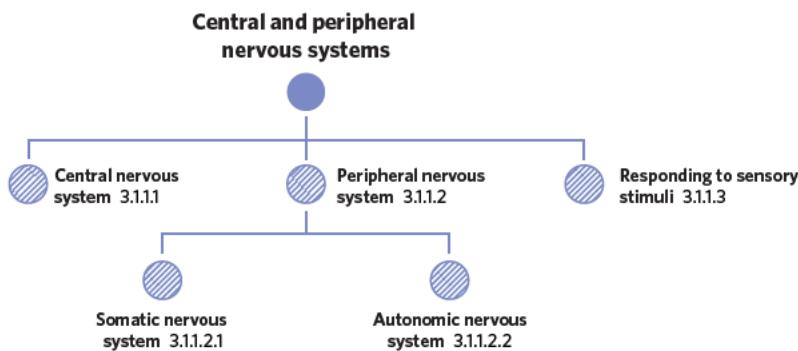
Image by Caleb Angel/Shutterstock.com

# 2A CENTRAL AND PERIPHERAL NERVOUS SYSTEMS

How does your body respond to the things going on inside it and to the world around it? In this chapter, you will begin to answer this question by looking at the nervous system. The nervous system is the network of neurons that allows communication between your brain and body. You will begin by focusing on the main divisions of this network: the central and peripheral nervous systems.

2A. Central and peripheral nervous systems	2B. The spinal reflex	2C. The neuron	2D. Neurotransmitters	2E. Chronic nervous system changes due to neurotransmitter dysfunction								
<b>Study design dot point</b>												
<ul style="list-style-type: none"> <li>the roles of different divisions of the nervous system (central and peripheral nervous systems and their associated sub-divisions) in responding to, and integrating and coordinating with, sensory stimuli received by the body</li> </ul>												
<b>Key knowledge units</b>												
<table> <tr> <td>Central nervous system</td> <td>3.1.1.1</td> </tr> <tr> <td>Somatic nervous system (Peripheral nervous system)</td> <td>3.1.1.2.1</td> </tr> <tr> <td>Autonomic nervous system (Peripheral nervous system)</td> <td>3.1.1.2.2</td> </tr> <tr> <td>Responding to sensory stimuli</td> <td>3.1.1.3</td> </tr> </table>					Central nervous system	3.1.1.1	Somatic nervous system (Peripheral nervous system)	3.1.1.2.1	Autonomic nervous system (Peripheral nervous system)	3.1.1.2.2	Responding to sensory stimuli	3.1.1.3
Central nervous system	3.1.1.1											
Somatic nervous system (Peripheral nervous system)	3.1.1.2.1											
Autonomic nervous system (Peripheral nervous system)	3.1.1.2.2											
Responding to sensory stimuli	3.1.1.3											

In this lesson, you will be learning about the body's two main nervous systems: **the central and peripheral nervous systems**, and their respective branches and functions. You will also learn how these systems work together to consciously respond to sensory stimuli.



## Central nervous system 3.1.1.1

### OVERVIEW

The central nervous system is comprised of the brain and the spinal cord. It is via the brain and the spinal cord that information from the rest of the body and the environment is processed, and responses are formulated.

### THEORY DETAILS

The **central nervous system (CNS)** is 'central' to the body in that:

- It consists of the brain and the spinal cord.
- The spinal cord runs down the middle of the body.
- It is from this 'centre' that all the body's activity is coordinated and integrated via communication with other areas.
- Figure 1 outlines the components of the CNS.

The **brain** is the control centre for the body, allowing the body to respond to information both from within and outside of the body.

The **spinal cord** is the inform transmitted to other parts of the body.

**Central nervous system (CNS)** the brain and the spinal cord, responsible for transmitting neural messages to and receiving neural messages from the peripheral nervous system

**Brain** the body's information centre, responsible for initiating and processing actions, thoughts and behaviour

**Spinal cord** a long cable of nerve tissue (neurons) connecting the brain to the peripheral nervous system, responsible for sending motor information from the brain, and sensory information from the body.

### Analogy

Think of the brain as the 'post office' of the body, in which letters (neural messages) are received, sorted and then sent out.

The spinal cord is the route via which the letters must travel to in order to get to and from the post office. This analogy is represented in figure 1 where the brain is the post office and spinal cord is the route for letters.

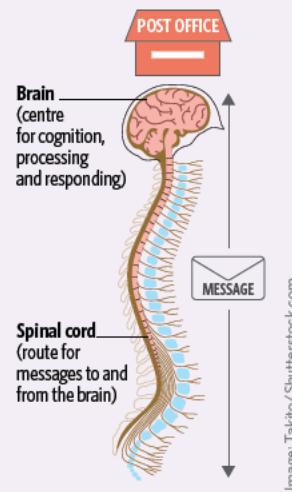


Image: Takito/Shutterstock.com

Figure 1 Memory analogy

## Peripheral nervous system 3.1.1.2

### OVERVIEW

The peripheral nervous system is made up of every neuron in the body outside of the CNS. It is further divided into two branches: the somatic and autonomic nervous systems.

### THEORY DETAILS

The **peripheral nervous system (PNS)** functions to bring information from the rest of the body to the CNS, and to bring information about how to respond from the CNS to the rest of the body. Figure 2 depicts the CNS and PNS in the body. The PNS can be further subdivided into two different systems: the **autonomic nervous system (ANS)** and the **somatic nervous system (SNS)**. Each of these subdivisions have a unique and important role.

#### Somatic nervous system 3.1.1.2.1

The somatic branch of the PNS is responsible for all voluntary movements and actions performed by an organism. These are formulated by communication with the CNS. The **somatic nervous system (SNS)** controls these voluntary movements by transmitting information about the body's sensations to the brain, and then coordinating the skeletal muscles to respond. This occurs through the communication of two different kinds of neurons:

- **Motor neurons** (also known as efferent neurons) are neurons that transmit messages from the brain (motor neural messages) to the skeletal muscles, giving instructions on how to move.
- **Sensory neurons** (also known as afferent neurons) are neurons that transmit information (sensory neural messages) about the body's sensations (including touch, smell, sight etc.) to the brain so that the brain can coordinate a response.

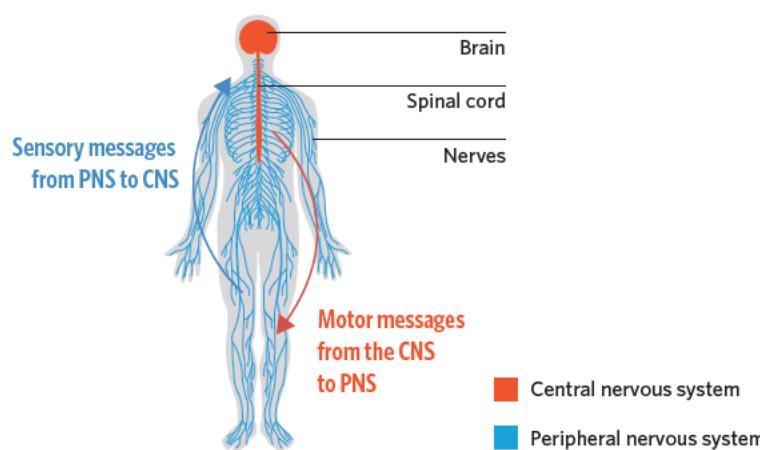


Image: Systemoff/Shutterstock.com

#### Peripheral nervous system

**(PNS)** all nerves outside the CNS, responsible for transmitting information to and from the CNS

#### Somatic nervous system

**(SNS)** the branch of the PNS responsible for sending motor information from the CNS to the body's skeletal muscles and bringing sensory information from the body to the CNS in order to formulate voluntary responses

#### Autonomic nervous system

**(ANS)** the branch of the PNS responsible for connecting the CNS and the body's visceral (non-skeletal) organs, muscles and glands like the heart and liver

**Motor neurons (also known as efferent neurons)** neurons that transmit information (motor neural messages) about voluntary movement from the CNS to the PNS

**Sensory neurons (also known as afferent neurons)** neurons that transmit information (sensory neural messages) about the body's sensations from the PNS to the CNS

**Figure 2** The relationship between the somatic division of the PNS and CNS in coordinating and integrating sensory and motor information

The **skeletal muscles** are involved in conscious movement, such as those in our fingers. These are different from **visceral muscles** like the heart, which do not require conscious mental effort to control. The SNS controls skeletal muscles only.

The SNS operates by:

- Sending sensory neural messages about the body and its environment, such as sensations of temperature and texture, to the CNS.
- Sending motor neural messages from the CNS to the skeletal muscles in order to initiate voluntary responses.

It is through the communication between the CNS and SNS that voluntary responses are coordinated, like running, talking and turning a page. The exact steps involved will be elaborated on later in this lesson.

**Skeletal muscles** muscles connected to the skeleton that are involved in conscious, voluntary movement

**Visceral muscles/organs/glands** the body's non-skeletal muscles, organs and glands that are largely self-regulating and don't require conscious control. These are controlled by the ANS

#### Useful tip

Remember 'S' for somatic nervous system, and 'S' for 'skeletal muscles' to help you remember that the SNS is responsible for coordinating voluntary actions performed by the skeletal muscles. Sometimes you might see sensory neural messages referred to as 'afferent neural messages', and 'motor neural messages' as 'efferent neural messages'.

To remember which is which, think of the acronym 'SAME':

Sensory messages are also called

**Afferent**

Motor messages are also called

**Efferent**

#### Analogy

Thinking back to the post office and letters analogy, the SNS includes:

Addresses from which letters about sensory information are sent to the post office

Addresses to which letters about motor information are sent from the post office

In general, the letters are sent to and from the CNS and the SNS. Letters sent to the CNS are sensory messages, while letters sent from the CNS are motor messages.

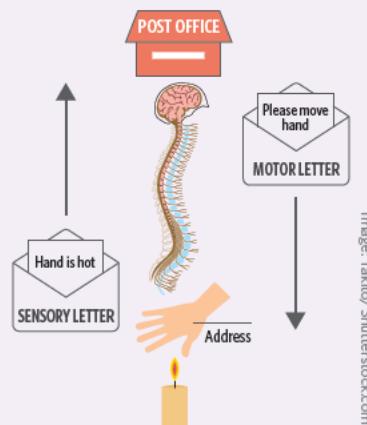


Image: Takto/Shutterstock.com

**Figure 3** A diagram of the post office memory analogy and the role of the CNS and SNS

#### Autonomic nervous system 3.1.1.2.2

The **autonomic nervous system (ANS)** is responsible for initiating the responses of the body's visceral muscles and glands, such as the heart, stomach and liver. It also sends feedback to the brain about their activity. The organs, muscles and glands involved in the ANS are mostly self-regulating in that they don't require conscious mental control to operate.

It is useful, however, to note that we do have conscious control over some of these actions. For example, we are able to regulate our breathing, making it faster or slower, or take deeper or more shallow breaths. The organs, muscles and glands regulated by the ANS are seen in figure 4.

#### Useful tip

Be careful when abbreviating divisions of the nervous system as some divisions start with the same letter (peripheral and parasympathetic, and somatic and sympathetic). In exam answers, always write the full name of the division you are talking about first before putting it in brackets. Do this in each individual question of the exam you are using an acronym in, and avoid abbreviating divisions that start with the same letter in one answer.

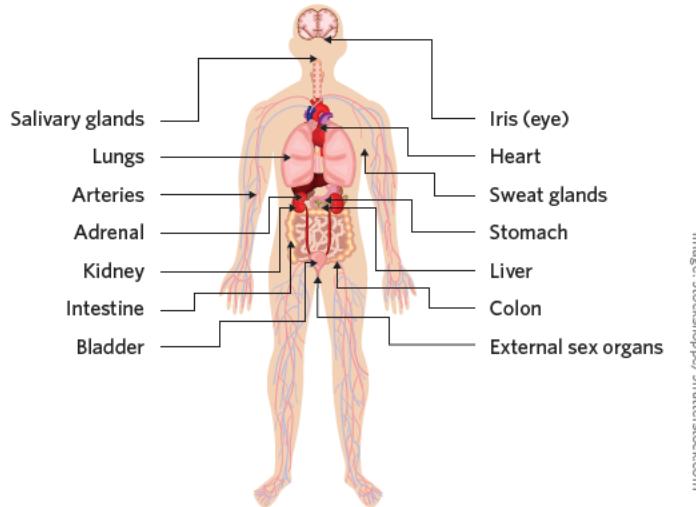


Image: Stockshoppe/Shutterstock.com

Figure 4 Some of the body organs, muscles and glands controlled by the ANS.

The ANS is further divided into two branches: the sympathetic nervous system and parasympathetic nervous system.

The **sympathetic nervous system** is responsible for activating the body's visceral organs, muscles and glands in order to prepare the body for dealing with high levels of activity, such as exercise or escaping a threat. The organs and glands need to be activated in particular ways so that they can help energise the body and be better able to deal with a threat. These changes are called 'sympathetic responses'. It is important that you are aware of the way different organs, muscles and glands are activated 'sympathetically' and why. Table 1 summarises some of these changes.

The **parasympathetic nervous system** is responsible for maintaining optimal levels of functioning of the visceral organs, muscles and glands. It also returns them to their balanced and ideal levels of functioning after the heightened arousal of a sympathetic response. If organs, muscles and glands are kept functioning at sympathetic levels when there is no threat, the body's energy becomes depleted.

Given their distinct roles, the two ANS systems cause different physiological responses in each of the body's muscles, organs and glands. These are listed in table 1.

Table 1 How different body parts are controlled by parasympathetic and sympathetic responses

Parasympathetic responses (During rest and inactivity)	Sympathetic responses (During high levels of activity/under threat)
Constricts pupils of the eye according to the light levels required to see optimally	Dilates pupils of the eyes to allow for more light to enter the eyes and subsequently improve sight where needed
Heart beats at a rate best for optimal functioning during inactivity	Heart rate increases to energise the body for activity by increasing blood flow
Lung airways constrict for ideal breathing rate at rest	Lung airways relax and expand to allow for increased oxygenation required for more intense activity
Digestion operates to allow for regular eating	Digestion is inhibited to allow for more essential bodily functions needed during activity
Blood flow is directed evenly around the body as skeletal muscles do not need increased blood flow at rest	Blood flow increases to allow for efficient movement of skeletal muscles
Bladder constricts and is controlled	Bladder relaxes to allow for more essential bodily functions needed during activity
Adrenal glands do not secrete stress hormones to allow the body to rest	Adrenal glands secrete stress hormones to energise the body
Body reduces release of glucose so it does not deplete the body of energy	Body increases release of glucose to energise the body



You will look at the role of the sympathetic nervous system again when you learn about the fight-flight-freeze response in lesson 3B: **Biological processes of stress.**

#### Sympathetic nervous system

a branch of the ANS responsible for activating the body's visceral organs, muscles, and glands for increased activity or when under threat

#### Parasympathetic nervous

**system** a branch of the ANS responsible for returning and maintaining the body's visceral organs, muscles and glands at optimal and balanced functioning

#### Useful tip

To remember the difference between the two branches of the ANS, it helps to associate each with a catch phrase. Think of the sympathetic nervous system as being in charge of 'fight-flight-freeze' because it helps to energise the body. You can remember the 'S' for sympathetic as well as 'S' for stress because it helps the body during stressful situations. Think of the parasympathetic nervous system as being in charge of 'rest and digest'. You can remember 'P' for parasympathetic as well as 'P' for parachute, as it helps to return the body safely back down to regular functioning after increased activation.

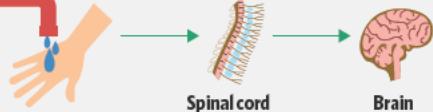
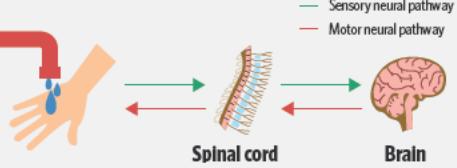
## Responding to sensory stimuli 3.1.1.3

### OVERVIEW

Once you understand the individual components of the nervous system, it is important that you know how they interact to form voluntary responses to sensory stimuli.

### THEORY DETAILS

There are distinct biological processes involved in the way the body integrates information and coordinates voluntary responses to sensory stimuli. Often, you will be required to explain the processes step-by-step, beginning with when the body registers a sensory stimulus, to when it responds. **Sensory stimuli** refers to anything that is registered by the body as a sensation. This sensation is first registered by **sensory receptors**, which are nerve endings that detect such information. When discussing **voluntary responses** to sensory stimuli, you must include the following information:

	Details	Example
<b>Step 1</b> The sensory stimulus is <b>registered</b> .	The sensory receptors in the part of the body in contact with a sensory stimulus register sensory information, such as temperature, light or texture.	The sensory receptors on an individual's hand register the pain of hot water. 
<b>Step 2</b> The sensory information is <b>integrated</b> .	Sensory neural messages are initiated in the PNS. These messages are sent along the sensory neural pathways of the PNS, via the spinal cord to be integrated by the brain (CNS).	The sensory neural messages travel to the brain via the spinal cord. The green line shows the pathway which the sensory neural messages travel along.  Sensory neural pathway Spinal cord Brain
<b>Step 3</b> A motor response is <b>coordinated</b> .	The brain coordinates a conscious motor response, and initiates it by sending motor neural messages out to the PNS via the spinal cord.	The brain will have registered the need to move the hand away from the heat source, and then initiate a response to move the hand.  Sensory neural pathway Motor neural pathway Spinal cord Brain
<b>Step 4</b> A <b>response occurs</b> .	The skeletal muscles receive the motor message, and respond accordingly.	The skeletal muscles of the hand register the motor message and move. 

### Useful tip

When answering questions about voluntary responses, make sure you include each step of the process to get full marks. This includes when each division of the nervous system is involved and the role it plays. It can be helpful to use language like 'coordinate' and 'integrate' in your responses.



This lesson covers how the body's CNS and PNS coordinate voluntary responses to sensory stimuli.

The next lesson, lesson **2B: The spinal reflex** will require you to contrast these conscious responses with unconscious responses of the nervous system, specifically one called the spinal reflex. Spinal reflex responses have different steps to the ones outlined in this lesson.

**Sensory stimuli** anything in the environment or body that is detected by the body's senses

**Sensory receptor** a nerve ending that detects sensations in the environment and body

**Voluntary response** an action coordinated by the body that is performed with conscious control and intention

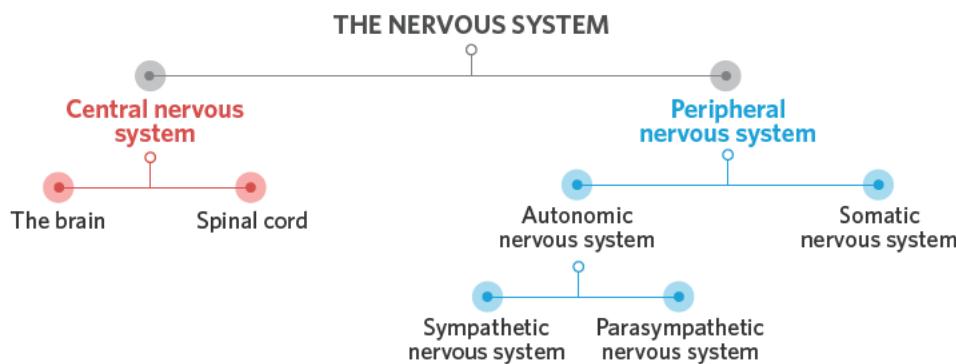


Figure 9 The nervous system and its subdivisions

### Theory summary

In this lesson, you have learned about the different divisions of the nervous system, specifically the central and peripheral nervous systems and their subdivisions. These are summarised in figure 9. You should be familiar with each system's function, as well as what they are comprised of. It is important to understand how the peripheral nervous system is divided into sub-branches, including the somatic and autonomic nervous system. You must be able to describe how the somatic nervous system and central nervous system integrate and coordinate responses to sensory stimuli, and be able to explain it in distinct steps. You should also be able to detail how the autonomic system's sympathetic and parasympathetic systems control the body's visceral parts in their respective ways and why.

### 2A Activities

- 1 With reference to the mail analogy, fill in the gaps using the list of words below to identify what part of the theory and analogy are missing.
- Addresses that letters are sent to and from
  - Brain
  - Motor messages
  - Sensory messages
  - The mail route

Analogy	Theory
The post office	
	The spinal cord
Letters sent to the post office	
Letters sent from the post office	
	The peripheral nervous system

- 2 Create your own step-by-step worked example of a response to sensory stimuli based on someone pricking their finger on a needle. Include at least 4 steps.

### 2A QUESTIONS

#### Theory review questions

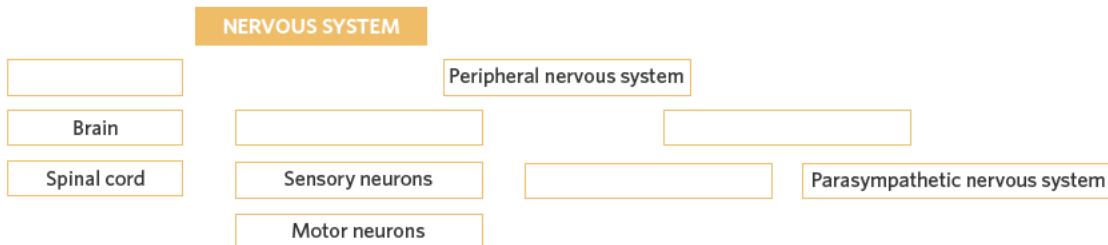
##### Question 1

Match the key term from the lesson to the corresponding definition.

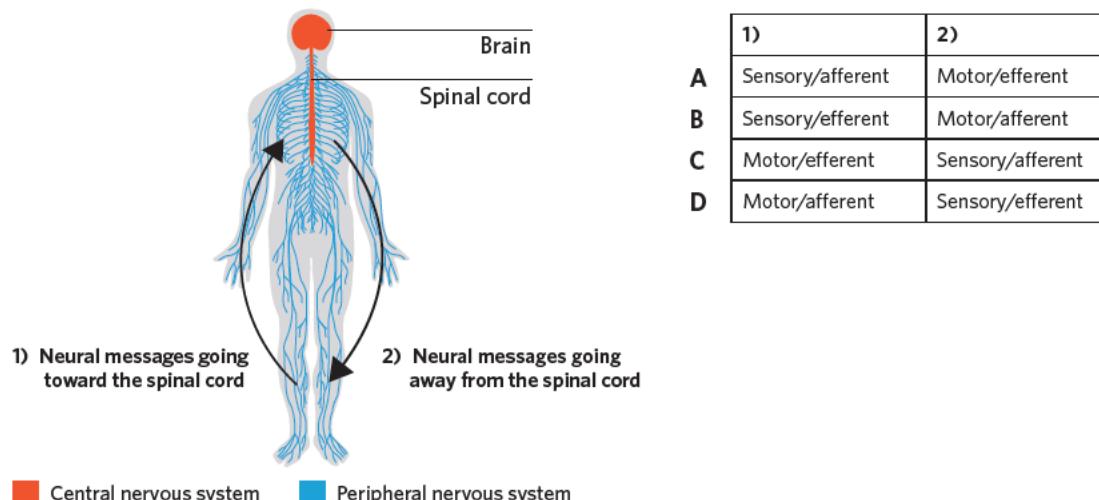
- |                                  |                             |                              |
|----------------------------------|-----------------------------|------------------------------|
| • Autonomic nervous system       | • Somatic nervous system    | • Sympathetic nervous system |
| • Parasympathetic nervous system | • Peripheral nervous system | • Central nervous system     |
- a A division of the nervous system, comprised of the brain and spinal cord. \_\_\_\_\_
- b A division of the nervous system that communicates messages to and from the central nervous system. \_\_\_\_\_
- c A subdivision of the autonomic nervous system that activates the fight-flight-freeze response. \_\_\_\_\_
- d A subdivision of the autonomic nervous system, active when the body is at baseline levels of functioning. \_\_\_\_\_
- e A subdivision of the peripheral nervous system responsible for largely involuntary physiological responses. \_\_\_\_\_
- f A subdivision of the peripheral nervous system that helps to coordinate voluntary responses. \_\_\_\_\_

**Question 2**

Fill in the blanks with the correct branch of the nervous system. Draw lines to connect the boxes in the correct way.

**Question 3**

Pick the option that most accurately corresponds with numbers on the diagram.

**Question 4**

Pick the option that lists the parts of the nervous system occurring in the correct order during somatic nervous system activation.

A	Brain	►	Sensory messages	►	Sympathetic nervous system	►	Motor messages	►	Spinal cord
B	Sensory messages	►	Brain	►	Spinal cord	►	Motor messages	►	Parasympathetic nervous system
C	Sensory messages	►	Spinal cord	►	Brain	►	Spinal cord	►	Motor messages
D	Motor messages	►	Spinal cord	►	Brain	►	Spinal cord	►	Sensory messages

**Exam-style questions***Remember and understand***Question 5** (1 MARK)

Which of the following processes is the parasympathetic division of the nervous system responsible for?

- A The fight-flight-freeze response
- B Dilation of pupils and decreased digestion
- C Mood and levels of physiological arousal
- D Sleep, eating and reproduction

**Question 6** (1 MARK)

One difference between the sympathetic and parasympathetic nervous system is that

- A the sympathetic nervous system harms the body, whereas the parasympathetic nervous system helps it.
- B the sympathetic nervous system includes involuntary responses, whereas the parasympathetic nervous system includes voluntary responses.
- C the sympathetic nervous system increases physiological arousal, whereas the parasympathetic nervous system decreases it.
- D the sympathetic nervous system is part of the central nervous system, whereas the parasympathetic nervous system is part of the peripheral.

**Question 7** (1 MARK)

When a person coordinates a voluntary response, the main divisions of the nervous system involved are

- A the sympathetic and the parasympathetic.
- B the central and the autonomic.
- C the somatic and the peripheral.
- D the central and the somatic.

**Question 8** (2 MARKS)

Name two primary functions of the parasympathetic nervous system.

**Question 9** (2 MARKS)

Outline two possible sympathetic nervous system responses that might occur when someone encounters a threat.

**Question 10** (4 MARKS)

In terms of nervous system functioning, describe how the human body would consciously coordinate a voluntary response after touching a hot pan.

**Apply and analyse****Question 11** (1 MARK)

Robert stumbled backwards and yelled when his little brother jumped out at him unexpectedly from behind his bedroom door. When he realised what had happened, he sat down and noticed that his breathing rate had increased and his hands were shaking.

Which divisions of the nervous system most likely coordinated Robert sitting down, his increased breathing rate, and shaking hands respectively?

- A Somatic, parasympathetic, sympathetic
- B Autonomic, parasympathetic, parasympathetic
- C Somatic, sympathetic, sympathetic
- D Sympathetic, sympathetic, sympathetic

**Use the following information for questions 12 and 13.**

Steven and Joseph are at the Australian Open tennis grand final together. They support opposing players and are both excited and nervous for the game.

**Question 12** (1 MARK)

Both Steven and Joseph's excitement and nervousness just prior to the start of the game is likely to produce which of the following physiological changes?

- A Constricted pupils and muscular relaxation
- B Constricted airways and bladder relaxation
- C Dilated pupils and increased release of glucose
- D Decreased heart rate and increased digestive contractions

**Question 13** (1 MARK)

Toward the end of the game, Steven is extremely excited whereas Joseph is very nervous.

What is the dominant autonomic nervous system division activated during this time for Steven and Joseph respectively?

- A Sympathetic nervous system, sympathetic nervous system
- B Sympathetic nervous system, parasympathetic nervous system
- C Parasympathetic nervous system, sympathetic nervous system
- D Parasympathetic nervous system, parasympathetic nervous system

**Question 14** (1 MARK)

Connie is very afraid of spiders. She opens her biology textbook and lands on a page that features an image of a large spider. Her heart begins to race and she freezes for a moment before realising that it is an image.

Which division of the nervous system is activated during Connie's reaction to the image of a spider?

- A Central nervous system
- B Somatic nervous system
- C Sympathetic nervous system
- D Parasympathetic nervous system

**Question 15** (2 MARKS)

Janet works at a cinema and has an intimidating boss that often shouts at his staff for small errors. One day Janet was sitting at home on her day off and heard her phone ring. She saw her boss's name on her phone screen and began to panic, even before picking up the phone to speak.

In terms of nervous system function, name the division of Janet's nervous system that would have been active when:

She saw her boss's name: \_\_\_\_\_

She picked up her phone: \_\_\_\_\_

**Question 16** (2 MARKS)

Ahmet was sitting by a campfire when he began to feel too hot. He was wearing a scarf and beanie, so decided to take them off.

In terms of neural messages, name the type of neural message in Ahmet's nervous system that would have been sent when:

He felt too hot: \_\_\_\_\_

He took his scarf and beanie off: \_\_\_\_\_

**Question 17** (5 MARKS)

Oliver was sitting in the garden and playing when he felt something crawl onto his leg. He saw that it was a large, red ant and brushed it away with his hand. Shortly after, he involuntarily kicked out his leg and felt a stinging sensation that made him yelp in pain. He realised that he had been bitten by the ant.

- a Identify the division of the nervous system and the type of response involved when Oliver brushed the red ant off his leg. (2 MARKS)

Division: \_\_\_\_\_

Response: \_\_\_\_\_

- b In terms of nervous system functioning, name and explain Oliver's response when Oliver brushed the ant off his leg. (3 MARKS)

Adapted from VCAA 2017 exam SAQ4

**Key science skills**

**Use the following information for questions 18–20.**

A psychologist wanted to investigate people's responses to the sound of a balloon popping. Details of the investigation were provided to a group of ten participants prior to the investigation. The investigation involved blindfolding participants and popping a balloon close to their ear at random time intervals over several trials.

**Question 18** (1 MARK)

When participants were sitting blindfolded they felt their hearts begin to race in anticipation. The main role of their autonomic nervous systems at this time were to

- A** quickly initiate a response to a threat.
- B** modify the activity of internal muscles, organs and glands.
- C** maintain homeostasis in internal muscles, organs and glands.
- D** ensure that the brain activates internal muscles, organs and glands.

*Adapted from VCAA 2018 exam MCQ6*

**Question 19** (1 MARK)

When the psychologist popped the first balloon behind one of the participant's heads, they were extremely frightened and ran away crying. They did not return to the experiment and the psychologist was unable to contact her afterwards.

Which ethical principle was most likely compromised as a result of the participant leaving the investigation before it had finished?

- A** debriefing
- B** beneficence
- C** confidentiality
- D** withdrawal rights

**Question 20** (1 MARK)

The psychologist repeated the investigation on another group of participants using exactly the same procedure and obtained similar results. What do the similar results suggest?

- A** high validity
- B** high reliability
- C** no confounding variables
- D** few participant differences

**Question 21** (2 MARKS)

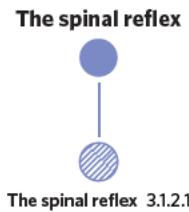
A researcher wants to investigate the relationship between gender and sympathetic nervous system responses. She plans to do this by getting participants to activate their sympathetic nervous system in a stress-inducing situation. What is one ethical principle she would need to abide by that is specific to researching sympathetic nervous system responses?

## 2B THE SPINAL REFLEX

Have you ever put your foot into a bath that is too hot, and yanked it out in less than a second? Have you ever wondered how your body can respond so quickly? In this chapter, you are learning about the human nervous system and how its components allow humans to function and respond to sensory stimuli. In the previous lesson, you learned about how the nervous system can create conscious motor responses. In this lesson, you will learn about the role of immediate unconscious responses to sensory stimuli, specifically a response called the spinal reflex.

2A. Central and peripheral nervous systems	2B. The spinal reflex	2C. The neuron	2D. Neurotransmitters	2E. Chronic nervous system changes due to neurotransmitter dysfunction
<b>Study design dot point</b>				
<ul style="list-style-type: none"> <li>the distinction between conscious and unconscious responses by the nervous system to sensory stimuli, including the role of the spinal reflex</li> </ul>				
<b>Key knowledge units</b>				
The spinal reflex				3.1.2.1

In this lesson, you will be learning about the difference between conscious responses you learned in the last lesson, and the **unconscious responses of the nervous system**. You will focus on one specific kind of unconscious response to sensory stimuli, that is, **the spinal reflex**.



### The spinal reflex 3.1.2.1

#### OVERVIEW

An unconscious response to sensory stimuli occurs automatically and without awareness. The spinal reflex is one kind of unconscious response, occurring at the spinal cord, that allows an organism to respond quickly to sensory stimuli.

#### THEORY DETAILS

Reflexes are a type of response to sensory stimuli which are unlearned and automatic. They are unconscious responses, and are often simple in nature. The **spinal reflex** is one kind of reflex that involves an immediate motor response. One example of a spinal reflex response is the withdrawal reflex. This reflex occurs, for example, when someone immediately withdraws their hand after touching a hot pan.

Unlike conscious responses, the spinal reflex is not initiated at the level of the brain, but at the spinal cord. Because of this, spinal reflexes involve fewer steps, allowing them to occur more quickly and automatically without the brain's awareness. Spinal reflexes occur in less than 0.5 seconds, with withdrawal reflexes occurring in as fast as 0.15 seconds. This means that they enhance survival because an organism is able to respond to danger and harm more quickly than in a conscious motor response.

**Spinal reflex** an unconscious response to sensory stimuli that is initiated at the spinal cord, not involving the brain

The spinal reflex occurs along a path known as the **spinal sensory-motor circuit**. Because of this, it involves specific steps that differentiate the unconscious spinal reflex from conscious motor responses. Instead of messages travelling between the central and somatic nervous systems as in conscious motor responses, the reflex arc occurs only along this spinal sensory-motor circuit in the somatic nervous system. The distinct steps of the reflex arc are:

1. The sensation of a sensory stimulus is detected by the body's sensory receptors, which send a signal via sensory neurons to the spinal cord.
2. The spinal cord, via **interneurons**, immediately relays a signal via motor neurons to initiate an automatic/unconscious motor response in the skeletal muscles to the sensory stimulus.
3. As the motor neurons send messages to tell the body to respond unconsciously, sensory neurons send their neural impulses to the brain to make it aware of any pain or sensation. The brain's conscious awareness is not necessary for the reflex response, but the brain will register the sensations independently and after the reflex response has occurred.

These steps are detailed in figure 1.

#### **Useful tip**

Because the brain consciously registers the pain or sensations that occur within the reflex arc independently, it is not responsible for the reflexive motor response that occurs. As such, you should describe the nature of the reflex response as involuntary and unconscious.

**Spinal sensory-motor circuit (reflex arc)** the path that neural messages take as part of the spinal reflex response, involving sensory messages to the spinal cord which are immediately relayed from the spinal cord as motor messages

**Interneurons** neurons that transfer impulses between sensory and motor neurons as part of the reflex arc

#### **Want to know more?**

Interneurons are a special kind of neuron that act to relay information from and to different kinds of neurons. In the reflex arc, they relay sensory neural impulses immediately to motor neural impulses at the spinal cord. In this way, they can perform the function of the brain in initiating a motor response, but without any conscious awareness.

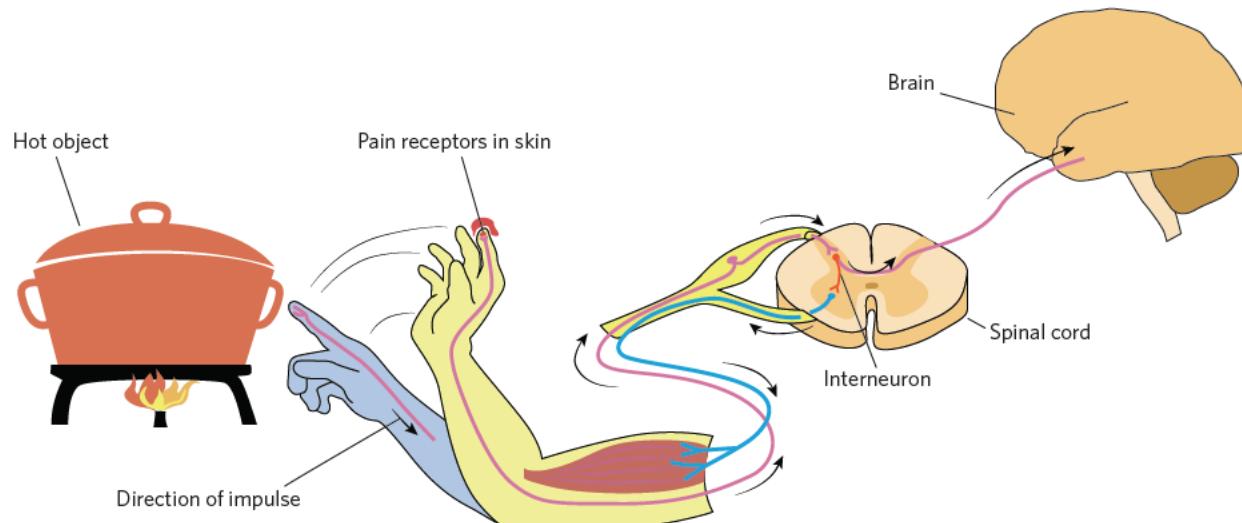


Image: udaix/Shutterstock.com

Figure 1 The spinal reflex response occurring in response to a person touching a hot pan

#### **Useful tip**

In some question and exam scenarios, you will have to figure out whether the response in question was conscious or unconscious. Some key words to look out for are terms like 'immediately' (e.g. 'she immediately withdrew her hand'), which imply that the response in question was reflexive rather than consciously controlled.

## **Theory summary**

In this lesson, you learned about the difference between conscious and unconscious responses to sensory stimuli. You examined one specific kind of unconscious response, that is, the spinal reflex. You should now be familiar with the distinct steps of the spinal reflex arc that are controlled by the spinal sensory-motor circuit. You should be able to compare and contrast these steps with the steps involved in conscious motor responses that you learned in the last lesson. This is summarised in table 1.

Table 1 Comparison of conscious and unconscious motor responses to stimuli

Conscious motor responses to sensory stimuli	Unconscious motor responses to sensory stimuli involving the spinal reflex arc
<ul style="list-style-type: none"> <li>The sensory receptors register the sensory stimulus.</li> <li>Sensory messages are sent along the PNS to the brain via the spinal cord.</li> <li>The brain coordinates a conscious motor response by sending motor messages out via the PNS.</li> <li>The skeletal muscles of the body receive the motor message and respond accordingly.</li> </ul>	<ul style="list-style-type: none"> <li>The sensory receptors register a sensory stimulus, and send a sensory message to the spinal cord.</li> <li>At the spinal cord the interneurons connect the sensory and motor neurons to immediately relay an automatic/unconscious motor response in the skeletal muscles to the sensory stimulus.</li> <li>This information is later consciously registered by the brain, but the reflex response occurs without the brain's awareness.</li> </ul>

## 2B Activities

- 1 Label what is occurring at points 1 to 6 in the spinal reflex arc.

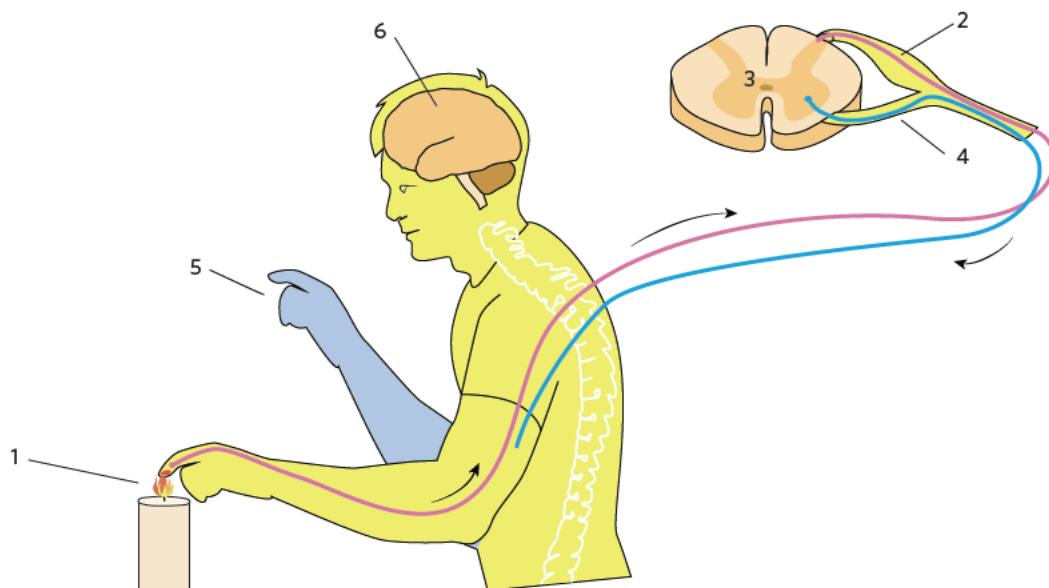


Image: udaix/Shutterstock.com

## 2B QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                                |                 |                |
|--------------------------------|-----------------|----------------|
| • Spinal sensory-motor circuit | • Spinal reflex | • Interneurons |
|--------------------------------|-----------------|----------------|
- a An involuntary, immediate response to sensory stimuli that occurs at the spinal cord \_\_\_\_\_
- b The path that neural messages travel along in the spinal reflex response \_\_\_\_\_
- c Neurons that communicate neural impulses between neurons \_\_\_\_\_

### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

The nature of the spinal reflex response is

- A controlled.
- B involuntary.
- C voluntary.
- D conditioned.

Adapted from VCAA 2017 Exam MCQs

**Question 3** (1 MARK)

Which of the following is true of the spinal reflex?

- A It is a conscious involuntary response to sensory stimuli.
- B It is an unconscious voluntary response to sensory stimuli.
- C It is a conscious voluntary response to sensory stimuli.
- D It is an unconscious involuntary response to sensory stimuli.

**Question 4** (1 MARK)

The spinal reflex aids survival by

- A allowing a more accurate response to harmful stimuli.
- B enabling faster reaction times to harmful stimuli.
- C occurring without conscious control.
- D occurring in response to some sensory stimuli and not others.

**Question 5** (1 MARK)

Name the subdivision of the nervous system that the spinal reflex is initiated in.

**Question 6** (3 MARKS)

Outline the processes involved in the spinal reflex arc.

**Apply and analyse****Question 7** (1 MARK)

Fergus was getting a tray of biscuits out of the oven when he accidentally touched the metal racks. He immediately dropped the tray of biscuits and then yelled in pain.

In Fergus's response, where would the instruction to drop the tray have first been sent from?

- A the brain
- B the spinal cord
- C his hands
- D sensory messages

**Question 8** (3 MARKS)

Pierce was lighting a candle for his bath when he accidentally stuck his finger in the flame. He involuntarily yanked his hand away, and then later registered how much his finger hurt. He looked at his finger and saw a red burn appearing.

In terms of nervous system functioning, name and explain Pierce's response when he yanked his hand away.

**Questions from multiple lessons****Question 9** (1 MARK)

Which of the following is not true regarding the similarities between the spinal reflex and conscious responses to sensory stimuli?

- A Both responses involve the brain and the spinal cord.
- B Both responses involve a conscious component at some point.
- C Both responses involve an immediate motor response.
- D Both responses can involve responding to harmful stimuli.

**Use the following information for questions 10-12.**

Clara has a watch her grandmother gave her before she died. Clara wears it everyday. One day, Clara realised she was not wearing the watch and began to panic. Her heart began to race and her mouth was dry. She frantically began to search all the drawers in her bedroom and then the kitchen. As she was searching in one of the kitchen drawers, she accidentally stabbed her hand on a knife and immediately pulled it back.

**Question 10** (1 MARK)

The division of the nervous system involved in Clara's heart racing and Clara pulling her hand back were respectively

- A the parasympathetic, the sympathetic.
- B the autonomic, the autonomic.
- C the sympathetic, the somatic.
- D the somatic, the autonomic.

**Question 11** (1 MARK)

The nature of Clara's response when her heart began to race and when she pulled her hand back was that

- A her heart racing was involuntary, while pulling her hand back was voluntary.
- B her heart racing was voluntary, while pulling her hand back was involuntary.
- C her heart racing was involuntary and so was pulling her hand back.
- D her heart racing was controlled while pulling her hand back was uncontrolled.

**Question 12** (1 MARK)

Which of the following best describes Clara's response when she pulled her hand back?

- A a sympathetic response
- B a parasympathetic response
- C a controlled motor response
- D the spinal reflex

*Adapted from VCAA 2018 Exam MCQ38*

**Question 13** (2 MARKS)

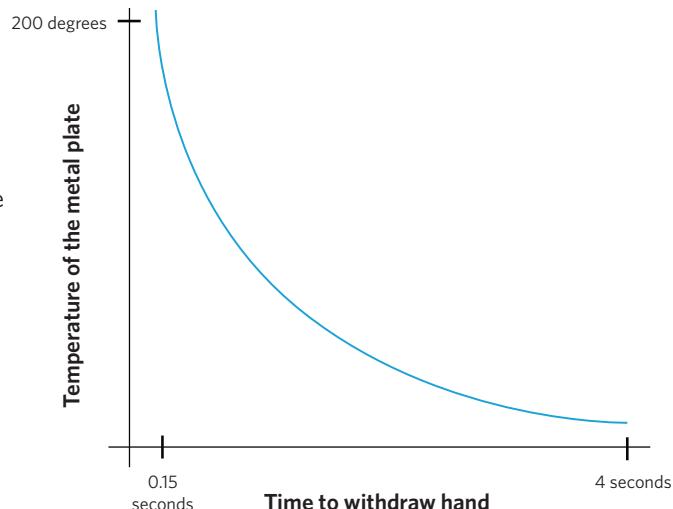
Describe one similarity and one difference between the spinal reflex and a conscious motor response to sensory stimuli.

**Key science skills****Question 14** (5 MARKS)

A researcher wanted to investigate the relationship between levels of pain and immediacy of motor responses. To do this, the researcher asked participants to touch a hot metal plate and recorded how much time there was between the participant making contact with the plate, and the participant moving their hand off the surface. This was done over several trials, with the temperature of the plate increasing in 10 degree intervals at each trial.

The results from the experiment are plotted on the graph provided.

- a What does the graph suggest about the relationship between the temperature of the plate, and the immediacy of motor responses? (1 MARK)
- b Comment on whether the temperature of the plate might influence the likelihood of an individual experiencing a reflex response. Refer to the results of the experiment to justify your response. (2 MARKS)
- c Identify and describe the ethical principle that was breached in this research. (2 MARKS)

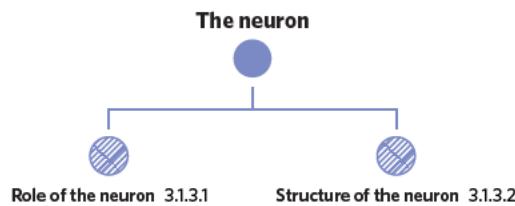


# 2C THE NEURON

So far in this chapter, you have been learning about the human nervous system and some of its important functions in communication. Now, you will focus more closely on the cell that allows this communication to happen: the neuron.

2A. Central and peripheral nervous systems	2B. The spinal reflex	2C. The neuron	2D. Neurotransmitters	2E. Chronic nervous system changes due to neurotransmitter dysfunction
<b>Study design dot point</b>				
<ul style="list-style-type: none"> <li>the role of the neuron (dendrites, axon, myelin and axon terminals) as the primary cell involved in the reception and transmission of information across the synapse (excluding details related to signal transduction)</li> </ul>				
<b>Key knowledge units</b>				
Role of the neuron				3.1.3.1
Structure of the neuron				3.1.3.2

**In this lesson, you will be learning about the neuron.** You will learn about the individual components of a neuron, including the **dendrites, axon, myelin, and axon terminals**. You will also consolidate your understanding of the **role of the neuron in the reception and transmission of information**.



## Role of the neuron 3.1.3.1

### OVERVIEW

The primary function of the neuron is to transmit, receive and process information in the human nervous system.

### THEORY DETAILS

Neurons are nerve cells that transmit, receive and process information to communicate messages across the human nervous system in the brain and body. Similar to a domino-effect, neural communication occurs in one direction. Like when dominoes fall, neural messages are carried by one neuron at a time and are rapidly conveyed from one neuron to the next in a smooth movement.

**Neural transmission** is when a message, in the form of an electrochemical message, is sent to another neuron, muscle or gland. Neural messages are electrochemical because chemicals containing the message are sent *between* neurons and this is powered by an electrical current generated *within* the neuron. When a neuron receives this message, it is known as **neural reception**. After this message is received, the neuron processes the message before sending it to the next neuron.

Neurons are organised into pathways or ‘networks’ within the nervous system. Communication occurs within these networks to perform specific functions. These neural structures are the basis for the things you think, feel and do.

**Neuron** a nerve cell responsible for transmitting, receiving and processing information

**Neural transmission** the process in which a neuron sends a message

**Neural reception** the process in which a neuron accepts, or receives, a message

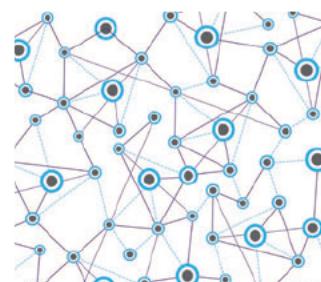


Image: By meribel/Shutterstock.com

**Figure 1** Neurons in the nervous system form many different circuits, each serving their own unique functions.

## Structure of the neuron 3.1.3.2

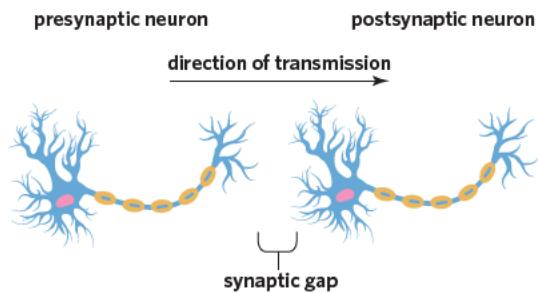
### OVERVIEW

There are several essential components of a neuron that allow for neural transmission. You must be able to identify each of these components and describe their role in neural transmission.

### THEORY DETAILS

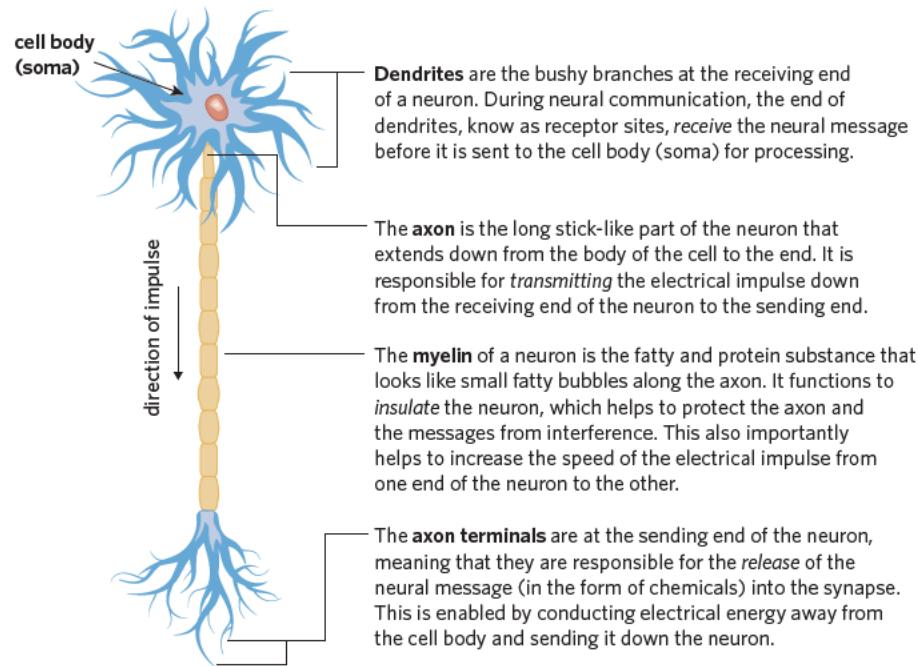
During neural transmission from one neuron to another, the neural message is sent across the space between the neurons, known as the **synaptic gap**. The neuron that fires the message into the synapse is known as the **presynaptic neuron**, (that is, the neuron that comes *before* the synapse). The neuron that receives this message from the synapse is known as the **postsynaptic neuron**, (the neuron that comes *after* the synapse).

The area where this transmission process occurs, including the very end of the presynaptic neuron, the synapse, and the very beginning of the postsynaptic neuron, is referred to as the **synapse**.



**Figure 2** A presynaptic and postsynaptic neuron. In a neural pathway, neurons transmit information to each other across the synapse.

There are several components of the neuron that work together to allow this transmission and reception of information across the synapse.



**Figure 3** A neuron. This diagram is specifically of a motor neuron, though there are other kinds.

### Theory summary

In this lesson, you have learned about the role of the neuron in the transmission of neural information. You should now have an understanding of the general processes relating to the transmission and reception of neural information across the synapse, as well as the role of a neuron's key structures, including the dendrites, axon, myelin and axon terminals.

**Synaptic gap** the space in between two neurons into which a neuronal message is sent

**Presynaptic neuron** the neuron that releases a message into the synapse

**Postsynaptic neuron** the neuron that receives a message from the synapse

**Synapse** the area in which neuronal transmission occurs between two neurons, including the sending end of the presynaptic neuron, the gap between two neurons, and receiving end of the postsynaptic neuron

**Dendrites** the bushy spines of a neuron that receive a message

**Axon** the long strand-like part of a neuron that transmits a message from one end of the neuron to the other

**Myelin** the fat and protein substance that surrounds and insulates the axon of a neuron

**Axon terminals** the ends of a neuron that release a message into the synapse



You will build on this fundamental understanding of the structure and function of neurons in many lessons throughout this book. In particular, you will apply this knowledge in the coming lesson **2D: Neurotransmitters**.

## 2C Activities

- 1 Complete the summary table below by outlining the function of the different parts of the neuron.

Structure	Functions
Dendrite	
Axon	
Myelin sheath	
Axon terminals	

Adapted from Edrolo and S.Luk-Tung, 2017

## 2C QUESTIONS

### Theory review questions

#### Question 1

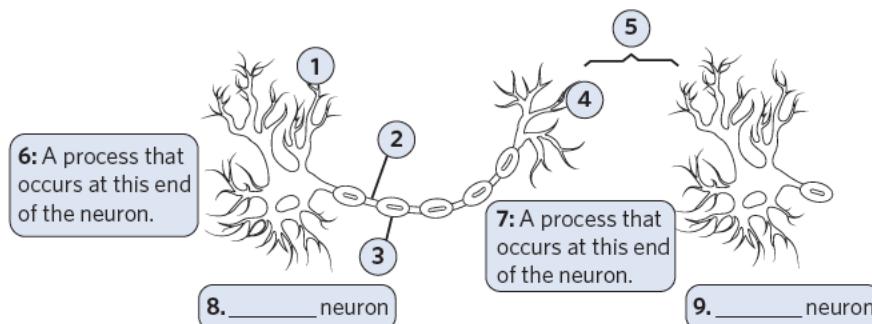
- a Match the key term from the lesson to the corresponding definition.

- Presynaptic (neuron)      • Neural transmission      • Myelin
- Dendrites                  • Axon terminals            • Neural reception
- Axon                        • Postsynaptic (neuron)    • Synapse

- I A process in which a neuron sends a neural message into the synapse
- II The neuron that sends the neural information
- III The bushy ends of the neuron that receive neural messages
- IV The part of the neuron protected by myelin, down which a neural message is sent
- V The neuron that receives neural information
- VI The small space between neurons into which a neural message is sent
- VII The structure at the end of a neuron that releases a neural message into the synaptic gap
- VIII A process in which a neuron accepts a neural message
- IX The substance which protects the axon of a neuron and insulates neural messages

- b Match the terms to points

1 to 9 on the diagram.



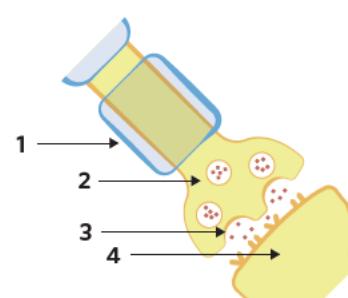
### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

Which of the following corresponds to the structures labelled 1 to 4 in the diagram?

	1	2	3	4
A	axon	myelin	dendrites	axon terminals
B	dendrites	axon	axon terminals	myelin
C	myelin	axon	axon terminals	dendrites
D	axon terminals	dendrites	myelin	axon



**Question 3** (1 MARK)

In terms of the transmission of neural information, the myelin and the axon respectively function to

- A transmit and receive neural information.
- B insulate and transmit neural information.
- C release and insulate neural information.
- D receive and transmit neural information.

*Adapted from VCAA 2018 exam MCQ2*

**Question 4** (1 MARK)

The order in which neural messages travel down a neuron is

- A axon, axon terminals, dendrites, myelin.
- B axon terminals, axon, dendrites, synapse.
- C dendrites, axon, axon terminals, synapse.
- D synapse, dendrites, axon, axon terminals.

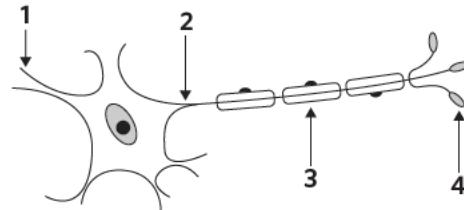
**Question 5** (1 MARK)

Identify the function of dendrites in neural transmission.

**Question 6** (1 MARK)

Name the components of a neuron that are shown at points 1 to 4 on the diagram.

*Adapted from VCAA 2017 exam MCQ1*

**Apply and analyse****Question 7** (1 MARK)

Some diseases such as multiple sclerosis result from the slowing of the speed of electrical transmission within a neuron. The part of the neuron most likely affected is the

- A axon.
- B axon terminals.
- C myelin.
- D dendrites.

*Adapted from VCAA 2017 exam MCQ3*

**Question 8** (1 MARK)

Some central nervous system diseases are caused by damage to the axon. Therefore, in terms of neural transmission, people who suffer from axon damage would most likely experience

- A increased difficulty in transmitting neural messages.
- B decreased difficulty in transmitting neural messages.
- C increased difficulty in receiving neural messages from surrounding neurons.
- D decreased difficulty in receiving neural messages from surrounding neurons.

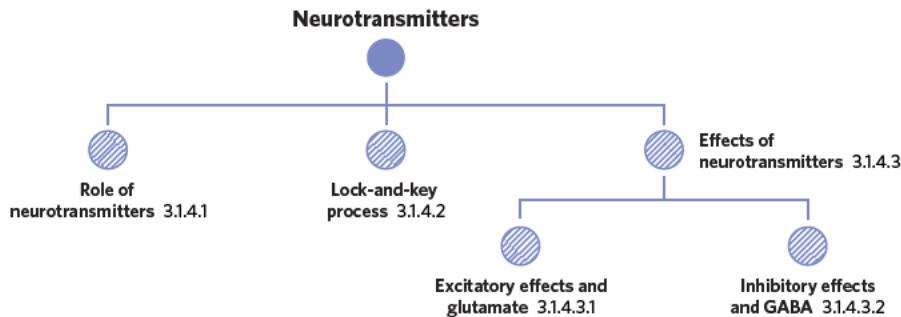
*Adapted from VCAA 2017 exam MCQ3*

# 2D NEUROTRANSMITTERS

Neurotransmitters are an important component of neural transmission. They are the key chemicals that convey information from one neuron to another. In this chapter, you have covered the makeup of the human nervous system and the structure of the neuron. You will now learn the way neurotransmitters function within these structures.

2A. Central and peripheral nervous systems	2B. The spinal reflex	2C. The neuron	2D. Neurotransmitters	2E. Chronic nervous system changes due to neurotransmitter dysfunction
<b>Study design dot point</b>				
<ul style="list-style-type: none"> <li>the role of neurotransmitters in the transmission of neural information between neurons (lock-and-key process) to produce excitatory effects (as with glutamate) or inhibitory effects (as with gamma-amino butyric acid [GABA])</li> </ul>				
<b>Key knowledge units</b>				
Role of neurotransmitters				3.1.4.1
Lock-and-key process				3.1.4.2
Excitatory effects and glutamate (Effects of neurotransmitters)				3.1.4.3.1
Inhibitory effects and GABA (Effects of neurotransmitters)				3.1.4.3.2

**In this lesson, you will be learning about** chemical substances released by neurons, known as **neurotransmitters**. You will learn about how they function and the effects they can have, with specific focus on two important neurotransmitters.



## Role of neurotransmitters 3.1.4.1

### OVERVIEW

Neurotransmitters are chemical substances which pass information from neuron to neuron. This transmission of neural information is the basis for everything you learn, think and do.

### THEORY DETAILS

As you learned, all of the actions you perform and the knowledge that you have comes from the transmission of neural information across your entire nervous system. The carrier of this information is a chemical substance called a **neurotransmitter**. Neurotransmitters are contained in small sacs (called synaptic vesicles or neurotransmitter vesicles) and are produced by a **presynaptic neuron** before being released from its vesicles contained within the **synaptic buttons**. They are then passed on to other neurons around the body. As you learned in the last lesson, communication between neurons occurs in the space between them, known as the **synaptic gap**. Once released into the synaptic gap, neurotransmitters reach the **receptor sites** on the dendrites of the **postsynaptic neuron**. This is how neural transmission occurs, and is detailed in figure 1.

**Neurotransmitter** a chemical substance that carries information between neurons

**Presynaptic neuron** the neuron that releases neurotransmitters into the synapse

**Postsynaptic neuron** the neuron that receives neurotransmitters

**Synaptic gap** the space in between two neurons into which a message is sent

**Synaptic buttons (also known as terminal buttons or synaptic knobs)** the end of the presynaptic neuron's axon terminals that release neurotransmitters

**Receptor sites** protein molecules located on the dendrites of a postsynaptic neuron, responsible for receiving neurotransmitters

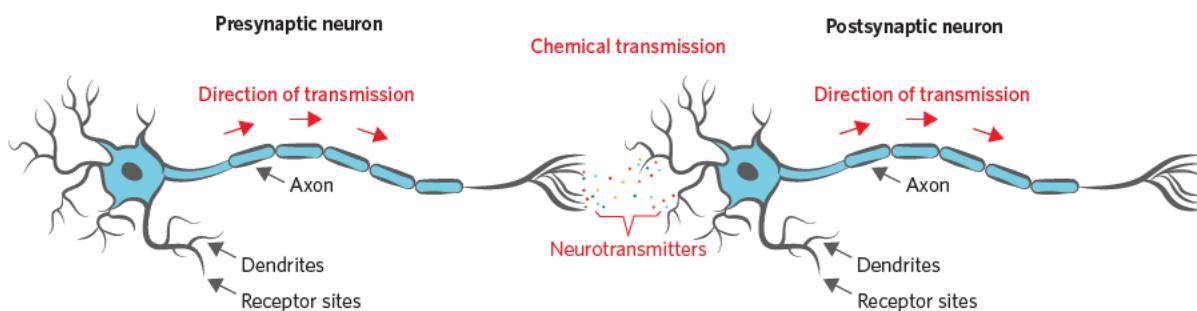


Figure 1 Neural transmission of neurotransmitters across a presynaptic and postsynaptic neuron

### Lock-and-key process 3.1.4.2

#### OVERVIEW

The lock-and-key process is an analogy used to explain the way neurotransmitters transmit information from one neuron to the next.

#### THEORY DETAILS

When a neurotransmitter is released from a presynaptic neuron into the synapse, it must successfully bind to the receptor sites of the postsynaptic neuron in order to have an effect. Located on the dendrites of the postsynaptic neuron, receptor sites are protein molecules with their own distinct shape and size. These act as a lock, for which a specific key is needed to release or 'unlock' their potential.

In this analogy, the key is the neurotransmitter. The key's molecular structure determines whether it is the right shape and size to fit into the lock, represented by the postsynaptic neuron's receptor sites. If the neurotransmitters are the right size and shape, the lock-and-key process occurs, leading to an effect on the postsynaptic neuron. Figure 2 demonstrates a situation in which neurotransmitters will successfully bind to the postsynaptic neuron, as the 'keys' are the right structure to fit into the 'locks'.

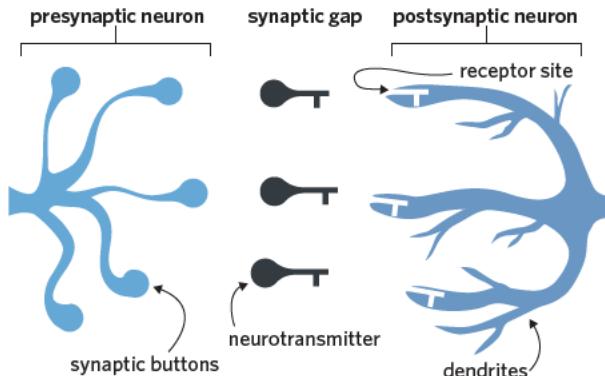


Figure 2 A visual representation of the lock-and-key process at the synapse of two neurons

### Effects of neurotransmitters 3.1.4.3

#### OVERVIEW

There are two possible effects a neurotransmitter can have on a postsynaptic neuron if they successfully bind to it: an excitatory or inhibitory effect.

#### THEORY DETAILS

An **action potential** is when a neuron sends an electrical impulse down the axon. In other words, the action potential is the neural message in electrical form. In order for an action potential to generate, the particles inside a neuron must reach a certain voltage threshold or 'charge'.

After neurotransmitters bind to the receptor sites of a postsynaptic neuron, they will have one of two effects. They will either activate the postsynaptic neuron to perform its function, or prevent it from performing its function. When a neurotransmitter activates a neuron and makes it more likely to fire an action potential, this is known as an **excitatory effect**. On the other hand, a neurotransmitter can also have an **inhibitory effect**, resulting in the postsynaptic neuron being less likely to fire an action potential.

**Lock-and-key process** an analogy used to describe the role and functions of neurotransmitters and receptor sites in the process of neural transmission

**lesson link** This current lesson builds on your knowledge from the previous lesson **2C: The neuron**. However, in this lesson you go into more depth about the role of neurotransmitters in the transmission of messages. You will learn more about neurotransmitters in future lessons, including lesson **2E: Chronic nervous system changes**, lesson **4B: Neurotransmitters** and neurohormones, and lesson **13C: Interventions for phobia**.

**Action potential** the neural message, in the form of an electrical impulse, sent down the axon of a neuron when certain conditions are met

**Excitatory effect** when a neurotransmitter causes the postsynaptic neuron to become more likely to fire an action potential

**Inhibitory effect** when a neurotransmitter causes the postsynaptic neuron to become less likely to fire an action potential

**Useful tip**

The relationship between neurotransmitters and neurons can sometimes be confusing. Some information that may aid your understanding includes:

- Both inhibitory and excitatory neurotransmitters bind to receptor sites if they are the right shape, the difference is the way they affect or 'charge' the particles within a postsynaptic neuron.
- Inhibitory and excitatory neurotransmitters simply increase or decrease the likelihood of a neuron firing, they don't guarantee this effect.
- Some chemical substances can act as both a neurotransmitter and neurohormone. The difference between these will be discussed in a later lesson.
- Both excitatory and inhibitory neurotransmitters are useful and needed for optimal levels of brain activity and function.

**Excitatory effects and glutamate** 3.1.4.3.1

As mentioned, an excitatory effect occurs when excitatory neurotransmitters bind with the receptor sites of a postsynaptic neuron. Once they are bound, they increase the likelihood of the postsynaptic neuron firing an action potential.

One of the most common and important excitatory neurotransmitters in the central nervous system is **glutamate**.

- Glutamate is essential for movement, thought, learning and memory
- An insufficiency of glutamate in the brain will result in difficulty with learning and concentration
- Too much glutamate can cause over-excitation, damaging neurons and potentially leading to nervous system dysfunction, such as seizures
- Glutamate has specific receptor sites that it binds to in the lock-and-key process

**Inhibitory effects and GABA** 3.1.4.3.2

Again, an inhibitory effect occurs when inhibitory neurotransmitters bind with the receptor sites of a postsynaptic neuron. Once they bind, they decrease the likelihood of the postsynaptic neuron firing an action potential.

Within the central nervous system, **gamma-amino butyric acid (GABA)** is the most common inhibitory neurotransmitter.

- GABA functions largely to counterbalance the effects of excitatory neurotransmitters such as glutamate
- An insufficiency of GABA can lead to an over-excitation of neurons, causing things such as seizures and anxiety
- GABA also works to regulate and balance brain function
- As with all neurotransmitters, GABA can only have an effect on the postsynaptic neuron if it successfully binds to specific receptor sites in the lock-and-key process

**Theory summary**

In this lesson, you have learned how neurotransmitters transmit neural information between neurons, and how this can be expressed through the analogy of the lock-and-key process. You should be able to explain the process of how neurotransmitters are released by one neuron and received by another, and correlate this to the lock-and-key analogy. Further, you have learned the function of and difference between excitatory and inhibitory neurotransmitters, with specific focus on two important neurotransmitters: glutamate (excitatory) and GABA (inhibitory). You should be able to explain the purpose, function and effect of each neurotransmitter, relating these to the lock-and-key process.

**Glutamate** the primary excitatory neurotransmitter

**Gamma-amino butyric acid (GABA)** the primary inhibitory neurotransmitter

 **Memory device** You can think of the roles of glutamate and GABA as traffic lights in the brain that allow for optimal functioning. Glutamate is the green light that says 'go' to the neurons, telling them to function and pass on information. However, for safe traffic flow and to avoid crashes, the red light GABA is sometimes needed to prevent neurons from sending messages, telling them to 'stop'.



 As mentioned, insufficient GABA levels can have harmful effects on the body. The role of GABA dysfunction will be explored in relation to phobic anxiety in lesson **13B: Contributing factors to phobia**.

## 2D Activities

- 1 Fill out the table using knowledge from the lesson.

Neurotransmitter	Effect (excitatory or inhibitory)	Effect on the postsynaptic neuron
GABA		Makes it more likely to fire

- 2 Fill in the gaps with terms below

- GABA
- Glutamate receptor site
- Excitatory effect
- GABA receptor site
- Glutamate
- Inhibitory effect



Increased likelihood of firing



Decreased likelihood of firing

## 2D QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

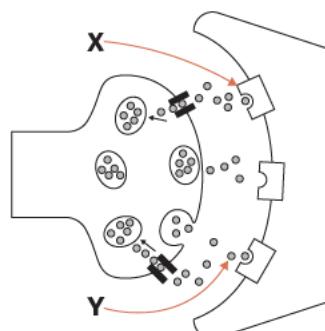
- |                        |                      |                     |
|------------------------|----------------------|---------------------|
| • Lock-and-key process | • Receptor sites     | • Inhibitory effect |
| • Postsynaptic neuron  | • Neurotransmitter   | • Glutamate         |
| • GABA                 | • Presynaptic neuron | • Excitatory effect |

- a a chemical produced by the body, that has a role in communication between pre and postsynaptic neurons \_\_\_\_\_
- b a mechanism by which specific neurotransmitters communicate with their corresponding receptor sites \_\_\_\_\_
- c a neuron that transmits information to the following neuron \_\_\_\_\_
- d a neuron that receives information from the previous neuron \_\_\_\_\_
- e found on the postsynaptic neuron; a structure that receives the neurotransmitter \_\_\_\_\_
- f a neurotransmitter function which increases the likelihood of a postsynaptic neuron firing \_\_\_\_\_
- g a neurotransmitter that typically produces an excitatory effect \_\_\_\_\_
- h a neurotransmitter function which decreases the likelihood of a postsynaptic neuron firing \_\_\_\_\_
- i a neurotransmitter that typically produces an inhibitory effect \_\_\_\_\_

#### Question 2

Which option correctly labels parts X and Y involved in neural transmission, and their corresponding component in the lock-and-key-process?

	X	Y
A	Receptor site - key	Neurotransmitter - lock
B	Neurotransmitter - lock	Receptor site - key
C	Receptor site - lock	Neurotransmitter - key
D	Neurotransmitter - key	Receptor site - lock



**Question 3**

Use the terms to fill in the blanks.

- key
- presynaptic neuron
- excitatory
- lock
- postsynaptic neuron
- neurotransmitter
- inhibitory
- receptor site

The \_\_\_\_\_ is released from the \_\_\_\_\_ into the synapse. It diffuses across the synapse to meet the \_\_\_\_\_ on the dendrites of the \_\_\_\_\_. In this process the neurotransmitter is considered to be the \_\_\_\_\_ and the receptor site is the \_\_\_\_\_, where only a specific neurotransmitter is the correct shape to fit with the receptor site and activate either an \_\_\_\_\_ or an \_\_\_\_\_ response.

**Exam-style questions****Remember and understand****Question 4** (1 MARK)

Glutamate plays a key role in nervous system by

- A acting as an inhibitory neurohormone released across the synaptic gap.
- B acting as an inhibitory neurotransmitter released across the synaptic gap.
- C acting as an excitatory neurohormone released across the synaptic gap.
- D acting as an excitatory neurotransmitter released across the synaptic gap.

*Adapted from VCAA 2017 Exam MCQ4*

**Question 5** (1 MARK)

Regarding the lock-and-key process of neural transmission, which of the following statements is true?

- A A specific receptor site acts as a key because it is the correct shape to bind and open the neurotransmitter, which is the lock.
- B The neurotransmitter acts as a key because it is the correct shape to bind to specific receptor sites which act as the lock.
- C When the neurotransmitter key is unable to bind and open the receptor site lock, only an inhibitory effect will occur.
- D When the neurotransmitter key is able to bind and open the receptor site lock, only an excitatory effect will occur.

**Question 6** (1 MARK)

The main neurotransmitter found in the central nervous system that increases the likelihood of neurons firing is

- A GABA, which has an inhibitory effect.
- B GABA, which has an excitatory effect.
- C glutamate, which has an inhibitory effect.
- D glutamate, which has an excitatory effect.

**Question 7** (1 MARK)

The function of the neurotransmitter GABA includes

- A decreasing the likelihood of the presynaptic neuron firing.
- B increasing the likelihood of the presynaptic neuron firing.
- C increasing the likelihood of the postsynaptic neuron firing.
- D decreasing the likelihood of the postsynaptic neuron firing.

**Question 8** (3 MARKS)

Explain why it is important to have both excitatory and inhibitory neurotransmitters.

**Question 9** (3 MARKS)

Outline the key difference between the functions of the neurotransmitters glutamate and GABA.

**Question 10** (4 MARKS)

Outline the lock-and-key process as it relates to neural transmission.

**Question 11** (4 MARKS)

With reference to the lock-and-key process, describe how an excitatory neurotransmitter successfully transmits neural messages after its release from the synaptic buttons of a presynaptic neuron. You may use a diagram.

Adapted from VCAA 2018 exam SAQ1

**Apply and analyse****Question 12** (1 MARK)

Seizures can sometimes result from over-excitation of neurons. Therefore, in terms of neural transmission, people who suffer from seizures likely experience

- A not enough inhibitory neural transmission.
- B too much neural transmission.
- C not enough excitatory neural transmission.
- D not enough neural transmission.

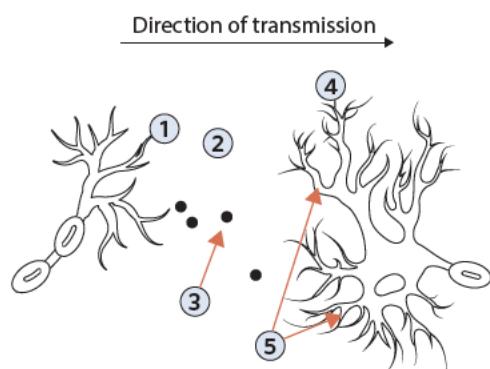
**Questions from multiple lessons****Question 13** (1 MARK)

Some diseases result from damage to the myelin sheath of neurons. In terms of neurotransmitters, this would mean that they

- A function more efficiently.
- B move more quickly from one end of the neuron to the other.
- C are not affected as they are sent between and not within neurons.
- D don't function at all.

**Question 14** (5 MARKS)

Label the components at points 1 to 5 involved in neural transmission from one neuron to another.

**Key science skills****Question 15** (5 MARKS)

Low levels of GABA in the brain have been linked to various kinds of seizures in some patients. Dr Freeman wants to investigate whether this applies to patients who experience epileptic seizures. At Stonnington hospital, Dr Freeman asked the first three patients with epilepsy she came across if she could run neurotransmitter level tests on them to check for a correlation.

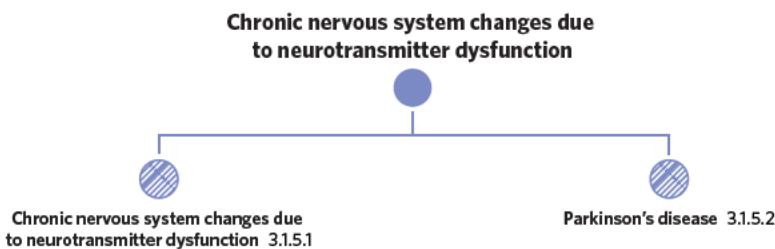
- a What sampling method was Dr Freeman using? (1 MARK)
- b What kind of research investigation did Dr Freeman undertake? Justify your response. (2 MARKS)
- c Comment on whether Dr Freeman can generalise any results she obtains. Justify your response. (2 MARKS)

# 2E CHRONIC NERVOUS SYSTEM CHANGES DUE TO NEUROTRANSMITTER DYSFUNCTION

In this chapter, you have been learning about nervous system functioning and the ways in which different components of the nervous system coordinate to allow humans to respond to stimuli. In the previous lesson, you learned about the importance of neurotransmitter levels in allowing humans to function. In this lesson, you will examine how changes to these optimal levels can have significant consequences on the human nervous system.

2A. Central and peripheral nervous systems	2B. The spinal reflex	2C. The neuron	2D. Neurotransmitters	2E. Chronic nervous system changes due to neurotransmitter dysfunction
<b>Study design dot point</b>				
<ul style="list-style-type: none"> <li>the effects of chronic changes to the functioning of the nervous system due to interference to neurotransmitter function, as illustrated by the role of dopamine in Parkinson's disease</li> </ul>				
<b>Key knowledge units</b>				
Chronic nervous system changes due to neurotransmitter dysfunction				3.1.5.1
Parkinson's disease				3.1.5.2

**In this lesson, you will be learning about** some of the ways in which **interference to neurotransmitter function** can result in **chronic nervous system changes**. To understand this, you will look at the example of **dopamine dysfunction** and how it contributes to the development of **Parkinson's disease**.



## Chronic nervous system changes due to neurotransmitter dysfunction 3.1.5.1

### OVERVIEW

Disruption to neurotransmitter levels and function can have serious consequences for nervous system functioning.

### THEORY DETAILS

Having the right levels of neurotransmitters released in the body without interference is vital to optimal nervous system functioning. As you learned in the previous lesson, a person needs both glutamate and GABA in order to function. Without the excitatory effects of glutamate, a person would not be able to perform many tasks or learn new information. However, without the inhibitory effects of GABA, a person's neural firing would exceed limits for optimal functioning, causing serious problems like seizures and anxiety.

There are a range of ways neurotransmitters can experience interference or malfunction. Some of these include:

- Neuronal loss and degeneration can mean there are simply not enough neurons in the brain to produce adequate levels of certain neurotransmitters, or to send messages at the right speed.
- Some structure or substance might build up in the synapses between or within neurons, preventing the transmission and reception of neurotransmitters.

- Some substance or structure may compete with neurotransmitters at a neuron's receptor sites, preventing neural reception.
- Something might deplete or 'use up' the brain's neurotransmitters before they perform their function, such as a bacteria or disease.

In the most serious cases, neurotransmitter dysfunction can cause chronic (long lasting) changes to the nervous system. This can lead to detrimental effects on people's bodies, brains and behaviour.

### Parkinson's disease 3.1.5.2

#### OVERVIEW

Parkinson's disease is a chronic nervous system condition caused by interference to the neurotransmitter dopamine.

#### THEORY DETAILS

As mentioned, one kind of neurotransmitter dysfunction is caused by the loss and degeneration of neurons. This occurs when parts of the brain experience a deterioration of, and a reduction in the number of neurons. As a result, a reduced production of certain neurotransmitters is also experienced. **Parkinson's disease** is a progressive disease of the nervous system, characterised by a decline in both motor and non-motor functions. While the exact causes of Parkinson's disease are unknown, many of its symptoms are understood to result from neuronal loss and a subsequent reduction of neurotransmitters.

Specifically, Parkinson's disease involves a deficiency of **dopamine** production. Dopamine is a neurotransmitter that has an important role in the coordination of voluntary movement and reward-based learning. You may have heard of dopamine in relation to pleasure, as it is responsible for regulating experiences of pleasure and pain.

The neuronal loss and damage characteristic of Parkinson's disease occurs in a region of the brain called the substantia nigra. The substantia nigra is located in the basal ganglia in the midbrain. It is this region of the brain that coordinates voluntary movement, and regulates experiences of reward and pleasure. When neurons in this area are damaged, there is consequently a decrease in dopamine production. This means that the brain receives slowed or insufficient neural messages that are required to coordinate voluntary movements. This is why Parkinson's is characterised by specific motor symptoms.

Along with the motor symptoms that occur, Parkinson's disease is also characterised by a range of non-motor symptoms. These are summarised in table 1. These symptoms only surface after significant neuronal loss, and not all of these symptoms result from decreased dopamine production.

**Table 1** Some motor and non-motor symptoms of Parkinson's disease

Motor symptoms	Non-motor symptoms
<ul style="list-style-type: none"> <li>Muscle rigidity (stiffness or tightness of muscles)</li> <li>Reduced motor control and precision of movement</li> <li>Tremors (uncontrollable and involuntary shaking)</li> <li>Slowed voluntary movements</li> <li>Difficulty balancing</li> <li>Stooped posture</li> </ul>	<ul style="list-style-type: none"> <li>Fatigue</li> <li>Mental health problems (such as depression due to the detrimental impacts on lifestyle and the effects of reduced dopamine)</li> <li>Increased sensitivity to temperature</li> <li>Decreased sense of smell</li> <li>Problems with cognition such as decision-making and memory</li> <li>REM sleep behaviour disorder</li> <li>Constipation</li> </ul>



For a refresher on the importance of glutamate and GABA in nervous system functioning, head back to the previous lesson **2D: Neurotransmitters**.

Alzheimer's disease involves an interference to neurotransmitter function. This is due to the build up of abnormal structures that prevent transmission of neurotransmitters. You will learn more about this in lesson **7A: Brain trauma and neurodegenerative disease**.

**Parkinson's disease** a progressive disease of the nervous system characterised by both motor and non-motor symptoms

**Dopamine** a neurotransmitter primarily responsible for the coordination of voluntary movement and experiences of pleasure and pain

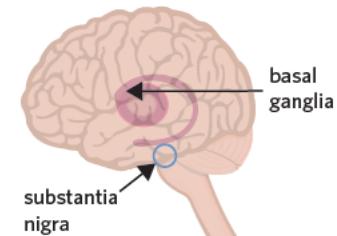


Image: joshya/Shutterstock.com

**Figure 1** Parkinson's disease is caused by a decrease in dopamine, due to the degeneration of neurons in the substantia nigra within the basal ganglia

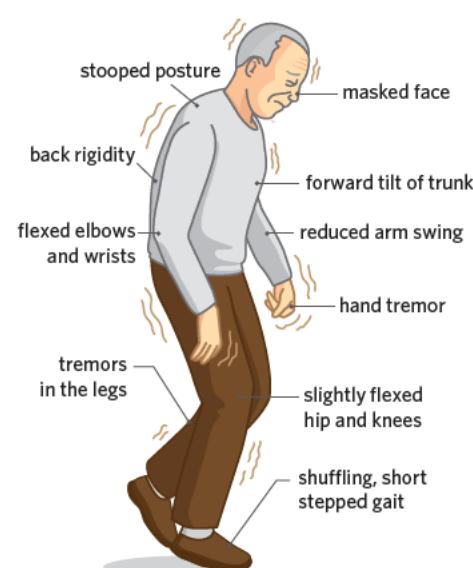


Image: solar22/Shutterstock.com

**Figure 2** Parkinson's disease involves a range of motor and non-motor symptoms. It is most commonly diagnosed after age 60.

**Want to know more?**

While there is no cure for Parkinson's disease, there are a range of treatments that act to reduce symptoms. Some treatments involve medication that largely operate on the mechanisms of the lock-and-key process you learned about in lesson 2D: **Neurotransmitters**. For example, some medications are converted into dopamine to act on receptor sites, while others mimic the effects of dopamine itself.



You will learn more about another type of neurotransmitter dysfunction, specifically GABA dysfunction, in lesson 13B: **Contributing factors to phobia**.

## Theory summary

In this lesson, you have learned about some of the effects of chronic changes to the nervous system. You should have a deeper understanding of the importance of neurotransmitters, and how interference to their function may lead to chronic nervous system changes. Specifically, you should have a clear understanding of how interference to dopamine contributes to some symptoms of Parkinson's disease.

## 2E Activities

- Fill in the table to summarise your knowledge of Parkinson's disease.

Parkinson's disease is a

It involves the neuronal change of

It involves changes to motor function including

It involves changes to non-motor function including

## 2E QUESTIONS

### Theory review questions

#### Question 1

Fill in the blanks with vocabulary from the lesson to summarise one chronic nervous system disease.

#### Vocabulary list:

- Dopamine
- Substantia nigra
- Parkinson's disease

\_\_\_\_\_ is a progressive nervous system disease characterised by both motor and non-motor symptoms. It involves interference to the neurotransmitter \_\_\_\_\_, caused by neuronal loss and degeneration in a structure of the brain known as the \_\_\_\_\_.

### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

One change in neural function that occurs in patients with Parkinson's disease is

- A increased myelination.
- B increased dopamine production.
- C synaptogenesis.
- D decreased dopamine production.

*Adapted from VCAA 2018 exam MCQ3*

**Question 3** (1 MARK)

Which of the following identifies a motor symptom of Parkinson's disease?

- A** decreased dopamine production
- B** depression
- C** impaired fine motor movement
- D** increased gross motor movement

Adapted from VCAA 2018 exam MCQ3

**Question 4** (1 MARK)

Which of the following identifies a cause and motor symptom associated with Parkinson's disease?

Cause	Motor symptom
<b>A</b> increased dopamine production	improved motor movement
<b>B</b> decreased dopamine production	improved motor movements
<b>C</b> increased dopamine production	impaired motor movement
<b>D</b> decreased dopamine production	impaired motor movement

Adapted from VCAA 2018 exam MCQ3

**Question 5** (2 MARKS)

Identify two symptoms of Parkinson's disease.

**Question 6** (3 MARKS)

Outline the role of neurotransmitter dysfunction in the development of Parkinson's disease.

**Apply and analyse****Question 7** (1 MARK)

Rory has been diagnosed with early-onset Parkinson's disease at age 47 after a lengthy testing procedure. Her neurologist confirmed Rory's condition after conducting a brain scan that showed abnormalities with one kind of neurotransmitter. This neurotransmitter was most likely

- A** dopamine.
- B** glutamate.
- C** gamma-amino butyric acid (GABA).
- D** adrenaline.

**Question 8** (2 MARKS)

Mert is a 67-year-old man who has been struggling to carry out his everyday tasks alone. He feels shaky, has fallen a few times recently, and feels that he is losing control of his independence. Concerned, Mert recently went to a doctor who conducted a neurological and physiological examination. From these two tests, Mert's doctor suggested he might be experiencing the onset of Parkinson's disease.

Outline one change in neural function and one change in motor function that Mert's doctor may have detected.

**Questions from multiple lessons****Question 9** (1 MARK)

Parkinson's disease results largely from interference to the neurotransmitter dopamine. In terms of the lock-and-key process, there is a/an

- A** reduction of required locks.
- B** reduction of required keys.
- C** over-production of required locks.
- D** over-production of required keys.

**Question 10** (1 MARK)

One cause of symptoms in Parkinson's disease is the overstimulation and under-stimulation of certain neurons in the brain. In terms of neurotransmitter functioning, this means that there is

- A inadequate excitation and inhibition.
- B too much neural reception.
- C too much neural transmission.
- D not enough locks for the keys.

**Question 11** (1 MARK)

A major motor symptom of Parkinson's disease is the lack of control of voluntary movements. In terms of nervous system functioning, this means that there is difficulty sending messages from the central nervous system to the

- A sympathetic nervous system.
- B somatic nervous system.
- C autonomic nervous system.
- D brain.

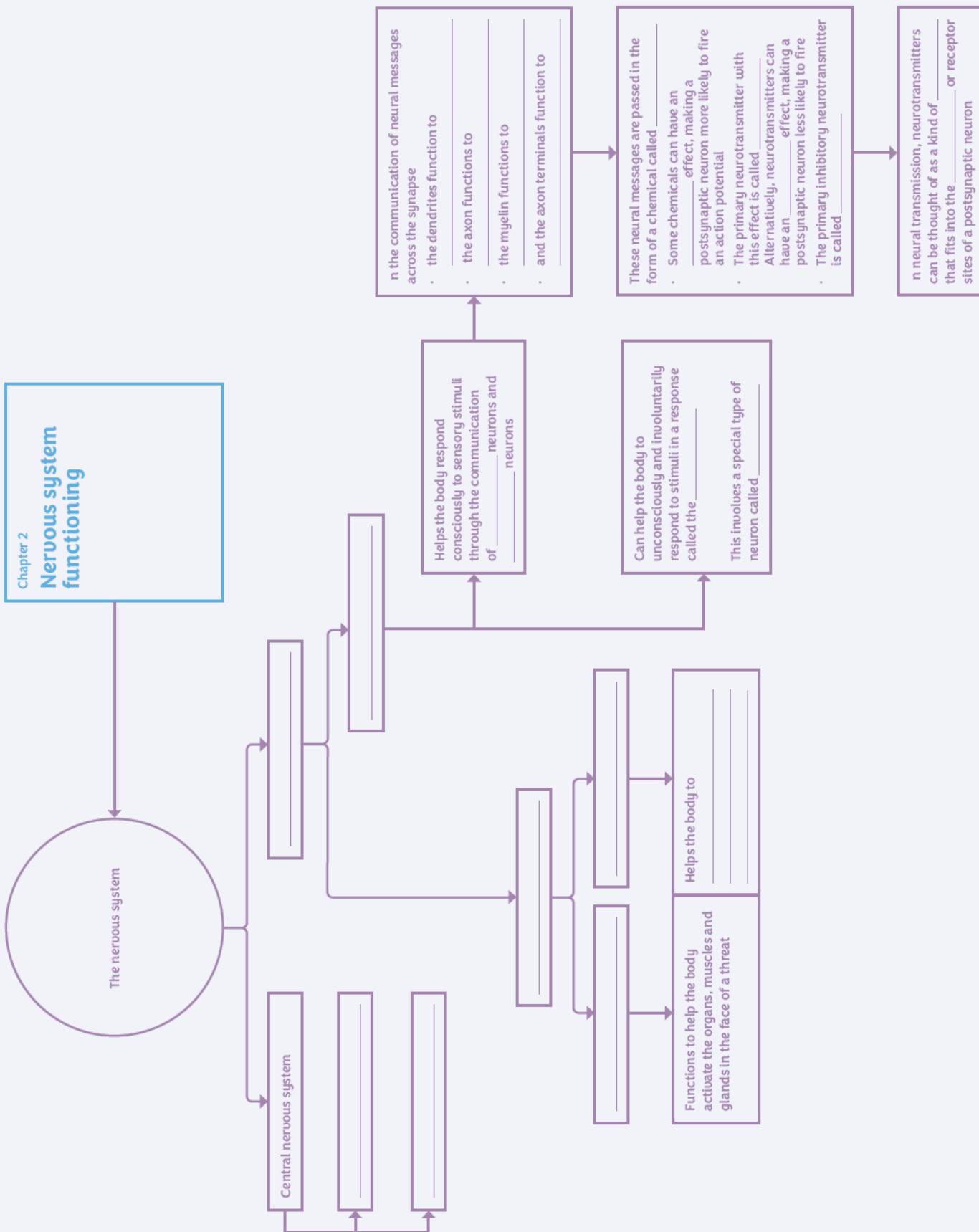
**Question 12** (5 MARKS)

One symptom of Parkinson's disease is an increased sensitivity to temperature. Gerry is a 65-year-old man with Parkinson's who frequently experiences this symptom. Often, when he has a warm cup of tea, he has to put it down as it feels too hot. However, when he coordinates this response, he often experiences difficulty putting the cup down without shaking. In terms of nervous system functioning, explain the neural process of Gerry coordinating this response to the temperature of the cup. In your response, describe the effects of Parkinson's disease on neural functioning.

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own that includes all concepts from the chapter.



### Review activity 2: Complete the comparison table

Fill in the table to consolidate your knowledge of sympathetic and parasympathetic nervous system responses.

Sympathetic nervous system arousal	Body Parts	Parasympathetic nervous system control
	Pupils	
	Salivary glands	
	Heart	
	Lungs	
	Adrenal glands	
	Stomach	
	Bladder	
	Cardiovascular system	

Adapted from Edrolo and S.Luk-Tung, 2017.

### Review activity 3: Summary table

Fill in the table to summarise the nervous system processes involved in conscious responses to sensory stimuli, and spinal reflex responses to sensory stimuli.

Conscious motor responses to sensory stimuli	Unconscious motor responses to sensory stimuli involving the spinal reflex arc
Step 1: _____	Step 1: _____
_____	_____
_____	_____
Step 2: _____	Step 2: _____
_____	_____
_____	_____
_____	_____

**Conscious motor responses to sensory stimuli****Unconscious motor responses to sensory stimuli involving the spinal reflex arc**Step 3: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Step 3: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Step 4: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# CHAPTER TEST

**Multiple choice questions****Question 1** (1 MARK)

When an excitatory neurotransmitter binds to the dendrites of a neuron, this means that

- A it increases the likelihood of the postsynaptic neuron firing an action potential.
- B it increases the likelihood of the presynaptic neuron firing an action potential.
- C it decreases the likelihood of the postsynaptic neuron firing an action potential.
- D it decreases the likelihood of the presynaptic neuron firing an action potential.

**Question 2** (1 MARK)

Parkinson's disease is a progressive condition of the nervous system characterised by

- A neurotransmitter dysfunction, impairing voluntary movements.
- B neurotransmitter dysfunction, improving voluntary movements.
- C neurohormone dysfunction, improving voluntary movements.
- D neurohormone dysfunction, impairing voluntary movements.

**Question 3** (1 MARK)

Which of the following identifies a change in neural function that occurs in a brain with Parkinson's disease?

- A increased glutamate production
- B decreased glutamate production
- C increased dopamine production
- D decreased dopamine production

***Use the following information for questions 4–6.***

Hugo is an 87-year-old man who has been living alone since his wife died two years ago. He notices that his days pass by without him doing much, but feels lucky that he can relax and carry out tasks with some independence. Despite being quite unstable on his feet, one night Hugo decided to run a bath. When he put his foot in, it took him over five seconds to realise that the water was almost boiling hot and that he needed to remove his foot.

**Question 4** (1 MARK)

Hugo's slow response to the very hot water demonstrates that he might be having trouble coordinating

- A a conscious motor response in the brain.
- B a conscious motor response in the spinal cord.
- C an unconscious motor response in the brain.
- D an unconscious motor response in the spinal cord.

**Question 5** (1 MARK)

The divisions of the nervous system responsible for Hugo taking his foot out of the bath would have been the

- A sympathetic and parasympathetic.
- B sympathetic and central.
- C central and somatic.
- D autonomic and somatic.

**Question 6** (1 MARK)

The neurotransmitter dopamine would have helped Hugo to transmit messages for the voluntary movement of removing his foot from the water. The order in which dopamine would have travelled along a neuron during transmission would have been

- A synapse, dendrite, axon, axon terminal.
- B dendrite, synapse, axon terminal, axon.
- C axon, axon terminal, dendrite, synapse.
- D axon terminal, axon, synapse, dendrite.

**Question 7** (1 MARK)

Myelin functions to speed up electrical nerve impulses. It also functions to

- A insulate and protect the dendrites.
- B insulate and protect the axon.
- C insulate and protect the synapse.
- D insulate and protect the axon terminals.

*Adapted from VCAA 2017 sample exam MCQ6*

***Use the following information for questions 8 and 9.***

Emilia's birthday was last week. On Tuesday, she came home from work and entered her house in the dark. After five or so seconds of looking for her keys, all of her lights switched on and a large group of her friends jumped out and surprised her with a birthday cake. Emilia screamed in shock and could feel her heart pumping quickly, but soon after was able to laugh and began to search for plates in her cupboard for the cake.

**Question 8** (1 MARK)

The main role of Emilia's nervous system when she screamed and felt her heart pumping was to

- A prepare her visceral muscles and glands to deal with a threat.
- B prepare her skeletal muscles to deal with a threat.
- C engage her spinal reflex.
- D engage her brain in activating her skeletal muscles.

*Adapted from VCAA 2018 exam MCQ6*

**Question 9** (1 MARK)

When Emilia was searching for plates, her brain would send which type of messages to her body?

- A inhibitory
- B sensory
- C motor
- D excitatory

**Question 10** (1 MARK)

Dendrites send neural messages to the soma (cell body) for processing. Another important function of dendrites is to

- A send neurotransmitters into the synapse.
- B receive neurotransmitters from the synapse.
- C insulate the axons of the neuron.
- D have an excitatory effect on the neuron.

*Adapted from VCAA 2017 sample exam MCQ6*

**Short answer questions****Question 11** (4 MARKS)

Parkinson's disease is characterised by reduced dopamine production, resulting in insufficient neural transmission of the messages needed to control voluntary movement. In terms of the lock-and-key process, describe how a healthy brain would successfully transmit dopamine after it reaches a presynaptic neuron's axon terminals to transmit necessary motor instructions.

*Adapted from VCAA 2018 exam SAQ1*

**Question 12** (2 MARKS)

Describe the role of interneurons in the spinal reflex.

**Question 13** (8 MARKS)

Jyah is about to go live on television as a contestant on a quiz show. Her mouth feels dry and she is thinking about all that could go wrong. Contestants on the show must press their buzzer when it lights up before other contestants to answer a question. When the show starts, Jyah will have to press the buzzer when she sees it light up in order to get a chance to earn points.

- a Outline two other sympathetic nervous system responses that Jyah might be experiencing prior to going on the show, and describe how they prepare the body to deal with a threat. (4 MARKS)
- b In terms of nervous system functioning, describe the processes involved when Jyah presses the button in response to seeing it light up. (4 MARKS)

**Question 14** (4 MARKS)

With reference to gamma-amino butyric acid (GABA), outline the processes involved in the successful neural transmission once the neural impulse has reached the axon terminal. In your response, refer to the lock-and-key process.

*Adapted from VCAA 2018 exam SAQ1*

**Key science skills questions****Question 15** (7 MARKS)

A psychologist wanted to test whether smelling something pleasant in a stress-inducing situation would decrease the intensity of sympathetic nervous system responses. When planning her research, she thought it would be best to use the same participants in both conditions. This would involve the same participants being exposed to a stressful situation in the presence of no smell, and then later in the presence of a pleasant smell. She would test the intensity of sympathetic nervous system responses by monitoring participants' heart rate in both conditions.

- a Identify the research design the psychologist intends to use. (1 MARKS)
- b Outline one advantage and one disadvantage of using this research design. (2 MARKS)
- c Operationalise the independent and dependent variable in this planned experiment. (4 MARKS)



UNIT 3 AOS 1, CHAPTER 3

# 03

## Stress as a psychobiological process

### 3A Stress

- sources of stress (eustress and distress) including daily pressures, life events, acculturative stress, major stress and catastrophes that disrupt whole communities

### 3B Biological processes of stress

- models of stress as a biological process, with reference to Selye's General Adaptation Syndrome or alarm reaction (shock/counter shock), resistance and exhaustion, including the 'fight-flight-freeze' response and the role of cortisol

### 3C Psychological processes of stress

- models of stress as a psychological process, with reference to Richard Lazarus and Susan Folkman's Transactional Model of Stress and Coping (stages of primary and secondary appraisal)

### 3D Coping with stress

- context-specific effectiveness, coping flexibility and use of particular strategies (exercise and approach and avoidance strategies) for coping with stress



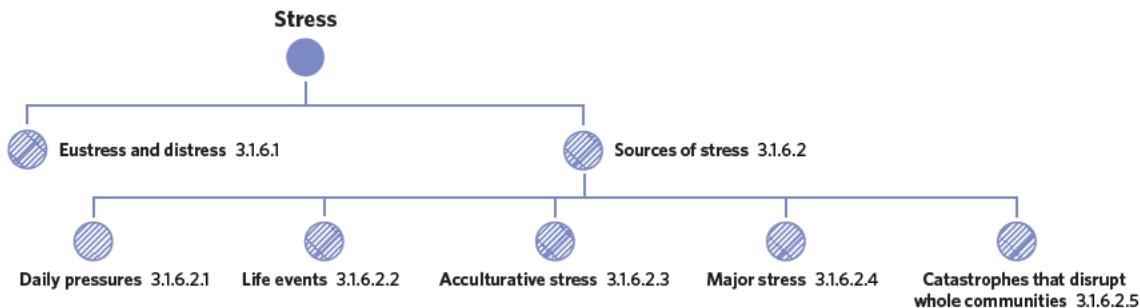
Image by kpakook/Shutterstock.com

# 3A STRESS

In this chapter, you will learn all about stress and how it involves both psychological and biological components. In this introductory lesson, you will learn about the different forms that stress can take and the range of sources of stress.

3A. Stress	3B. Biological processes of stress	3C. Psychological processes of stress	3D. Coping with stress
<b>Study design dot point</b>			
<ul style="list-style-type: none"> <li>sources of stress (eustress and distress) including daily pressures, life events, acculturative stress, major stress and catastrophes that disrupt whole communities</li> </ul>			
<b>Key knowledge units</b>			
Eustress and distress			3.1.6.1
Daily pressures (Sources of stress)			3.1.6.2.1
Life events (Sources of stress)			3.1.6.2.2
Acculturative stress (Sources of stress)			3.1.6.2.3
Major stress (Sources of stress)			3.1.6.2.4
Catastrophes that disrupt whole communities (Sources of stress)			3.1.6.2.5

In this lesson, you will be learning about stress. You will focus on the different types of stress (**eustress and distress**) and the sources of stress, including **daily pressures, life events, acculturative stress, major stress and catastrophes that disrupt whole communities**.



## Eustress and distress 3.1.6.1

### OVERVIEW

Often, when people think of stress, they think of it as a wholly negative experience. However, stress can also be positive and adaptive.

### THEORY DETAILS

Stress is both a psychological and biological experience that occurs when a person encounters a stressor. **Stressors** are stimuli that demand attention and efforts to cope. They can be both internal (something mental or biological within a person), or external (something that confronts a person from outside of their own body).

Regardless of the type of stressor, similar biological reactions are experienced, generally involving a heightened arousal of the sympathetic nervous system. However, the psychological processes of stress tend to be more varied. On the one hand, stress may be experienced as a negative psychological state. This is known as **distress**, and often occurs when a stressor presents an individual with an undesirable circumstance or challenges that are too demanding. For example, when a person loses the keys to their car, they often experience distress; emotions like worry and frustration occur as the individual contemplates the major inconveniences brought about by not finding their keys again.

**Stress** a psychological and biological experience that occurs when an individual encounters something of significance that demands their attention and/or efforts to cope

**Stressor** a stimulus (internal or external) that prompts the stress response

**Distress** a form of stress characterised by a negative psychological state

Alternatively, stress can be experienced as a positive psychological state involving emotions such as motivation and excitement. This state is known as **eustress**, and tends to occur when the stressor provides a positive opportunity or circumstance for the individual. For example, being offered a place at university can be stressful in that it demands change and effort, but it often results in positive emotions like motivation for personal growth.

Importantly, eustress and distress are highly subjective, and what may elicit eustress for one individual may elicit distress in another.

Furthermore, they are not static states, meaning that they are open to change and constant reinterpretation by the individual. For example, what may begin as eustress could later change to distress if the demands of the stressor increase.

As a general rule, high levels of eustress prompt an increase in performance and functioning for individuals. Distress also prompts high performance, however if it becomes so overwhelming that an individual cannot cope, performance may decrease.

Ultimately, this demonstrates the utility of stress in some circumstances, as certain levels of physiological and psychological stress can prompt a rise in productivity. This is illustrated in figure 1.

## Sources of stress 3.1.6.2

### OVERVIEW

There are five different sources of stress you should be familiar with.

### THEORY DETAILS

Source of stress	Explanation	Examples
<b>Daily pressures</b> 3.1.6.2.1   Image: imagedb.com/Shutterstock.com	<b>Daily pressures</b> are stressors that come up as part of day-to-day life. These include small inconveniences and problems that most people face semi-regularly at some point in their life.	<ul style="list-style-type: none"> <li>Losing belongings temporarily such as keys, phone, wallet</li> <li>Boredom</li> <li>Commuting to work or school</li> <li>Financial worry</li> <li>Health concerns</li> <li>Worries about appearance</li> <li>Concerns about academic performance</li> <li>Cooking</li> <li>Small conflicts among friends and/or family</li> </ul>
<b>Life events</b> 3.1.6.2.2   Image: Sudowoodo/Shutterstock.com	<b>Life events</b> are stressors that force a person to change something about their lifestyle in order to cope with new circumstances that arise. These can elicit experiences of eustress or distress, but are primarily characterised by forced adaptation.	<ul style="list-style-type: none"> <li>Having a baby</li> <li>Marriage</li> <li>Death of friend or family member</li> <li>Moving house</li> <li>Career changes</li> <li>Major health issues</li> </ul>
<b>Acculturative stress</b> 3.1.6.2.3   Image: M-SUR/Shutterstock.com	<b>Acculturative stress</b> is a source of stress caused by the challenges associated with moving into a new and foreign culture. Also known as 'culture shock', acculturative stress is greatest when the culture a person has to adjust to is significantly different from the culture that they came from. Acculturative stress occurs whether someone moves by choice or by force, but is often more difficult for people who have no choice in leaving their home country. Acculturative stress may also occur when moving interstate or to another city if the culture is significantly different from the culture a person moved from.	<ul style="list-style-type: none"> <li>Adapting to cultural and linguistic differences (whether by choice or by force)</li> <li>Feeling isolated or culturally excluded</li> <li>Missing elements of one's own culture that a person can no longer engage with</li> <li>Experiencing racism and xenophobia</li> <li>Adapting to a new country's belief systems and philosophies</li> <li>Separation from family, friends and a sense of 'home'</li> <li>Finding work and financial stability</li> </ul>

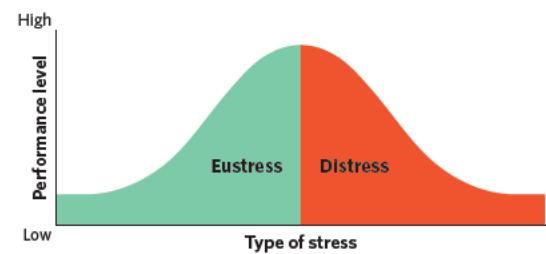


Figure 1 Eustress and distress can prompt different performance levels depending on the extent to which they are felt

**Eustress** a form of stress characterised by a positive psychological state

**Daily pressures** small inconveniences and problems that are experienced as a part of day-to-day life

**Life events** stressors that change a person's circumstances and force them to change something about their lifestyle

**Acculturative stress** stress that results from the challenges presented by adapting to a new and foreign culture

Source of stress	Explanation	Examples
<b>Major stress</b> 3.1.6.2.4   Image: John T Takai/Shutterstock.com	<b>Major stress</b> is a form of stress that causes trauma and distress. They are often life-threatening, and/or present a threat to both psychological and physiological wellbeing. Major stressors are objectively bad, and cause stress for anyone who is confronted by them.	<ul style="list-style-type: none"> <li>• Experiencing physical and/or sexual violence</li> <li>• Witnessing violence and/or sexual violence</li> <li>• Experiencing natural and/or man-made disasters and crises (such as bush fires, war)</li> <li>• Being involved in or witnessing a serious accident (car accidents, major injuries)</li> <li>• Having a life-threatening or terminal illness</li> </ul>
<b>Catastrophes that disrupt whole communities</b> 3.1.6.2.5   Image: Lorelyn Medina /Shutterstock.com	<b>Catastrophes that disrupt whole communities</b> are large-scale, major upheavals that affect an interconnected population.	<ul style="list-style-type: none"> <li>• Bush fires</li> <li>• Floods</li> <li>• Genocide</li> <li>• Bombings</li> <li>• War</li> <li>• Industrial or transport disasters</li> <li>• Major environmental pollution (such as oil spills, nuclear disasters)</li> <li>• Cyclones</li> <li>• Drought</li> <li>• Forced migration</li> <li>• An epidemic</li> </ul>

## Theory summary

In this lesson, you have been introduced to the topic of stress. You should now be familiar with the different types of stress (eustress and distress) as well as the five different sources of stress (daily pressures, life events, acculturative stress, major stress and catastrophes that disrupt whole communities). From a given scenario, you should be able to identify what type of stress is being experienced as well as identify the source of stress.

**Major stress** stressors that present significant and negative threats to a person's psychological and/or physiological wellbeing

**Catastrophes that disrupt whole communities** large-scale events or upheavals that affect an interconnected population



You will learn more about the factors that contribute to someone's subjective interpretation of a stressor as either eustress or distress in lesson **3C: Psychological processes of stress**. You will also look at the biological processes brought on by both eustress and distress in lesson **3B: Biological processes of stress**.

## 3A Activities

1 Fill in the table to summarise information about stress. The first has been completed for you.

Source of stress	Circle all that apply	Provide specific examples of when this source of stress might cause eustress and/or distress
Daily pressures	Eustress / distress	Eustress: waiting to get a test result back at school which you know you performed well on Distress: missing the bus on the way to work
Life events	Eustress / distress	
Acculturative stress	Eustress / distress	
Major stress	Eustress / distress	
Catastrophes that disrupt whole communities	Eustress / distress	

# 3A QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |            |                   |                        |   |
|------------|-------------------|------------------------|---|
| • eustress | • daily pressures | • acculturative stress | • catastrophes that disrupt whole communities |
| • distress | • life events     | • major stress         |   |
- a a significant and distressing experience of a stressor that results in threat or harm to a person's wellbeing \_\_\_\_\_
- b stress experienced as a negative psychological state \_\_\_\_\_
- c stress that results from the pressures and demands of adjusting to a new culture \_\_\_\_\_
- d major events that cause extensive disturbances to a population \_\_\_\_\_
- e hassles or disruptions that occur as part of everyday life \_\_\_\_\_
- f stress experienced as a positive psychological state \_\_\_\_\_
- g significant events that require a person to adjust some part of their lifestyle \_\_\_\_\_

## Exam-style questions

### Remember and understand

### Question 2 (1 MARK)

One difference between major stress and life events is that

- A major stress always cause distress, whereas life events always cause eustress.  
B major stress always cause eustress, whereas life events always cause distress.  
C major stress can cause eustress or distress, whereas life events always cause distress.  
D major stress always cause distress, whereas life events can cause eustress or distress.

### Question 3 (1 MARK)

Floods, bushfires and earthquakes are examples of which source of stress?

- A natural disasters  
B catastrophes that disrupt whole communities  
C life events  
D daily pressures

### Question 4 (2 MARKS)

Outline the difference between eustress and distress using an example.

## Apply and analyse

**Use the following information for questions 5 and 6.**

Every day, Sachi gets dressed for her job in the city. Although she cares about how she will look, Sachi feels excited each day to plan a new outfit.

### Question 5 (1 MARK)

What is the source of stress that Sachi is experiencing?

- A eustress, daily pressure  
B eustress, life event  
C distress, daily pressure  
D distress, life event

**Question 6** (1 MARK)

One day, Sachi found that the dress she wanted to wear had shrunk in the wash. The stress that Sachi most likely experienced was

- A eustress, daily pressure
- B eustress, life event
- C distress, daily pressure
- D distress, life event

**Question 7** (2 MARKS)

Diego's dog Jerry just died after a year of liver cancer. Although Diego knew Jerry would die sooner or later, he feels extremely saddened and as though he has lost his best friend. He no longer has anyone to walk to the local river with and to greet him when he comes home from school.

Name and describe Diego's source of stress.

**Question 8** (3 MARKS)

Lenny and Billie recently adopted a baby boy. It has been two weeks since adopting their son, and both parents are very stressed. Billie is feeling very overwhelmed by having to constantly care for Lenny and the baby, as well as having to go back to work soon. On the other hand, while Lenny feels stressed because of having to constantly hold and feed the baby, he is mostly overjoyed by the presence of the baby and being able to invest in a new life.

With reference to sources of stress, explain the difference between Lenny and Billie's response to their new baby boy.

**Questions from multiple lessons****Use the following information for questions 9 and 10.**

Ai has noticed his grandmother shaking a lot whenever he visits her home. She will often drop things, and has fallen a few times recently after losing her balance. Worried, Ai spoke to a doctor on the phone about what his grandmother's symptoms could mean. One of the potential problems the doctor mentioned to Ai was Parkinson's disease. Ai immediately began to worry, feeling very upset about the potential for a great decline in his grandmother's health and how much more he will have to care for her. He feels especially sad because she had already struggled so much in her youth to set up a new life in Australia after moving from China.

**Question 9** (1 MARK)

In terms of sources of stress, Ai's stress about his grandmother's future and his grandmother's struggle to set up a new life in Australia are, respectively

- A acculturative stress and a life event.
- B a life event and acculturative stress.
- C major stress and a life event.
- D a catastrophe and acculturative stress.

**Question 10** (1 MARK)

If Ai's grandmother has Parkinson's disease, she would likely experience

- A a decline in dopamine production and an impairment of fine motor skills.
- B a decline in glutamate production and an impairment of fine motor skills.
- C an over-production of dopamine and an impairment of fine motor skills.
- D an over-production of glutamate and an impairment of fine motor skills.

**Question 11** (3 MARKS)

Zeneb is at the state finals for her age group in long jump. She is feeling very excited and is about to run, and notices her heart beating quickly in her chest.

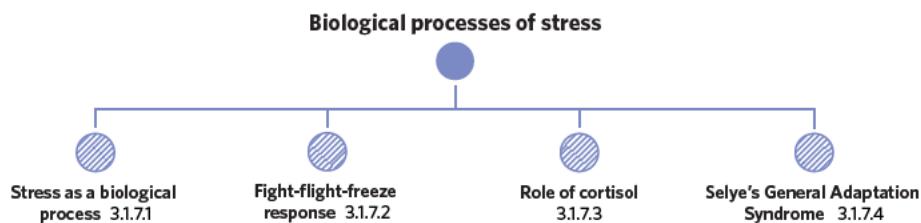
- a Is Zeneb experiencing eustress or distress? Justify your response. (2 MARKS)
- b Identify the division of the nervous system responsible for Zeneb's heart beating quickly. (1 MARK)

# 3B BIOLOGICAL PROCESSES OF STRESS

In this chapter, you are looking at stress as a psychobiological process. To understand this, you need to understand the way stress can be viewed from both biological and psychological lenses. In this lesson, you will begin by considering stress as a biological process.

3A. Stress	3B. Biological processes of stress	3C. Psychological processes of stress	3D. Coping with stress
<b>Study design dot point</b>			
<ul style="list-style-type: none"> <li>models of stress as a biological process, with reference to Selye's General Adaptation Syndrome of alarm reaction (shock/counter shock), resistance and exhaustion, including the 'fight-flight-freeze' response and the role of cortisol</li> </ul>			
<b>Key knowledge units</b>			
Stress as a biological process			3.1.7.1
Fight-flight-freeze response			3.1.7.2
Role of cortisol			3.1.7.3
Selye's General Adaptation Syndrome			3.1.7.4

In this lesson, you will be learning about **stress as a biological process**. This will involve understanding stress as the range of physiological reactions that occur in the presence of stressors. To do this, you will learn about the **fight-flight-freeze response**, the **role of cortisol**, and Selye's model of stress called the **General Adaptation Syndrome**.



## Stress as a biological process 3.1.7.1

### OVERVIEW

Stress can be understood as both a producer and a product of biological processes in the body.

### THEORY DETAILS

Stress produces a range of both psychological and physiological reactions in people. These reactions are influenced by a range of factors, including the type of stressor, its significance to the individual, and situational factors like the environment it appears in. VCE Psychology requires you to understand stress as a psychobiological process. This means understanding the way stress can manifest in both cognitive and affective processes (psychological) and physiological reactions (biological). This lesson examines models for understanding the biological components of stress, namely the fight-flight-freeze response and Selye's General Adaptation Syndrome. It also examines the role of cortisol, a hormone released by the body when faced with stress.

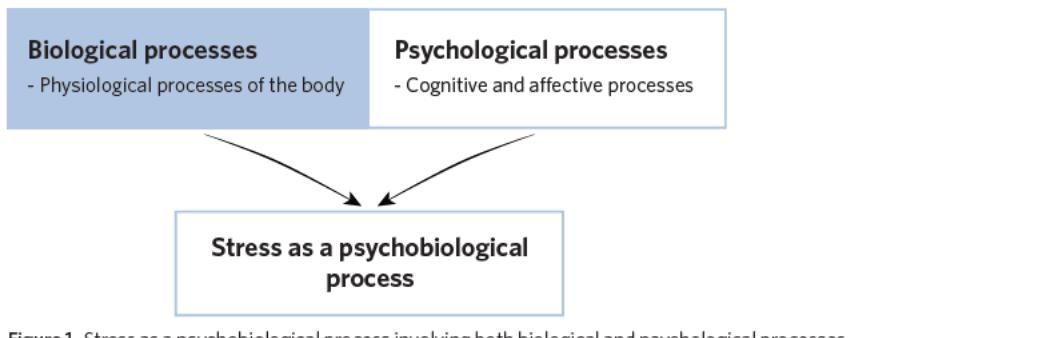


Figure 1 Stress as a psychobiological process involving both biological and psychological processes

## Fight-flight-freeze response 3.1.7.2

### OVERVIEW

The fight-flight-freeze response is a biological response to stressors that are an immediate threat to an organism.

### THEORY DETAILS

Some forms of stress present an immediate threat to an organism's safety. In order to survive, an organism must quickly respond and activate their physiological responses. This quick and involuntary response is referred to as the **fight-flight-freeze response**, and can take a range of forms depending on the organism and its circumstance. Generally speaking, the fight-flight-freeze response is adaptive in some way for an organism, helping it to survive in the face of a stressor. To do this, there is an activation of the autonomic nervous system, causing the organism to respond in one of three ways: fight, flight or freeze.

**Fight-flight-freeze response**  
an involuntary and automatic response to a threat that takes the form of either confronting it, escaping it or freezing in the face of it

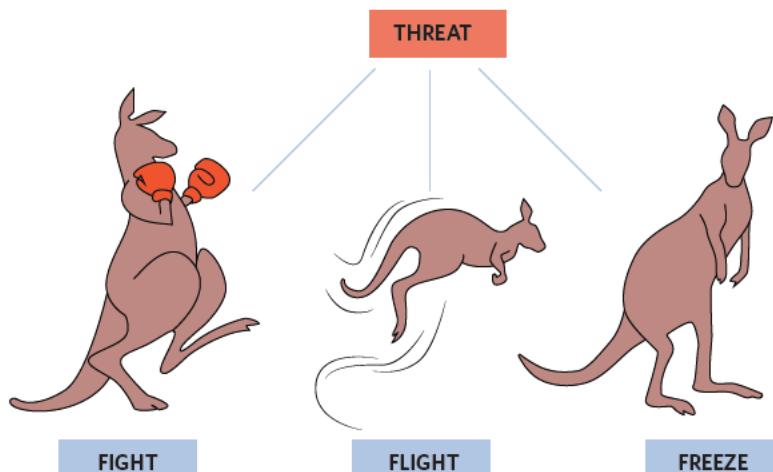


Figure 2 In the face of a threat, the fight-flight-freeze response occurs



Each of the responses in the fight-flight-freeze response involve an activation of the autonomic nervous system that you learned about in lesson **2A: Central and peripheral nervous systems**. You can look at this lesson to understand some of the specific biological reactions that may occur in this response.

Some of the responses of the physiological response activated by the fight-flight-freeze include:

- increased heart rate and blood flow (fight-flight)
- increased breathing rate (fight-flight)
- drop in blood pressure (freeze)

Fight	Flight	Freeze
<ul style="list-style-type: none"> <li>• In the 'fight' response, an organism confronts their threat.</li> <li>• This reaction is characterised by the activation of sympathetic responses which energises the body and make it better able to deal with danger.</li> </ul>	<ul style="list-style-type: none"> <li>• In the 'flight' response, an organism flees from the source of danger.</li> <li>• This is generally because escaping the situation is perceived by the organism to be the safest option.</li> <li>• This response also depends on an activation of the sympathetic nervous system, allowing the body to quickly flee from the threat.</li> </ul>	<ul style="list-style-type: none"> <li>• The 'freeze' response is characterised by the body's immobility and shock in response to a threat.</li> <li>• This is generally because the stressor seems so threatening that the body cannot respond right away, being physically 'frozen' as it orients itself and processes the stressor.</li> <li>• It can also occur when the body perceives that it lacks adequate energy or time to fight against, or flee from the stressor.</li> <li>• Further, remaining very still can sometimes be the greatest guarantee of safety for an organism. For example, animals that encounter predators may remain very still in order to remain unseen.</li> <li>• In terms of nervous system responses, the freeze response involves a brief activation of the parasympathetic nervous system as some bodily reactions, such as blood pressure, drop below normal levels.</li> <li>• However, it can also involve an almost simultaneous activation of the sympathetic nervous system, with the freeze response often only lasting seconds.</li> </ul>

## Role of cortisol 3.1.7.3

### OVERVIEW

Cortisol is one of the most important hormones released during stress, serving a range of functions that help the body to deal with a threat.

## THEORY DETAILS

**Cortisol** is a steroid hormone that is released in times of stress to aid the body in initiating and maintaining heightened arousal. It is released by the adrenal glands, and is involved in both short-term and longer-term responses to stress. During the fight-flight response, cortisol helps to energise the body by inducing the release of glucose and a rise in blood-sugar levels. However, unlike adrenaline and noradrenaline, cortisol also helps the body to remain at above-average levels of arousal even after this initial fight-flight-freeze response is over. Due to cortisol being stimulated by a different pathway when compared to adrenaline and noradrenaline, cortisol takes longer to be secreted into the body but is released over a more prolonged period. This allows the body to continue to deal with stress for longer, rather than simply in the face of an imminent threat.

During the stress response, cortisol serves the adaptive functions of:

- Increasing blood sugar levels
- Improving metabolism
- Energising the body
- Reducing inflammation

However, when stress is long-term and high cortisol levels remain in the bloodstream, cortisol can suppress the immune system. This is because it causes the body's functions to operate at heightened levels, depleting the body of the energy required to fight off bacteria. The body cannot maintain high levels of cortisol forever, and eventually its stores will deplete.

## Selye's General Adaptation Syndrome 3.1.7.4

### OVERVIEW

Hans Selye's General Adaptation Syndrome details the biological stages involved in dealing with a persistent stressor.

### THEORY DETAILS

Hans Selye's **General Adaptation Syndrome** is a biological model of stress that tracks the physiological reactions to stress over time. Selye proposed that regardless of the stressor, the same biological reactions occur in response to stress. Importantly, the stages of his model occur in the face of a persistent stressor. This means that the kind of stress addressed by this model is by nature long-term. There are three stages of the General Adaptation Syndrome:

Stage	Example
<p><b>1. Alarm reaction</b> is the first stage and the immediate reaction that occurs when a person initially encounters and is made aware of a stressor. This stage mobilises the body to confront a stressor, and is comprised of two substages:</p> <ul style="list-style-type: none"> <li>• <b>Shock</b> is the first substage in which the body's biological reactions fall below normal functioning. The body acts as though it is injured, experiencing a temporary drop in temperature and blood pressure. The ability to deal with the stressor is momentarily reduced.</li> <li>• <b>Counter shock</b> is the second substage in which sympathetic nervous system responses occur. This includes the release of stress hormones including adrenaline and noradrenaline (as a sympathetic response) by the adrenal glands. Additionally, the hormone cortisol is secreted by a system called the HPA axis (hypothalamic-pituitary-adrenal axis). Reactions in this stage are similar to those in fight-or-flight.</li> </ul>	At the beginning of year 12, a student hears about how close all of their exams are together in the end of the year exam period. Upon hearing this, they feel shocked and scared before some sympathetic nervous system responses, such as their heart beating quickly, kick in.
<p><b>2. Resistance</b> occurs after the body's initial alarm reaction to stress. It functions as an adaptive stage in response to a persistent stressor, sustaining high levels of physiological arousal as the body adjusts to increased hormone levels. Although the sympathetic nervous system responses within alarm reactions decrease in intensity, the body does experience a rise in its resistance to the stressor. In this stage, high levels of stress hormones like cortisol begin to suppress the functioning of the immune system (immunosuppression), making an individual more susceptible to 'wear and tear', such as getting sick. Often in this stage, an individual focusses most of their energy on the stressor at hand, ignoring other life commitments such as socialising or work. While the individual's resistance to the most significant stressor rises, their resistance to other forms of stress likely decrease.</p>	Five months down the line, the student does not always feel intense sympathetic nervous system reactions, but continues to study every day for their exams. While they have gotten a few colds throughout the five months due to stress, they continue to study and work hard.
<p><b>3. Exhaustion</b> is the final stage of the General Adaptation Syndrome. In this stage, an organism's resistance to a stressor falls below normal levels of functioning as the body becomes depleted and unable to maintain heightened arousal. A person in the exhaustion stage often experiences fatigue, sickness, and an increased susceptibility to mental health disorders such as anxiety and depression, as well as more serious physical illnesses.</p>	Half way through their exam period, the student develops a bad flu. Luckily they have studied enough, but the student feels feverish and sick during their final two exams.

It is important to be able to relate the fight-flight-freeze response and the role of cortisol to the different stages of General Adaptation Syndrome. Keep in mind that the fight-flight-freeze response would occur during the alarm reaction stage. Table 1 details the role of cortisol at each stage of the model.

**Cortisol** a hormone released into the body in times of stress

**General Adaptation Syndrome** a model that examines the biological stages of stress involved in responding to a persistent stressor

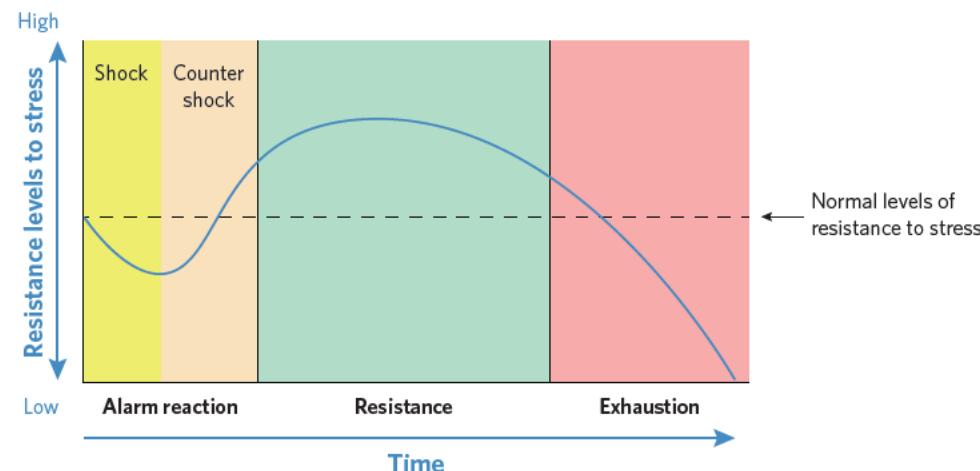
**Alarm reaction** the first stage of the General Adaptation Syndrome which involves the body's initial decline and then rise in arousal to a stressor

**Resistance** the second stage of the General Adaptation Syndrome which involves the body sustaining high levels of arousal to a persistent stressor

**Exhaustion** the final stage of the General Adaptation Syndrome which involves the body's defences and energy levels depleting, leading to a greatly reduced ability to cope with current and future stressors

**Table 1** Stages of General Adaptation Syndrome and the corresponding role of cortisol

Name of stage	Role of cortisol
Alarm reaction	Cortisol levels rise to mobilise the body to respond to the stressor.
Resistance	Cortisol levels are sustained at a heightened level to maintain an increased ability to respond to the stressor.
Exhaustion	Cortisol levels are depleted and the body's ability to respond to the stressor is reduced.

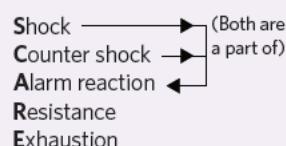
**Figure 3** Levels of resistance at each stage of General Adaptation Syndrome. It is important to note the fall that occurs in shock before the rise that begins in countershock

In general, you should also familiarise yourself with some of the strengths and limitations of Selye's General Adaptation Syndrome in order to apply the key science skill of evaluating scientific models. Some of these are outlined in table 2.

**Useful tip**

When identifying shock or counter shock in exam scenarios, it's important to mention that they are part of the alarm reaction stage. If the scenario gives enough information to, you should specify whether shock (alarm reaction) or counter shock (alarm reaction) is being experienced.

To remember the order of the stages in General Adaptation Syndrome, remember the acronym 'SCARE':

**Table 2** Strengths and limitations of Selye's General Adaptation Syndrome

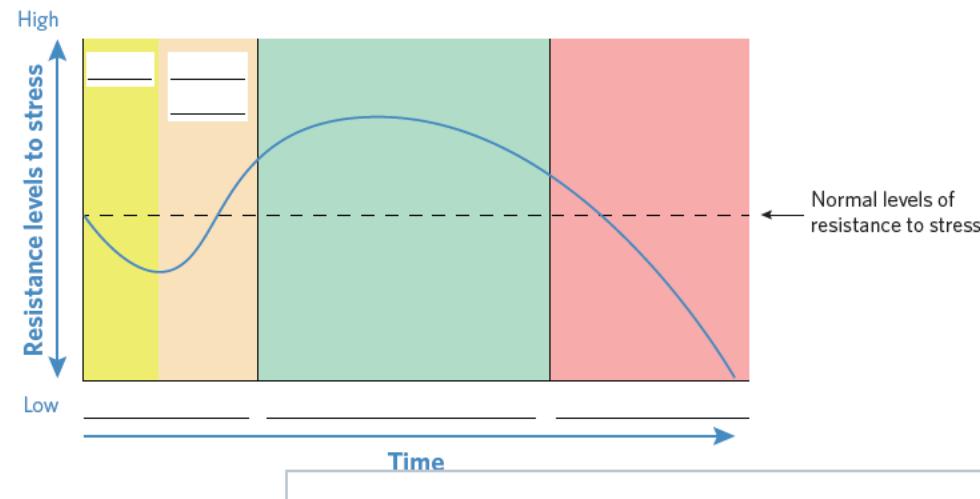
Strengths	Limitations
<ul style="list-style-type: none"> <li>Acknowledges the relationship of stress to sickness and disease</li> <li>Identifies the biological processes associated with different stages of stress</li> </ul>	<ul style="list-style-type: none"> <li>Only considers the biological components of stress, not psychological</li> <li>Does not acknowledge the subjective nature of the stress response (both psychologically and biologically) by prescribing a set of defined processes for stress</li> <li>Findings are based on research with animals, so it is difficult to generalise results to a human population confidently</li> </ul>

**Theory summary**

In this lesson, you have looked at the processes of stress from a biological perspective. You should now be able to explain the role of the fight-flight-freeze response and cortisol in responding to stress, as well as the distinct stages of Selye's General Adaptation Syndrome. You should also be able to explain how the fight-flight-freeze response and cortisol relate to Selye's model.

**3B Activities**

- 1 Label this model with the names of the stages and substages of the General Adaptation Syndrome.



# 3B QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |                  |                               |                                |
|------------------|-------------------------------|--------------------------------|
| • Alarm reaction | • Resistance                  | • Cortisol                     |
| • Exhaustion     | • General Adaptation Syndrome | • Fight-flight-freeze response |
- a A model of stress which tracks how an organism physiologically responds to a stressor over time \_\_\_\_\_
- b A stage of responding to a stressor that occurs when the body's energy is depleted and it can no longer maintain high levels of arousal \_\_\_\_\_
- c A quick and intense response to a threat, resulting in confronting it, escaping it, or being still in the face of it \_\_\_\_\_
- d A stage of responding to a stressor in which the body's defences against a stressor are maintained, but suppression of the immune system begins \_\_\_\_\_
- e A stage of responding to a stressor which involves two substages that begin initial and intense physiological reactions \_\_\_\_\_
- f A hormone which energises the body when under stress \_\_\_\_\_

## Exam-style questions

### Remember and understand

#### Question 2 (1 MARK)

The fight-flight-freeze response can be considered

- A a short-term psychological response to stress.
- B a long-term psychological response to stress.
- C a short-term biological response to stress.
- D a long-term biological response to stress.

#### Question 3 (1 MARK)

During prolonged stress, cortisol

- A keeps the body at optimal functioning.
- B can cause immunosuppression.
- C triggers the freeze response.
- D helps to reduce stress.

*Adapted from VCAA 2018 exam MCQ4*

#### Question 4 (1 MARK)

Selye's General Adaptation Syndrome is a model of stress that

- A tracks short-term biological reactions to stress.
- B tracks long-term biological reactions to stress.
- C considers the subjective nature of the biological response to stress.
- D considers the way different stressors produce different biological responses to stress.

#### Question 5 (3 MARKS)

Describe the role of cortisol as it applies to each stage of Selye's General Adaptation Syndrome.

Name of stage	Role of cortisol
Exhaustion	
Resistance	
Alarm reaction	

#### Question 6 (3 MARKS)

In terms of Selye's General Adaptation Syndrome, explain the role of the alarm reaction stage in responding to a stressor.

**Apply and analyse****Question 7** (1 MARK)

Willow is at an auction for a house she is trying to buy. She has fallen in love with the property, and really wants to beat the other buyers. During the auction, as the bidding begins, Willow can feel her heart beating loudly and feels as though her body is rushing with energy. The role of cortisol for Willow during the bidding is to

- A** mobilise her body to confront a stressor.
- B** mobilise her body to stay calm in the face of a stressor.
- C** weaken her immune system.
- D** activate her freeze response.

**Question 8** (2 MARKS)

Jude is going to donate blood for the first time, even though he is very scared of seeing his own blood. When the pathologist put the needle in his arm and Jude saw his blood flowing through the tube, Jude's temperature dropped and he felt faint. In terms of Selye's General Adaptation Syndrome, describe the stage Jude is currently experiencing.

Adapted from VCAA 2018 exam MCQ5

**Question 9** (8 MARKS)

Dillon and Cora are about to go on stage at their school talent show. They both enter the stage and stand before the audience as their song starts to play. Although nervous, Dillon feels energised and starts to sing his part. However, for her first two lines, Cora is stunned by the audience, stands still and cannot sing.

- a** In terms of the fight-flight-freeze response, describe the types of responses that Dillon and Cora experienced at the beginning of the song. (4 MARKS)
- b** In terms of Selye's General Adaptation Syndrome, identify the likely stage each student was experiencing at the beginning of the song. Justify your response. (4 MARKS)

**Questions from multiple lessons****Question 10** (1 MARK)

According to Selye's General Adaptation Syndrome, the alarm reaction stage activates which division of the nervous system?

- A** sympathetic
- B** parasympathetic
- C** sympathetic, then parasympathetic
- D** parasympathetic, then sympathetic

**Question 11** (3 MARKS)

Dexter's partner has recently been diagnosed with Parkinson's disease at age 50, so is below the average age for the onset of the disease. Dexter just found out, and although he isn't saying anything to his partner, feels as though it is very horrible news. Dexter hasn't started planning or doing anything to help just yet, as he feels overwhelmed by the news and like he needs to rest on it first.

- a** In terms of Selye's General Adaptation Syndrome, identify and describe the stage Dexter is most likely experiencing. (2 MARKS)
- b** Describe one change in neural function that Dexter's partner would likely be experiencing. (1 MARK)

**Key science skills****Question 12** (7 MARKS)

Professor Prictor wanted to investigate the relationship between male and female genders and the time it takes to reach the exhaustion stage in Selye's General Adaptation Syndrome. To do this, Professor Prictor sampled 20 males and 20 females who had had a family member diagnosed with cancer in the past month, and measured their cortisol level. He measured their cortisol levels every three weeks for an eight-month period. He obtained this sample by asking people visiting the cancer ward at Roselle Hospital if they would participate.

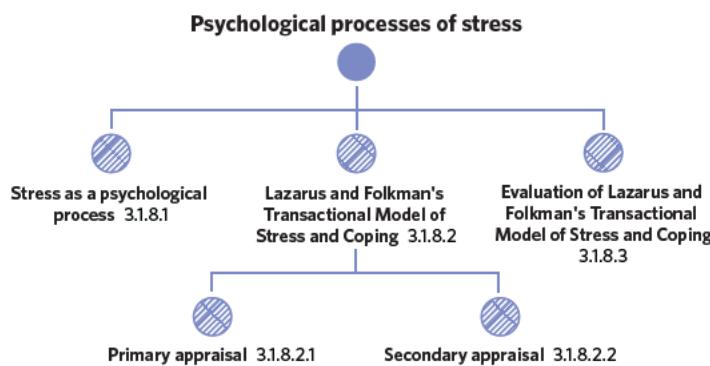
- a** State a research hypothesis for this experiment. (3 MARKS)
- b** Identify the sampling procedure Professor Prictor used to obtain his participants. (1 MARK)
- c** In terms of Selye's General Adaptation Syndrome, explain why Professor Prictor measured participants' cortisol levels. (3 MARKS)

# 3C PSYCHOLOGICAL PROCESSES OF STRESS

In this chapter, you are looking at how stress can be understood as a psychobiological process. In the last lesson, you examined stress through a biological lens. Now, you will look at stress from a psychological perspective.

3A. Stress	3B. Biological processes of stress	3C. Psychological processes of stress	3D. Coping with stress
<b>Study design dot point</b>			
• models of stress as a psychological process, with reference to Richard Lazarus and Susan Folkman's Transactional Model of Stress and Coping (stages of primary and secondary appraisal)			
<b>Key knowledge units</b>			
Stress as a psychological process			3.1.8.1
Primary appraisal (Lazarus and Folkman's Transactional Model of Stress and Coping)			3.1.8.2.1
Secondary appraisal (Lazarus and Folkman's Transactional Model of Stress and Coping)			3.1.8.2.2
Evaluation of Lazarus and Folkman's Transactional Model of Stress and Coping			3.1.8.3

In this lesson, you will examine how **stress** can be understood from a **psychological perspective**. This will include looking at **Lazarus and Folkman's Transactional Model of Stress and Coping**, as well as evaluating the strengths and limitations of this model.



## Stress as a psychological process 3.1.8.1

### OVERVIEW

Many psychological factors can influence how an individual perceives and processes stressors, and this can affect a person's unique formulation of the stress response.

### THEORY DETAILS

In order to develop a holistic understanding of stress as a psychobiological process, it is important to understand how psychological processes contribute to individuals' stress responses. These processes primarily include the subjective cognitive and perceptual processes that are involved in understanding, and then acting upon, stressors that arise.

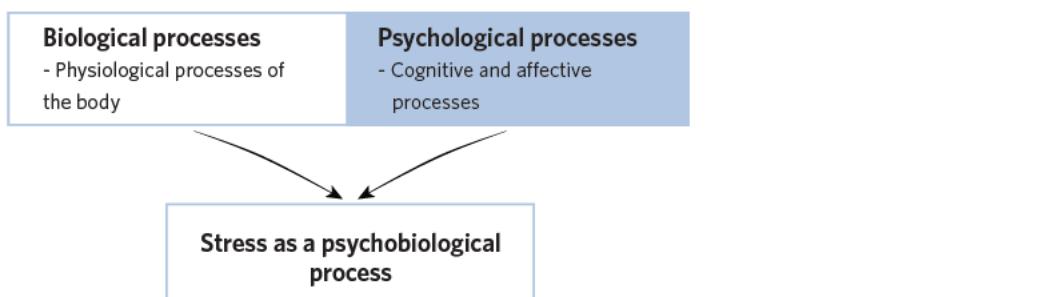


Figure 1 Stress as a psychobiological process involving both biological and psychological processes

## Lazarus and Folkman's Transactional Model of Stress and Coping 3.1.8.2

### OVERVIEW

Lazarus and Folkman's Transactional Model of Stress and Coping is a model that helps to track and interpret an individual's subjective psychological stress response.

### THEORY DETAILS

Lazarus and Folkman's Transactional Model suggests that stress is a subjective 'transaction' between an incoming stressor and the personal and environmental factors specific to an individual. The model explains that the unique stress response of an individual results from their interpretation of the stressor and their belief in their ability to cope with it. According to the model, stress arises when there is a perceived imbalance between what a stressor requires and the coping resources believed to be available to deal with it. Therefore, the model views stress from a psychological perspective because it tracks the subjective cognitive and affective interpretations of an individual, and their contributions to stress. The complete model is shown in figure 2.

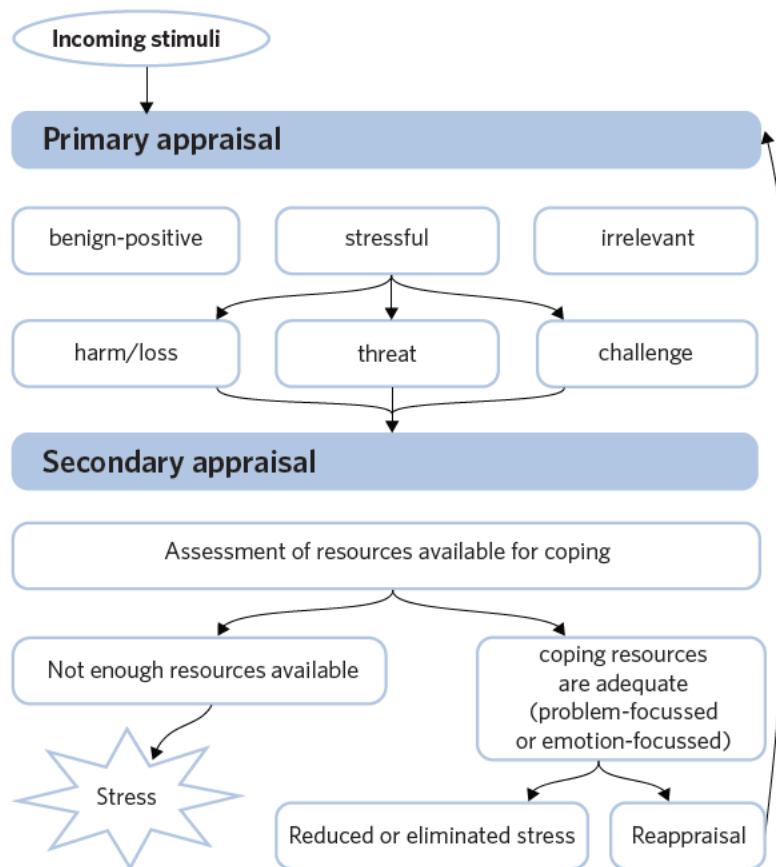


Figure 2 Lazarus and Folkman's Transactional Model of Stress and Coping

#### Want to know more?

Lazarus and Folkman's model is referred to as being 'transactional' because it explains stress as an 'output' resulting from an 'input'. In a bank withdrawal for example, you might enter your pin number and the amount of money you wish to withdraw (an input), in order to get cash out (an output). In Lazarus and Folkman's model, there is a unique input of the stressor according to an individual's own appraisals, which provides the output of their own unique stress response.

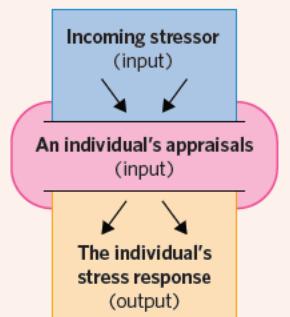


Figure 3 Lazarus and Folkman's model can be understood as a 'transaction'

### Primary appraisal 3.1.8.2.1

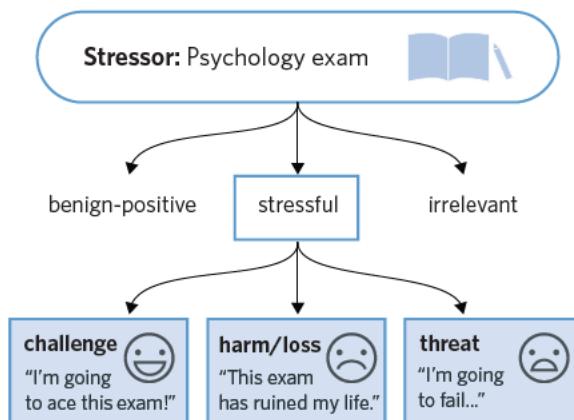
The first stage of the Transactional Model is known as 'primary appraisal'. In this stage, an individual first determines the nature of the incoming stimulus and the type of stress it might cause. This is done in two separate substages. Primary appraisal first involves the individual deciding whether or not the incoming stimulus will actually cause them to experience stress. There are three initial ways an incoming stressor can be appraised:

- **Benign-positive:** this means that the individual perceives the stimulus as neutral or positive, and as such, that it will not cause stress.
- **Irrelevant:** the stimulus is perceived as not presenting an issue or source of worry for the individual in any way. The stimulus then will not cause stress.
- **Stressful:** the stimulus will worry or force the individual to respond in some way, and as such is interpreted as being a stressor.

The transaction continues only if this initial component of primary appraisal evaluates an incoming stimulus as 'stressful'. Otherwise, the incoming stimulus is disregarded. If considered to be 'stressful', the stimulus (now called a stressor) undergoes further appraisal, being labelled according to the form of stress it causes. Lazarus and Folkman outline three potential forms of stress:

- **Harm/loss:** the stressor is perceived as having already caused some damage for the individual. This means the individual has experienced distress.
- **Threat:** the stressor is perceived as potentially causing damage for the individual in the future. This appraisal causes the individual to experience distress.
- **Challenge:** the stressor is perceived as potentially providing a good opportunity for change or growth, though will be taxing in some way. This would cause the individual to experience eustress.

Figure 4 provides an example of how an individual may subjectively appraise the incoming stressor of a psychology exam in primary appraisal.



**Appraisal** an assessment or evaluation

**Primary appraisal** the initial process of evaluating the nature of an incoming stressor, specifically the kind of stress it will cause

**Benign-positive** an initial appraisal of a stimulus as neutral or good, and not causing stress for the individual

**Irrelevant** an initial appraisal of a stimulus as a non-issue for the individual

**Stressful** an initial appraisal of a stimulus as a source of worry or emotional significance for the individual

**Harm/loss** a further appraisal of a stressor as having caused some damage for the individual

**Threat** a further appraisal of a stressor as potentially causing damage for the individual in future

**Challenge** a further appraisal of a stressor as potentially providing a good opportunity for growth or change for the individual

#### Useful tip

Remember, primary appraisal contains two 'substages', each with three different options. Only if the individual selects 'stressful' in the first substage does the model continue on to further evaluations.

Figure 4 Primary appraisal stages and potential responses to the stimulus of a psychology exam

### Secondary appraisal 3.1.8.2.2

After the initial evaluation is made about the nature of the stressor, a further assessment is made about the coping mechanisms required to actually deal with it. This process is called 'secondary appraisal'.

In secondary appraisal, the individual decides what types of coping mechanisms or strategies will be needed to confront a stressor, and whether or not these are available to them. **Coping** refers to the process of dealing with a stressor. As previously mentioned, further stress is created when the individual believes that their coping resources cannot meet the demands of the stressor.

If the individual believes they know what resources are needed and that these are available to them, this may prevent any further stress. Lazarus and Folkman's model also details two different kinds of coping strategies individuals may use to deal with a stressor:

- **Emotion-focussed coping:** the use of coping strategies that target the emotional components of a stressor, dealing with the stressor indirectly rather than confronting its source.
- **Problem-focussed coping:** the use of coping strategies that directly target the source of the stressor, aiming to reduce it in a practical way

**Secondary appraisal** the process of evaluating the resources available and required in order to cope with a stressor

**Coping** the process of dealing with stress

**Emotion-focussed coping** the use of coping strategies that target the emotional components of a stressor, dealing with it indirectly rather than confronting its source

**Problem-focussed coping** the use of coping strategies that directly target the source of the stressor, aiming to reduce it in a practical way

**Table 1** Examples of emotion-focussed and problem-focussed coping strategies

Emotion-focussed coping strategies	Problem-focussed coping strategies
<ul style="list-style-type: none"> <li>Wishful thinking; 'I don't think my exam will be too hard'</li> <li>Denial; 'I don't even care about my exam'</li> <li>Reframing; 'Actually, it's not too bad if I think about it like this...'</li> <li>Optimism; 'It will surely turn out for the best'</li> <li>Venting emotions; 'I am so upset about this'</li> </ul>	<ul style="list-style-type: none"> <li>Seeking information or advice, whether from medical or mental health professionals, or people with relevant knowledge</li> <li>Taking action; 'I must study for four hours a night'</li> <li>Time management; creating a plan for how best to invest time into the stressor</li> </ul>

**Want to know more?**

There is a final, optional stage of Lazarus and Folkman's Transactional Model. This is not explicitly on the study design, but can help you to understand the way this model illustrates stress as a subjective transaction. Reappraisal occurs when something about the original stressor changes or progresses, and so involves a reassessment of the resources needed to cope. For example, if an upcoming exam changes to a later date, a person might reappraise the stressor and find that they can plan slightly less study each day before the exam.

## Evaluation of Lazarus and Folkman's Transactional Model of Stress and Coping 3.1.8.3

### OVERVIEW

Although the study design doesn't specify evaluating Lazarus and Folkman's model, it is good to familiarise yourself with some of its strengths and limitations to consolidate your understanding of the model as a whole and to develop your critical thinking skills.

### THEORY DETAILS

As with all models outlining psychological concepts, Lazarus and Folkman's Transactional Model of Stress and Coping has its strengths and limitations. These are outlined in table 2. Broadly, although it serves as a useful model to begin to understand some of the psychological processes involved in a person's stress response, there are limitations to the extent that the model is reflective of the complexities of human psychology.

**Table 2** Strengths and limitations of Lazarus and Folkman's model

Strengths	Limitations
<ul style="list-style-type: none"> <li>Allows one to track the subjective stress response of an individual</li> <li>Allows for consideration of cognitive processes within the stress response, which the biological models do not take into account</li> <li>Human subjects were used as a source of data during the creation of the model</li> <li>Helps to explain why the same stressor may have different effects on different people</li> <li>Reappraisal stage acknowledges that a stressor and its demands may change over time</li> <li>Coping stage (emotion and problem-focussed strategies) provide suggestions for dealing with a stressor</li> </ul>	<ul style="list-style-type: none"> <li>Some argue that the stages of primary and secondary appraisal can occur simultaneously, and so ordering them chronologically may not always be reflective of the true stress response</li> <li>Individuals are not necessarily aware of why they feel certain kinds of stress as primary appraisal suggests</li> <li>Does not include biological processes of stress, when in practice stress is a combination of both biological and psychological factors</li> <li>Cannot easily be tested by research, as human subjects are not necessarily consciously aware at all stages of appraisal, and therefore there is a lack of empirical evidence to support the model</li> </ul>

### Theory summary

In this lesson, you have looked at psychological processes of stress, examining Lazarus and Folkman's Transactional Model of Stress and Coping. You should now be able to explain why this model describes the psychological processes of stress, including the details of its primary and secondary appraisal stages. You should also have an awareness of some of the strengths and limitations of the model, and be able to differentiate it from biological models of stress.

## 3C Activities

- 1 Read the following scenario and select the term corresponding to Nicola's subjective response:

Nicola recently quit her job at a supermarket. She has some savings, but no active source of income right now.

- I. When she first quit her job, she felt a little anxious about what it could mean for her in the future. Nicola's primary appraisal is:

- A Stressful
- B Irrelevant
- C Benign-positive

- II. Despite no income, Nicola is excited to find a new job that she will enjoy more than working in the supermarket. Nicola's appraisal is:

- A Harm/loss
- B Threat
- C Challenge

- III. Just a day after quitting, Nicola began to look online for jobs she could apply for. Nicola's secondary appraisal is:

- A Emotion-focussed coping
- B Problem-focussed coping
- C Reappraisal

- 2 Label the following examples as either 'E' for an emotion-focussed coping strategy, or 'P' for a problem-focussed coping strategy.

- a Wishing that you didn't have to do a SAC next week \_\_\_\_\_
- b Seeking a doctor's advice when you have ongoing headaches \_\_\_\_\_
- c Crying and venting emotions when you have an argument with a family member \_\_\_\_\_
- d Avoiding going to school when you are stressed about work load \_\_\_\_\_
- e Making a list of things you need to do to get a new job \_\_\_\_\_
- f Learning how to get public transport to university before you begin studying \_\_\_\_\_

## 3C QUESTIONS

### Theory review questions

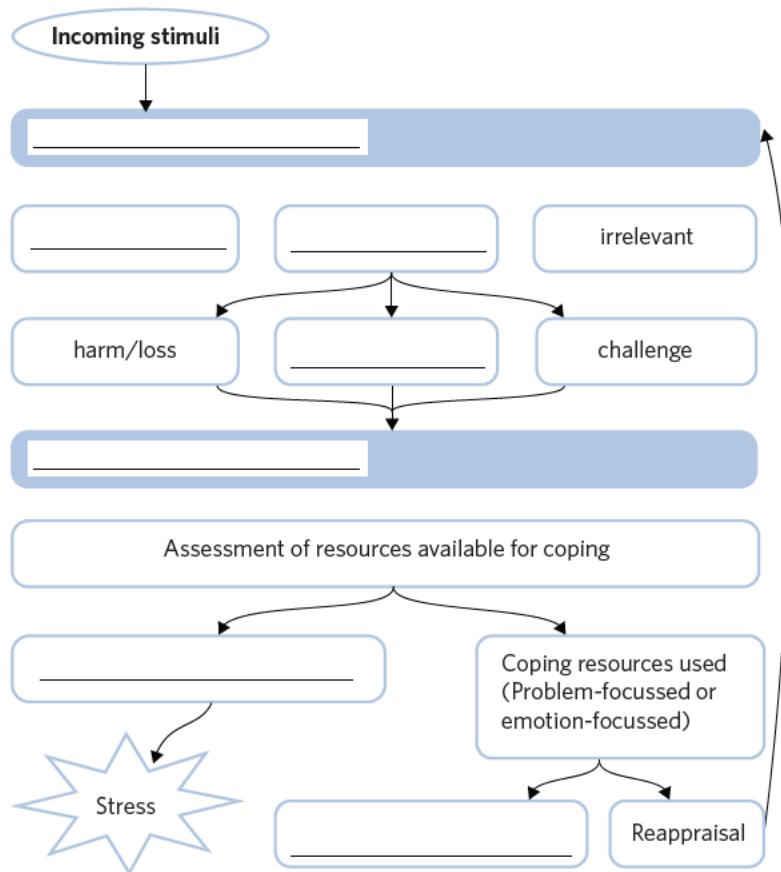
#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                   |              |             |
|-------------------|--------------|-------------|
| • Challenge       | • Irrelevant | • Threat    |
| • Benign-positive | • Harm/loss  | • Stressful |
- a The incoming event/stimuli is perceived as unimportant to the individual and will no longer be considered \_\_\_\_\_
  - b The stressor is perceived by the individual as a positive opportunity, resulting in eustress \_\_\_\_\_
  - c The incoming event/stimuli is perceived as not harmful or neutral to the individual and will no longer be considered \_\_\_\_\_
  - d The incoming event/stimuli is perceived as demanding in some way by the individual \_\_\_\_\_
  - e The stressor is deemed by the individual as already having caused damage or suffering \_\_\_\_\_
  - f The stressor is deemed by the individual as potentially causing damage or suffering in future \_\_\_\_\_

**Question 2**

Fill in the blanks to complete the Transactional Model of Stress and Coping.

**Question 3**

Draw lines from the definitions to match the correct key term.

- |   |  |                         |
|---|--|-------------------------|
| a | An evaluation of stress in any form  | Coping                  |
| b | An initial assessment of the nature of the stressor and what it could mean for the individual  | Secondary appraisal     |
| c | A general term to describe dealing with a stressor, effectively or ineffectively   | Primary appraisal       |
| d | An optional stage in the Transactional Model of Stress and Coping which involves a reconsideration of the resources needed to deal with a stressor | Emotion-focussed coping |
| e | An assessment of the coping mechanisms necessary for the stressor  | Appraisal               |
| f | A coping strategy that involves pragmatically confronting the source of the stressor   | Reappraisal             |
| g | A coping strategy that does not confront the source of the stressor, but attempts to reduce it by reconsidering its impact on the individual       | Problem-focussed coping |

**Exam-style questions***Remember and understand***Question 4** (1 MARK)

According to Lazarus and Folkman's Transactional Model of Stress and Coping, during primary appraisal there is a/an

- A** use of problem focussed coping.
- B** assessment of whether more coping resources are needed.
- C** use of emotion focussed coping.
- D** assessment of the nature of the stressor.

**Question 5** (1 MARK)

In Lazarus and Folkman's Transactional Model of Stress and Coping, the difference between a primary appraisal and a secondary appraisal is that

- A primary appraisal is subjective, while secondary appraisal is objective.
- B primary appraisal involves emotion-focussed coping strategies, while secondary involves problem-focussed.
- C primary appraisal assesses the nature of the stressor, while secondary appraisal assesses the coping resources available.
- D primary appraisal assesses the coping resources available, while secondary appraisal reassesses this at a later stage.

**Question 6** (1 MARK)

According to Lazarus and Folkman's Transactional Model of Stress and Coping, stress arises when

- A an individual refuses to cope with an incoming stressor.
- B an individual believes there is an imbalance between the coping resources available and the demands a stressor.
- C an individual appraises the stressor as a irrelevant or harm/loss.
- D an individual selects emotion-focussed coping strategies over problem-focussed coping strategies.

**Question 7** (2 MARKS)

Describe one strength and limitation of Lazarus and Folkman's Transactional Model of Stress and Coping.

**Question 8** (3 MARKS)

Outline the primary appraisal stage in Lazarus and Folkman's Transactional Model of Stress and Coping with an example.

**Apply and analyse**

**Use the following information for questions 9-11.**

Thomas recently decided he would learn how to drive. He is quite anxious and overwhelmed about accidents and being able to afford lessons. He considers two options: asking his busy father if he will teach him, or saving up for a lesson.

**Question 9** (1 MARK)

According to Lazarus and Folkman's Transactional Model of Stress and Coping, Thomas initially feeling anxious about possible car accidents and being able to afford lessons is an example of a

- A secondary appraisal, where he considers accidents and financial pressure as a challenge.
- B primary appraisal, where he considers accidents and financial pressure as a threat.
- C secondary appraisal, where he considers accidents and financial pressure as a threat.
- D primary appraisal, where he considers accidents and financial pressure as a challenge.

**Question 10** (1 MARK)

When looking into paying for lessons, Thomas worried about how he could make the money to pay for them. Lazarus and Folkman's Transactional Model of Stress and Coping would suggest that Thomas is currently in the stage of

- A secondary appraisal, where he considers problem-focussed approaches for coping with his stressor.
- B secondary appraisal, where he considers emotion-focussed approaches for coping with his stressor.
- C primary appraisal, where he re-evaluates coping resources available after something about his stressor changed.
- D primary appraisal, where he first evaluates coping resources available for the stressor.

**Question 11** (1 MARK)

Thomas later found out that the price of lessons was very expensive, and felt so anxious about his limited options that he decided not to bother learning to drive just yet. This is an example of

- A emotion-focussed coping, in which Thomas avoided dealing with the stressor.
- B primary appraisal, in which Thomas considered the price of the lessons a threat.
- C problem-focussed coping, in which Thomas confronted the source of the stressor by avoiding it.
- D primary appraisal, in which Thomas considered the price of the lessons as harm/loss.

**Question 12** (5 MARKS)

Dean and Yasmin just got back from a three-month trip in Europe, during which they spent most of their savings. Although they had a wonderful time, Yasmin is feeling overwhelmed about how she will work and build up her savings when she is back home studying full time. On the other hand, Dean does not have to study again just yet. He is less worried than Yasmin, and is excited to start looking for a new job so that he can begin saving again.

- a In terms of the primary appraisal stage of Lazarus and Folkman's Transactional Model of Stress and Coping, explain how Dean and Yasmin likely evaluated their situations differently. (3 MARKS)
- b Describe two emotion-focussed coping strategies Yasmin could use to reduce her stress. (2 MARKS)

**Questions from multiple lessons****Question 13** (5 MARKS)

Sonya recently moved from England to Australia, beginning at a new school in year 11. She has found it difficult to join a friendship group, and feels like she has lost her old friends from home and a big part of her identity.

- a What is the name of the source of stress Sonya is experiencing? (1 MARK)
- b In terms of Lazarus and Folkman's primary appraisal stage, explain how Sonya evaluated this kind of stress. (2 MARKS)
- c As she walked into the school gate on her first day at the new school, Sonya felt her heart begin to race and her breathing speed up. In terms of Selye's General Adaptation Syndrome, identify the stage is Sonya experiencing and justify your response. (2 MARKS)

**Question 14** (2 MARKS)

Both Lazarus and Folkman's Transactional Model of Stress and Coping and Selye's General Adaptation Syndrome help to track an individual's stress response. In terms of stress as a psychobiological process, explain the key difference between the models.

**Key science skills****Question 15** (4 MARKS)

Dr Robert wanted to investigate the effect of alcohol on an individual's choice of coping mechanism during Lazarus and Folkman's secondary appraisal stage. He designed an experiment involving 30 students, aged 20-25, all from the same university. In condition 1, half of the individuals were required to drink 160mL of vodka before receiving a text message stating that they had a meeting with a professor in their field of study. In condition 2, the other half of individuals drank 160mL of vodka-flavoured water before receiving the same text message. Both groups were then required to write down how they intended to prepare for the meeting.

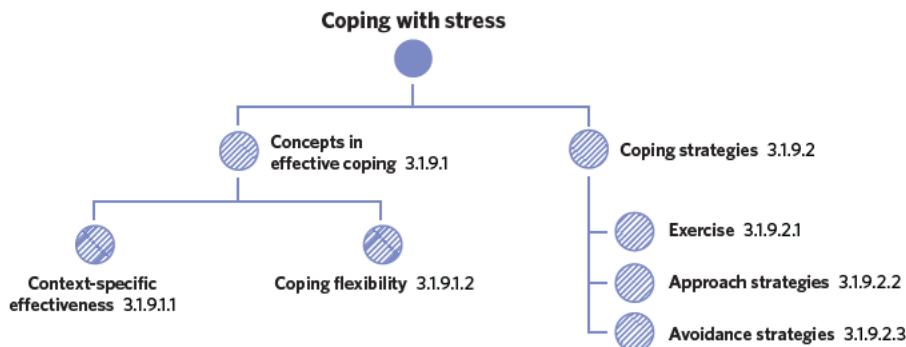
- a What was the experimental design used by Doctor Robert? (1 MARK)
- b State whether quantitative or qualitative data was collected regarding the participants' secondary appraisal choices. (1 MARK)
- c Explain why Doctor Robert administered one group of participants vodka-flavoured water. (2 MARKS)

# 3D COPING WITH STRESS

In this chapter, you have looked at stress as a psychobiological process. In this final lesson, you will look at how people may cope with stress through both psychological and biological means.

3A. Stress	3B. Biological processes of stress	3C. Psychological processes of stress	3D. Coping with stress
<b>Study design dot point</b>			
▪ context-specific effectiveness, coping flexibility and use of particular strategies (exercise and approach and avoidance strategies) for coping with stress			
<b>Key knowledge units</b>			
Context-specific effectiveness (Concepts in effective coping)			3.1.9.1.1
Coping flexibility (Concepts in effective coping)			3.1.9.1.2
Exercise (Coping strategies)			3.1.9.2.1
Approach strategies (Coping strategies)			3.1.9.2.2
Avoidance strategies (Coping strategies)			3.1.9.2.3

**In this lesson, you will be learning** about the concept of **coping**. There are many different ways individuals cope with stress, some more effective than others. In this lesson, you will cover concepts relating to effectively dealing with stress, as well as some **particular strategies** individuals may use.



## Concepts in effective coping 3.1.9.1

### OVERVIEW

Two components of effective coping include the ability to exhibit context-specific effectiveness and coping flexibility.

### THEORY DETAILS

Coping refers to the process of dealing with stress and can be done through the use of affective, biological, cognitive and behavioural strategies. People deal with stress in many different ways, and some coping mechanisms help to confront or reduce the source of stress more effectively than others.

#### Context-specific effectiveness 3.1.9.1.1

The ability to reduce and eliminate stress efficiently and effectively is important for an individual's wellbeing. The best coping mechanisms depend not only on the type of stress, but also on situational factors such as the individual's unique personality and needs, and the environment of the stressor. Therefore, it is ideal to use a coping strategy that takes into account a range of these contextual factors, rather than using a one-size-fits-all approach.

**Context-specific effectiveness** refers to when there is a good balance or 'fit' between the coping strategy used and the demands of the stressor. A strategy that demonstrates this quality will take into account a variety of contextual factors.

**Coping** the process of dealing with stress

**Context-specific effectiveness** when the coping strategy or mechanism used is appropriate for the demands of the stressor

For example, if the source of stress is an upcoming psychology SAC on the central nervous system, the specific context of each student will differ. Therefore, the most effective coping strategy will be different for a student that has already studied the content, compared to one who has not. This is detailed in table 1.

**Table 1** A comparison of how two individuals need to use different coping strategies to achieve context-specific effectiveness

	<b>Student 1:</b>	<b>Student 2:</b>
<b>Individual circumstance</b>	Has never studied the CNS	Has studied the CNS twice
<b>Stressor</b>	SAC on the CNS	SAC on the CNS
<b>Context-specific coping mechanism/s to effectively reduce stress:</b>	<ul style="list-style-type: none"> <li>• Read about the CNS</li> <li>• Create a summary</li> <li>• Make a poster</li> <li>• Self-test</li> </ul>	<ul style="list-style-type: none"> <li>• Make a poster</li> <li>• Self-test</li> </ul>

In the above scenario, the demands of the stressor are different for the two individuals, so the most effective coping strategy is specific to the context. Student 1 must study more than student 2 to effectively meet the demands of the stressor. This is taking into account their relative situations and individual characteristics. In this case, their respective knowledge is most important to selecting the most effective strategies.

### Coping flexibility 3.1.9.1.2

**Coping flexibility** refers to the ability to adjust or change one's coping strategies depending on the unique and changing demands of a stressor. Someone's first choice of the coping strategy may no longer be the most effective if something about the individual, environment or stressor changes, or if one's initial choice of strategy hasn't provided any relief. Coping flexibility is demonstrated when a person can change their coping strategies in situations like this. For example, if in the above scenario, student 2 became sick two days before the SAC, they may need to consider an alternative coping approach. Depending on how sick they are, they may need to ask their teacher if they can reschedule their SAC to a later date, spreading their study out over those extra days while making sure to eat and sleep well for optimal performance.

### Coping strategies 3.1.9.2

#### OVERVIEW

Coping strategies are the mechanisms and ways in which an individual deals with stress. You should be familiar with three different strategies: exercise, approach strategies and avoidance strategies.

#### THEORY DETAILS

##### Exercise 3.1.9.2.1

In VCE psychology, **exercise** is used specifically to refer to physical activity performed to improve and maintain one's health and wellbeing. Exercise has a range of benefits for stress reduction, and so is often a good strategy for coping with stress. This is dependent on the amount and regularity of exercise, as well as whether the specific stressor can be reduced by exercise. You should become familiar with some physiological and psychological benefits of exercise for stress. Some of these are summarised in table 2.

**Table 2** Benefits of exercise for stress reduction

<b>Physiological benefits of exercise</b>	<b>Psychological benefits of exercise</b>
<ul style="list-style-type: none"> <li>• May reduce the intensity of sympathetic nervous system responses to stress, thereby preventing immunosuppression (weakened immune system)</li> <li>• Some forms of exercise 'use up' stress hormones like cortisol, which when released too often, can suppress the functioning of the immune system and cause further stress</li> <li>• Releases beta-endorphins which help to improve one's mood and contribute to feelings of elation after exercise</li> <li>• Helps to improve the functioning of the cardiovascular system, thereby improving the body's reactions to future stressors</li> </ul>	<ul style="list-style-type: none"> <li>• Many sports can provide an opportunity for social engagement, serving as an outlet and release for stress</li> <li>• Exercise can provide a break or distraction from persistent stressors, reducing anxiety</li> <li>• Can cause relaxation after 'stressful energy' is released</li> </ul>

**Coping flexibility** an individual's ability to adjust or change their coping strategies depending on the unique and changing demands of a stressor

**Exercise** physical activity performed to improve a person's health and wellbeing

### Approach strategies 3.1.9.2.2

Approach strategies are coping mechanisms which involve directly confronting and working to reduce the source of stress. These strategies generally deal with stress in a practical way. For example, studying for a psychology SAC directly deals with the stressor by equipping an individual with the knowledge and skills to successfully complete it. Some approach strategies are detailed in table 3.

### Avoidance strategies 3.1.9.2.3

Avoidance strategies are coping mechanisms which involve evading or distancing oneself from the source of stress. These strategies often deal with the more emotional components of stress, channelling thoughts and behaviour away from the stressor. Some examples of avoidance strategies are also detailed in table 3. Figure 1 details how the stressor of a psychology SAC may be dealt with using either approach or avoidance strategies.

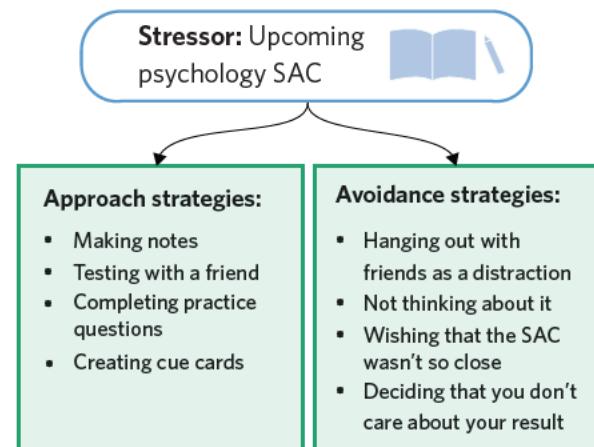


Figure 1 Approach and avoidance strategies that may be used to deal with a psychology SAC

#### **Useful tip**

While avoidance strategies don't directly confront the source of stress, this does not mean that they are necessarily less effective. Depending on the type of stressor, avoidance coping might be more appropriate. For example, if an individual is dealing with the death of a friend but also has an upcoming exam, it might be necessary to employ distraction temporarily, such as hanging out with friends (an avoidance strategy), in order to be able to eventually study (an approach strategy) during such an emotionally difficult time.

Table 3 Examples of approach and avoidance strategies

Approach strategies	Avoidance strategies
<ul style="list-style-type: none"> <li>Making a list of pros and cons</li> <li>Seeking advice or counselling</li> <li>Targeting the stressor</li> <li>Making a plan and executing it</li> <li>Making a list of ways to approach the stressful situation</li> </ul>	<ul style="list-style-type: none"> <li>Denial</li> <li>Wishful thinking</li> <li>Re-evaluation</li> <li>Substance use</li> <li>Venting emotions</li> <li>Distraction</li> <li>Sleeping and eating</li> <li>Acceptance</li> <li>Evading the stressful situation/environment</li> </ul>

#### **Useful tip**

If you are asked about coping strategies in general, be careful to use the terms 'approach' and 'avoidance strategies' rather than Lazarus and Folkman's 'emotion-focussed' and 'problem-focussed coping' terms, unless specified.

**Approach strategies** coping strategies which confront the source of the stressor

**Avoidance strategies** coping strategies that evade the stressor, seeking to reduce stress by indirectly dealing with it

**lesson link** You may have noticed a similarity between Lazarus and Folkman's coping stage in lesson **3C: Psychological processes of stress**, and the forms of coping described in this lesson. Problem-focussed coping is very similar to approach strategies, and emotion-focussed coping to avoidance strategies.

## Theory summary

In this lesson, you have covered ideas surrounding coping with stress. You should now be familiar with two core ideas about effectively coping with stress, namely, context-specific effectiveness and coping flexibility. It is important that you can define them and recognise them in an example, as well as explain their role in coping with stress. You have also covered three particular kinds of coping strategies: exercise, approach and avoidance strategies. Again, you must be able to recognise these in examples, define them, and identify when it is most appropriate to use each.

## 3D Activities

- 1 Fill in the missing information in the table below:

Coping strategy	Example	Benefits	Limitations
Exercise			
Approach coping			
Avoidance coping			

- 2 Using the following situations, fill in the table and describe how context-specific effectiveness and coping flexibility could be relevant or applied. The first one has been done for you.

Situation	Context-specific effectiveness	Coping flexibility
A 60-year-old father lost his job, but needs to keep working to sustain his family.	The father looks at his skill set and applies for jobs he knows that he is definitely qualified for. This is effective for his context as he can more likely get a job in a desperate time.	If the father keeps getting rejected from jobs, he might adjust his resume to try another approach and respond to something that might be wrong with his present coping strategy.
A 15-year-old boy has a hockey tournament coming up, but has just got a cold.		
A 30-year-old woman who works full time just found out she is pregnant.		

## 3D QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                      |                    |                                  |          |
|----------------------|--------------------|----------------------------------|----------|
| • Coping flexibility | • Avoidance coping | • Context-specific effectiveness | • Coping |
| • Approach coping    | • Exercise         |                                  |          |
- a Occurs when there is a good balance between the demands of the stressor and the coping mechanism used in response to it \_\_\_\_\_
- b A form of coping involving physical activity, often planned \_\_\_\_\_
- c A kind of coping with stress that involves minimising its effects indirectly, without confronting the actual stressor or its source \_\_\_\_\_
- d A general term referring to attempts to reduce stress \_\_\_\_\_
- e A kind of coping that involves confronting the stressor directly to minimise its effects \_\_\_\_\_
- f The ability or practice of adjusting to the changing demands of a stressor \_\_\_\_\_

**Exam-style questions****Remember and understand****Question 2** (1 MARK)

Context-specific effectiveness is when there is a good balance between

- A the coping mechanism used and the individual experiencing stress.
- B the coping mechanism used and the demands of the stressor.
- C the demands of the stressor and how an individual perceives them.
- D the demands of the stressor and the environment the stressor occurs in.

**Question 3** (1 MARK)

The difference between approach and avoidance strategies of coping is that

- A approach strategies confront a stressor, whereas avoidance strategies actively evade a stressor.
- B approach strategies actively evade a stressor, whereas avoidance strategies confront a stressor.
- C approach strategies deal with emotional components of a stressor, whereas avoidance strategies deal with behavioural components.
- D approach strategies reduce the stressor, whereas avoidance strategies do not.

**Question 4** (2 MARKS)

Identify one psychological and one biological way exercise may help to reduce stress.

**Question 5** (3 MARKS)

Using an example, outline how having coping flexibility can help a person deal with a stressor.

**Apply and analyse****Use the following information for questions 6 and 7.**

Dom had to give a speech at a school assembly in front of 1000 people. Two days before, he had no idea what he would say and so instead worked on other things and took his dog, Tojo, for a walk. When walking Tojo, an idea for his speech came to him and so he quickly walked home and wrote down a speech.

**Question 6** (1 MARK)

The coping strategies Dom used before the idea for his speech came to him can be considered

- A avoidance strategies.
- B exercise and approach strategies.
- C exercise.
- D exercise and avoidance strategies.

*Adapted from VCAA 2017 exam MCQ23*

**Question 7** (1 MARK)

Dom walking home quickly after thinking of an idea for his speech **cannot** be considered as

- A an approach strategy.
- B context-specific effectiveness.
- C an avoidance strategy.
- D coping flexibility.

**Question 8** (7 MARKS)

Genevieve has a young daughter Maddy who has been sick with a cold for the last five days. Despite Maddy still being sick, Genevieve is relieved on Monday when she can drop Maddy off at kindergarten and have a break from nursing her. When Genevieve picked Maddy up at the end of the day, she realised Maddy was even more sick than before and so booked her a doctor's appointment for the following day.

- a** When Genevieve dropped Maddy off even though she was sick at kindergarten on Monday, what kind of coping strategy was Genevieve using? Justify your response. (2 MARKS)
- b** When Genevieve booked Maddy a doctor's appointment, what kind of coping strategy did she use? Justify your response. (2 MARKS)
- c** Explain how Genevieve demonstrated coping flexibility in this scenario. (3 MARKS)

**Questions from multiple lessons****Use the following information for questions 9 and 10.**

Archie has recently been diagnosed with Parkinson's disease and is extremely anxious about the likely decline of his health over the coming years. An avid sports fan, Archie has relieved stress by playing football all throughout his life. He now finds it very difficult to coordinate his movements enough to play football, so has decided to try walking to relieve some of his stress.

**Question 9** (1 MARK)

Archie's inability to coordinate his movements enough to play football is likely due to

- A** an insufficient production of the neurotransmitter dopamine.
- B** an insufficient production of the neurohormone dopamine.
- C** an overproduction of the neurotransmitter dopamine.
- D** an overproduction of the neurohormone dopamine.

**Question 10** (2 MARKS)

Archie trying out walking to relieve his stress is an example of which of the following processes?

- A** operant conditioning
- B** avoidance coping
- C** coping flexibility
- D** sympathetic coping

**Question 11** (7 MARKS)

Janet recently separated from her husband and they are both now moving out of their shared home to live independently. Janet works full time and has a major work review coming up which will take 40 hours of preparation over the next two weeks. Her deadline for moving out is also in two weeks. Janet has been working non-stop on clearing out her stuff, as well as her work, and is naturally very upset about the separation. In the past few days, she has felt overwhelmed by her stress and is finding it difficult to keep up with her demands. She has also noticed that she is getting sick, further adding to her stress. Over the past few days, Janet has been going for a run in the evening to distract herself from the burden of her stressors.

- a** Using the language of Selye's General Adaptation Syndrome, describe which stage of stress Janet is currently experiencing. (2 MARKS)
- b** In terms of context-specific effectiveness, is going for a run an appropriate coping strategy for Janet? Justify your response. (3 MARKS)
- c** In terms of sources of stress, what type of stress is Janet experiencing? Justify your response. (2 MARKS)

**Key science skills****Question 12** (4 MARKS)

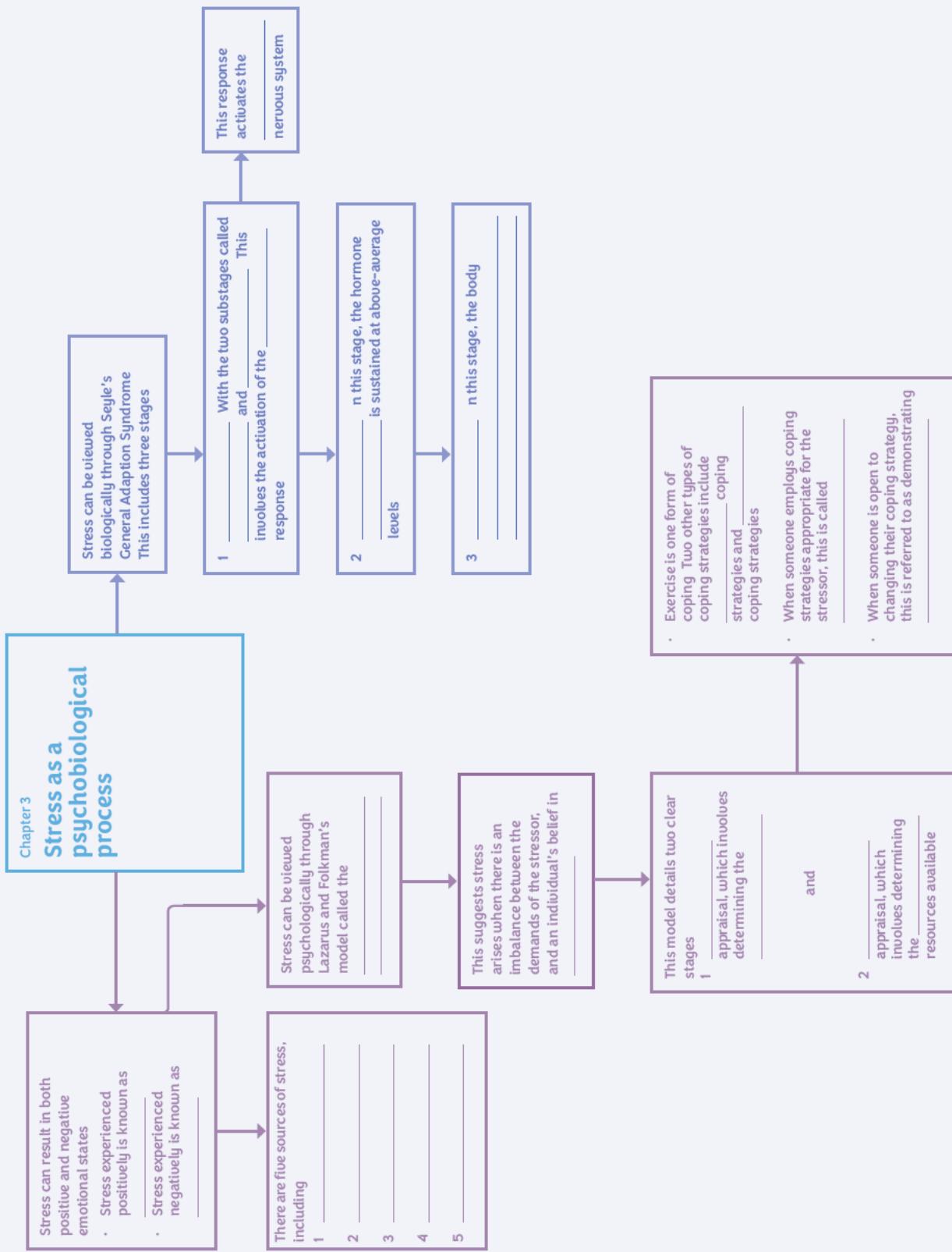
A researcher wants to investigate the relationship between jogging compared to walking each day and perceived stress levels amongst 18 to 25-year-old La Trobe University students.

- a** Explain one method the researcher could use to obtain a stratified sample. (2 MARKS)
- b** Identify and operationalise the independent variable of this study. (2 MARKS)

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own.  
This includes all concepts from the chapter.



**Review activity 2: Example bank**

Fill in the table with your own notes.

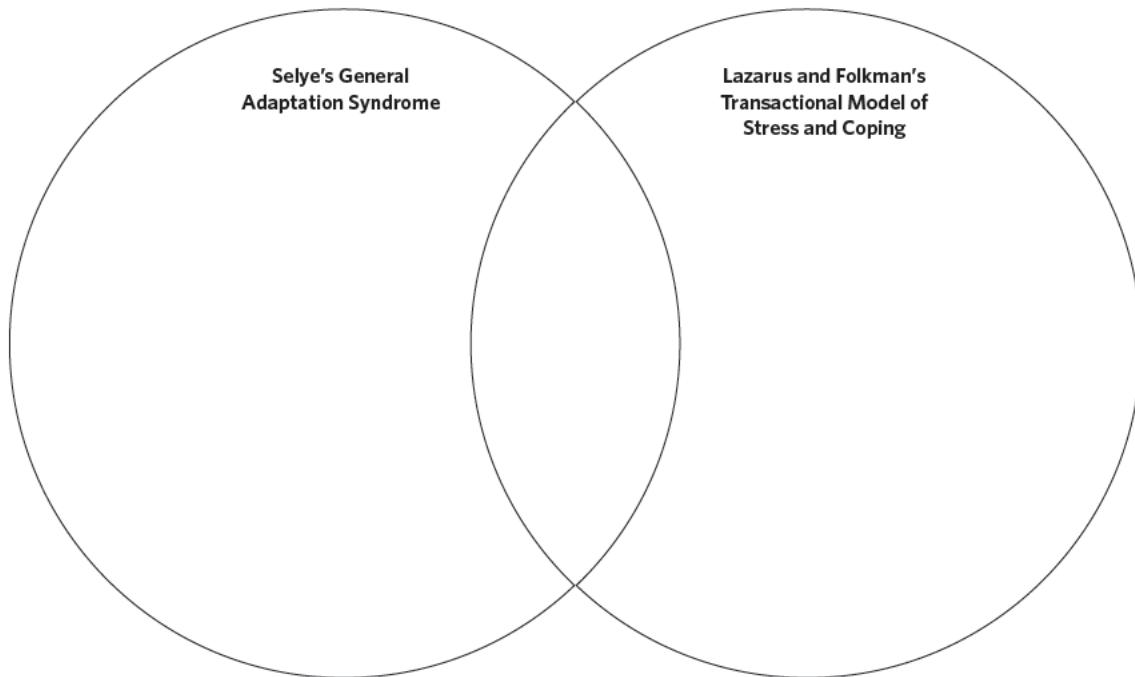
Key terminology	Your own definition	Example
Stress		
Eustress		
Distress		
Daily pressures		
Life events		
Acculturative stress		
Major stress		
Catastrophes that disrupt whole communities		
Fight-flight-freeze response		
Cortisol		
General Adaptation Syndrome		
Alarm reaction		

Key terminology	Your own definition	Example
Resistance		
Exhaustion		
Appraisal		
Primary appraisal		
Secondary appraisal		
Coping		
Benign-positive		
Irrelevant		
Stressful		
Harm/loss		
Threat		
Challenge		
Context-specific effectiveness		

Key terminology	Your own definition	Example
Coping flexibility		

### Review activity 3: Venn diagram

Fill in the venn diagram to compare and contrast Selye's General Adaptation Syndrome with Lazarus and Folkman's Transactional Model of Stress and Coping. Put anything that the two models have in common in the overlap of the two circles.



## CHAPTER TEST

### Multiple choice questions

#### Question 1 (1 MARK)

Coping flexibility refers to

- A the ability to change yourself in the face of stressors.
- B the ability to select the most effective coping strategy for the context.
- C the ability to change coping strategies depending on the changing demands of a stressor.
- D the ability to stop pursuing a goal if the stressor becomes too difficult.

#### Question 2 (1 MARK)

In terms of Selye's General Adaptation Syndrome, cortisol levels are sustained to maintain increased arousal in the face of stress during

- A resistance.
- B shock.
- C countershock.
- D exhaustion.

**Question 3** (1 MARK)

An advantage of Lazarus and Folkman's Transactional Model of Stress and Coping is that

- A it takes into account the subjective nature of the stress response.
- B it considers both psychological and physiological responses to stress.
- C it is easy to test through psychological research.
- D it is easy to align with the role of cortisol in the stress response.

Adapted from VCAA 2012 exam 2 MCQ32

***Use the following information for questions 4 and 5.***

Darius just smashed his phone screen, and plans to go straight to his local repair shop to fix it.

**Question 4** (1 MARK)

In terms of Lazarus and Folkman's Transactional Model, Darius is in the stage of

- A primary appraisal and is exhibiting an approach strategy.
- B primary appraisal and is exhibiting an avoidance strategy.
- C secondary appraisal and is exhibiting an approach strategy.
- D secondary appraisal and is exhibiting an avoidance strategy.

**Question 5** (1 MARK)

When Darius arrived at the repair shop, it was closed. Even though there was another, cheaper repair shop down the road, he decided to go home and not worry about fixing his phone. In this scenario, Darius did not exhibit

- A avoidance strategies.
- B coping flexibility.
- C coping.
- D secondary appraisal.

**Question 6** (1 MARK)

Being diagnosed with Parkinson's disease could be considered to be a

- A life event.
- B major stress.
- C catastrophe.
- D disaster.

***Use the following information for questions 7–9.***

Andrea's best friend of 50 years recently died, and she has been struggling to cope. As an elderly woman without many other friends, Andrea has decided to stay in bed and cry alone for a few weeks.

**Question 7** (1 MARK)

Which of the following identifies the type of stress Andrea is experiencing?

- A life event
- B major stress
- C a catastrophe
- D a daily pressure

**Question 8** (1 MARK)

Andrea staying in bed and crying is an example of

- A approach coping.
- B problem-focussed coping.
- C avoidance coping.
- D coping flexibility.

**Question 9** (1 MARK)

Given the traumatic nature of the stressor, Andrea could be considered to be demonstrating

- A coping flexibility.
- B eustress.
- C approach coping.
- D context-specific effectiveness.

**Question 10** (1 MARK)

A person experiencing eustress compared to distress would most likely experience

- A more parasympathetic nervous system responses.
- B more sympathetic nervous system responses.
- C about the same level of sympathetic nervous system responses.
- D more somatic nervous system responses.

**Short answer questions****Question 11** (9 MARKS)

Antoni's house was badly flooded six months ago, and since then he has been renting an apartment as the damage is repaired. The repairs have been very expensive, and he is running out of money as he pays for both rent and repairs at the same time. When his house first flooded, Antoni thought about all the possessions he had lost and thought that he would never be able to rebuild his house. Six months on, Antoni believes he will eventually fix his house, and works tirelessly on it each day. Although he gets colds from stress occasionally, he is still able to work on his house each day, and has barely seen his friends for months.

- a In terms of Lazarus and Folkman's Transactional Model of Stress and Coping, explain how Antoni appraised the stressor six months ago in both the primary and secondary stage. (4 MARKS)
- b In terms of Selye's General Adaptation Syndrome, describe the likely stage Antoni is experiencing six months after the flooding. (2 MARKS)

As Antoni ran out of money, he decided to focus repairs on one room of his house so that he could live in there while the rest of the house's damage was repaired. This meant that he no longer had to spend lots of money on renting a separate apartment.

- c Describe the concept of coping flexibility and explain whether Antoni is demonstrating it in this scenario. (3 MARKS)

**Question 12** (3 MARKS)

Using examples, describe the difference between approach and avoidance coping strategies.

**Question 13** (2 MARKS)

Outline the secondary appraisal stage of Lazarus and Folkman's Transactional Model of Stress and Coping with an example.

**Question 14** (7 MARKS)

Cecilia has been experiencing shaky muscles and fatigue. She Googled her symptoms, and was horrified to find out that some of her symptoms matched that of Parkinson's disease. Cecilia immediately called her friend Andrew to tell him that she feared for her health, but Andrew told her to calm down and that because she is only 30, that she couldn't possibly have Parkinson's disease.

- a In terms of Lazarus and Folkman's Transactional Model of Stress and Coping, discuss Cecilia and Andrew's primary appraisal of the stressor of hearing that some of Cecilia's symptoms matched that of Parkinson's disease. (4 MARKS)
- b If the shakiness of Cecilia's muscles is due to Parkinson's disease, describe the role of neurotransmitter dysfunction in contributing to this symptom. (3 MARKS)

**Key science skills questions****Question 15** (9 MARKS)

Dr Peppe wanted to investigate the relationship between different sources of stress and cortisol release over an extended period of time. Specifically, he wanted to compare the impact of life events in one's home country and acculturative stress. To do this, he recruited 50 middle-aged women from Melbourne, half of which had recently experienced a life event such as divorce, being fired from their job or beginning a new job. The other half of women had moved to Melbourne in the last three months from another, non-English speaking country. Over a ten-month period, Dr Peppe conducted monthly blood tests on these women to measure their cortisol levels. When he compared their cortisol levels, he found a general trend that after around six months, cortisol levels began to fall. However, there was no statistically significant difference between either group.

- a State an aim for Dr Peppe's study. (1 MARK)
- b Identify and describe two possible extraneous variables in this study and suggest how Dr Peppe might rectify them in a future replication of this study. (6 MARKS)
- c In terms of Selye's General Adaptation Syndrome, explain why both groups of women may have experienced a drop in cortisol levels after around six months. (2 MARKS)



# UNIT 3

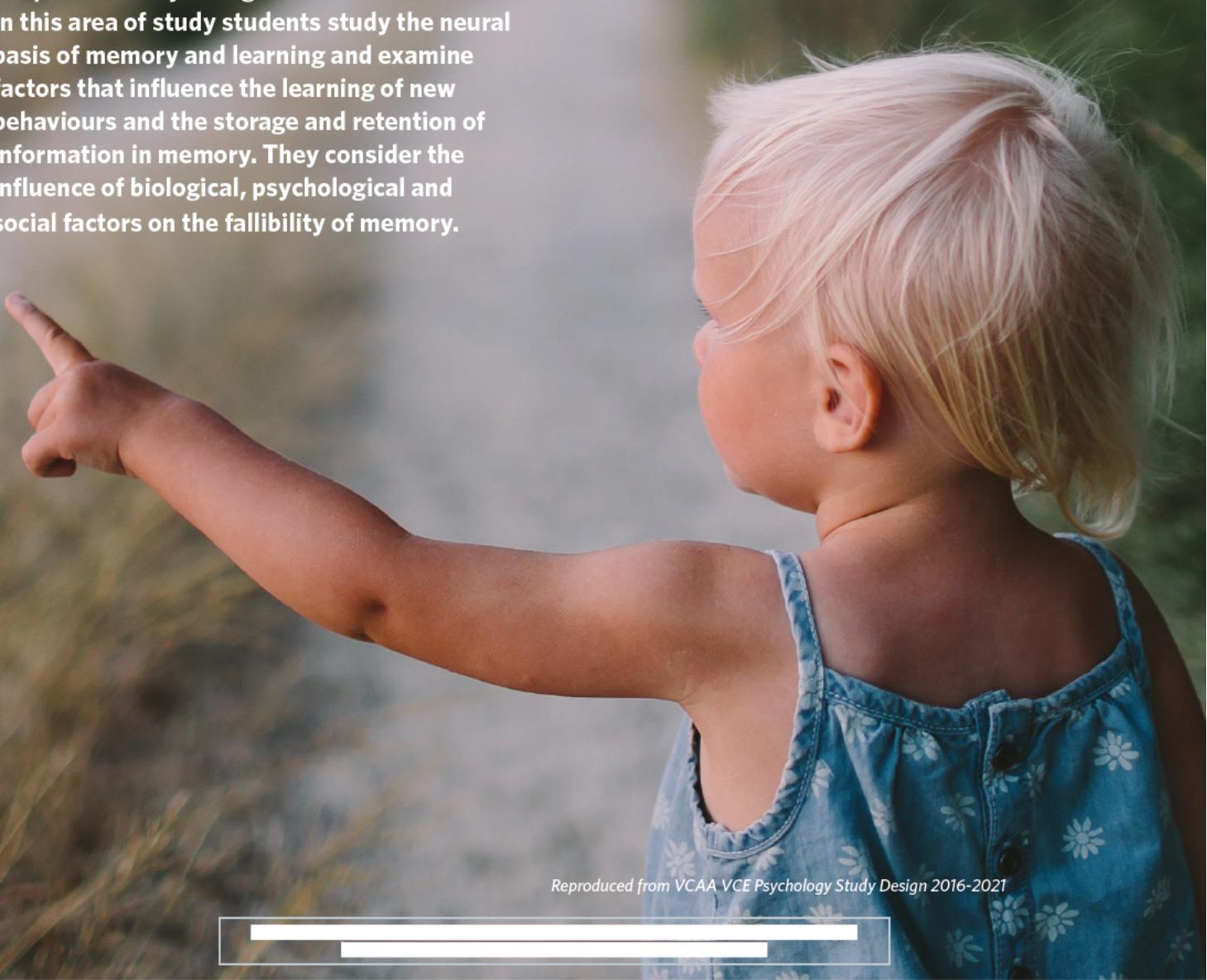
# AOS2

## How do people learn and remember?

**Memory and learning are core components of human identity: they connect past experiences to the present and shape futures by enabling adaption to daily changes in the environment.**  
**In this area of study students study the neural basis of memory and learning and examine factors that influence the learning of new behaviours and the storage and retention of information in memory. They consider the influence of biological, psychological and social factors on the fallibility of memory.**

### Outcome 2

On completion of this unit the student should be able to apply biological and psychological explanations for how new information can be learnt and stored in memory, and provide biological, psychological and social explanations of a person's inability to remember information.





UNIT 3 AOS 2, CHAPTER 4

# 04

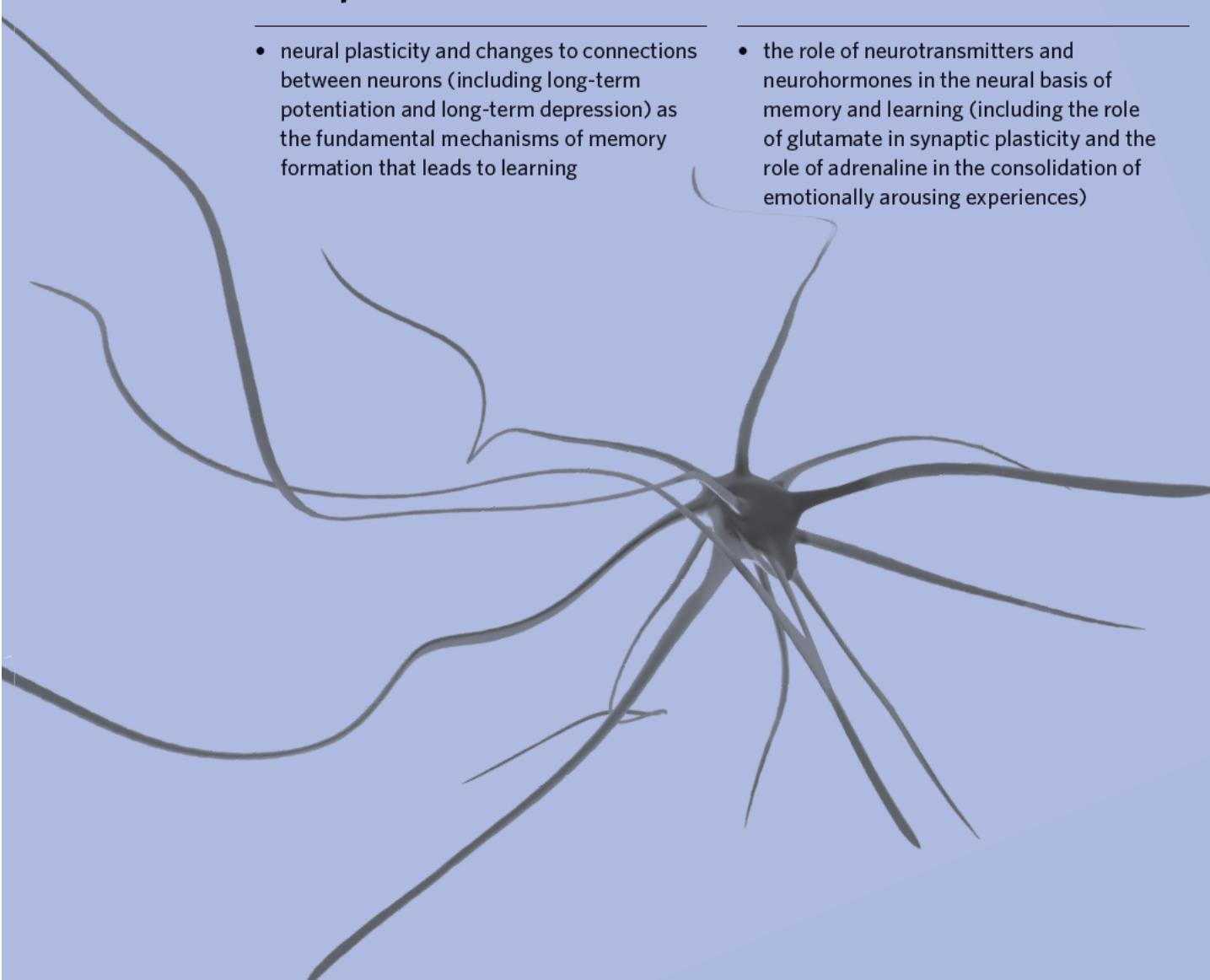
## Neural basis of learning and memory

### 4A Long-term potentiation and long-term depression

- neural plasticity and changes to connections between neurons (including long-term potentiation and long-term depression) as the fundamental mechanisms of memory formation that leads to learning

### 4B Neurotransmitters and neurohormones

- the role of neurotransmitters and neurohormones in the neural basis of memory and learning (including the role of glutamate in synaptic plasticity and the role of adrenaline in the consolidation of emotionally arousing experiences)

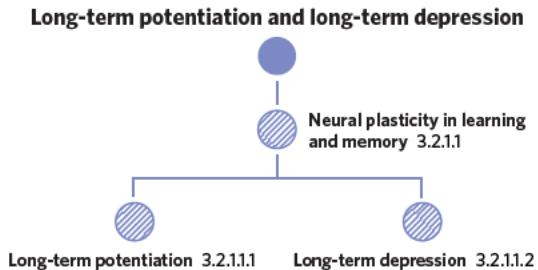


# 4A LONG-TERM POTENTIATION AND LONG-TERM DEPRESSION

In this chapter, you will apply and extend your knowledge of nervous system functioning to understand the neural basis for learning and memory. You will begin to understand that in order to learn new things, the physical structures of the brain must change to incorporate new information as physical memories. In this lesson, you will learn how part of this requires changes to connection between neurons.

4A. Long-term potentiation and long-term depression	4B. Neurotransmitters and neurohormones
<b>Study design dot point</b>	
<ul style="list-style-type: none"> <li>neural plasticity and changes to connections between neurons (including long-term potentiation and long-term depression) as the fundamental mechanisms of memory formation that leads to learning.</li> </ul>	
<b>Key knowledge units</b>	
Long-term potentiation (Neural plasticity in learning and memory)	3.2.1.1.1
Long-term depression (Neural plasticity in learning and memory)	3.2.1.1.2

**In this lesson, you will be learning about long-term potentiation and long-term depression** as two of the fundamental processes in the brain underlying the formation of memories. In order to learn new things, your brain must physically change in response to experience to encode new information. These changes in the brain refer to processes of neural plasticity, of which long-term potentiation and long-term depression are essential components.



## Neural plasticity in learning and memory 3.2.1.1

### OVERVIEW

Neural plasticity is the fundamental mechanism behind the formation of memories that lead to learning.

### THEORY DETAILS

You have already learned about the role of the neuron in the communication of messages throughout the body. In addition to allowing communication from cell to cell, neurons also undergo changes in their connections with one another in response to experience and activity. These changes to connections can occur between just two neurons. Alternatively, entire circuits and pathways may form, creating neural ‘networks’ that serve as the communication basis for specific memories, functions, and tasks that you perform. Within these networks, messages are sent between specific neurons when an activity requires their communication.

When you learn something new, such as riding a bike, networks form between the neurons that are activated during this task. This demonstrates that the structure of the brain is malleable (able to be altered), with certain connections being formed between neurons depending on the task being completed and stage of life the individual is in. This ability for structures in the brain to change in response to learning or stages of life is known as **neural plasticity**.

**Neural plasticity** the ability of the brain to physically change in response to experience

One specific form of neural plasticity is synaptic plasticity. **Synaptic plasticity** refers more specifically to the ability of synapses between neurons to form, strengthen or weaken. This process underlies the formation of memories in the brain, essential to everything that you learn and do. When neural pathways form in response to learning and create a new memory, the resulting structure is sometimes referred to as a ‘memory trace’. This refers to memories having a physical and structural basis.

#### Want to know more?

Aside from synaptic plasticity, other changes in the brain that occur as part of neural plasticity include:

- Changes in the location of where certain functions are performed in the brain. For example, if someone suffers from brain damage to a certain region, the tasks of that brain region may be performed elsewhere in the brain
- The creation of new neurons
- The growth of the brain.

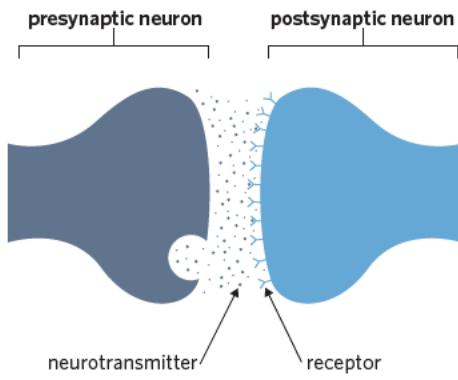
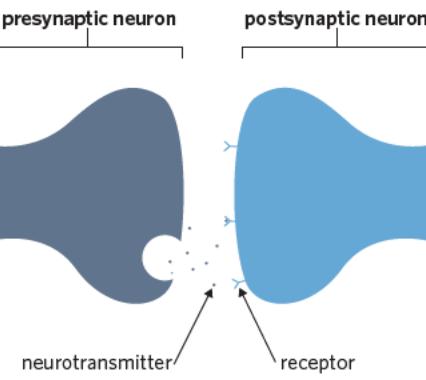
 Remember that plastic is often flexible. In this sense, neural plasticity refers to the brain's ability to change (and be flexible) in response to experience. As you learn new things, neural structures change to include these memories.



Image: M88/Shutterstock.com

It is important to understand that there is an optimal amount of neural connections in the brain for efficient functioning. Some research suggests that there is actually a limit to the neural connections that can form in the brain. If there are too many neural networks and pathways, the brain cannot operate efficiently or encode new information necessary for learning. Ultimately, it is possible for there to be too much ‘going on’ in the brain for it to function. Two fundamental processes work together to promote optimal levels of encoding and synaptic connections. These processes are known as **long-term potentiation** and **long-term depression**.

Table 1 Long-term potentiation and long-term depression

Long-term potentiation 3.2.1.1.1	Long-term depression 3.2.1.1.2
Long-term potentiation refers to the long-lasting and experience-dependent strengthening of synaptic connections.	Long-term depression refers to the long-lasting and experience-dependent weakening of postsynaptic responses.
<p><b>presynaptic neuron</b></p>  <p>neurotransmitter</p> <p>receptor</p>	<p><b>presynaptic neuron</b></p>  <p>neurotransmitter</p> <p>receptor</p>
<p><b>Figure 1</b> This diagram shows a strong connection between two ‘potentiated’ neurons. Their synapse’s increased strength is clear in the high number of receptors on the postsynaptic neuron due to the high level of neurotransmitter being sent (repeatedly) between them.</p> <ul style="list-style-type: none"> <li>• Long-term potentiation is an experience-dependent form of neural plasticity.</li> <li>• It is ‘experience-dependent’ because synapses are strengthened in response to them being used more regularly during learning and memory formation.</li> <li>• During memory formation, neural messages are sent over the same synapses repeatedly.</li> <li>• This repeated coactivation of a pre and postsynaptic neuron results in a strengthening of these synapses, making a postsynaptic neuron more receptive to the messages sent from a presynaptic neuron.</li> </ul>	<p><b>Figure 2</b> Long-term depression results from the repeated low-intensity stimulation of postsynaptic neurons. In this diagram, the postsynaptic neuron is being stimulated at a low level due to low levels of neurotransmitter, and fewer receptor sites for its uptake.</p> <ul style="list-style-type: none"> <li>• Long-term depression is also an experience-dependent form of neural plasticity.</li> <li>• It involves the long-lasting weakening of neural connections in a memory trace, pathway or network when postsynaptic neurons become less receptive to the neural message sent by a presynaptic neuron.</li> <li>• This occurs as the result of a repeated low-intensity (or subthreshold) stimulation of postsynaptic neurons.</li> </ul>

**Synaptic plasticity** a type of neural plasticity that refers to the ability of synaptic connections to form, weaken or strengthen in response to activity and experience

**Long-term potentiation** the long-lasting and experience-dependent strengthening of synaptic connections

**Long-term depression** the long-lasting and experience-dependent weakening of postsynaptic responses

Long-term potentiation	Long-term depression
<ul style="list-style-type: none"> <li>Long-term potentiation results in an increased efficacy of neural transmission, making the transfer of neural messages in a specific pathway or network quicker and more effective.</li> </ul>	<ul style="list-style-type: none"> <li>This results in the weakening of a specific memory trace or neural connection and a decreased efficiency of neural transmission.</li> </ul>
Example	Example
<p>When a person learns guitar, the neural signals required to perform actions like strumming and picking are repeatedly coactivated. The connections between the neurons that send these signals are strengthened as a result, demonstrating that long-term potentiation is an experience-dependent form of neural plasticity.</p>	<p>When a person replaces a previously learned guitar strumming technique with a new one, the neurons that send messages for the old strumming technique are activated at a lower rate. Over time, this leads to the memory trace and neural pathway responsible for the old technique weakening. This reduces the strength of memories for the old style of strumming, often resulting in a reduced ability to strum that way. This would occur as long-term potentiation occurs for the new strumming technique.</p>

**Useful tip**

When describing the process of long-term depression, it's important to describe it as resulting from the repeated low-intensity stimulation of *postsynaptic neurons* and not the disuse or weak stimulation of *neural pathways* (the latter is part of a process called decay). This is because long-term depression isn't a result of networks being entirely disused (decay), but rather, the synaptic connections within them being weakened. You can however, say that this results in the weakening of the neural connections and/or memory trace.



You learned about the neuron in lesson 2C:

**The neuron.** Long-term potentiation results in some structural changes to neurons. When memories are formed, the dendrites of a postsynaptic neuron grow bushier, allowing them to more easily and effectively uptake neurotransmitters sent across the synapse. This results in increased synaptic strength.

**Want to know more?**

Long-term potentiation and depression also apply to mental processes. This is why avoiding negative thought patterns and encouraging healthy ones is so important to wellbeing. If a person consistently dwells on negative aspects of their life, the neural pathways involved in these thought patterns become strengthened as a result of long-term potentiation and this frame of mind becomes easier to slip into. In response, a person should consistently employ healthier thought patterns and create new habits to allow for long-term depression to weaken negative thoughts.

Specifically, you will learn about how long-term potentiation can contribute to phobia in lesson 13B: **Contributing factors to phobia.**



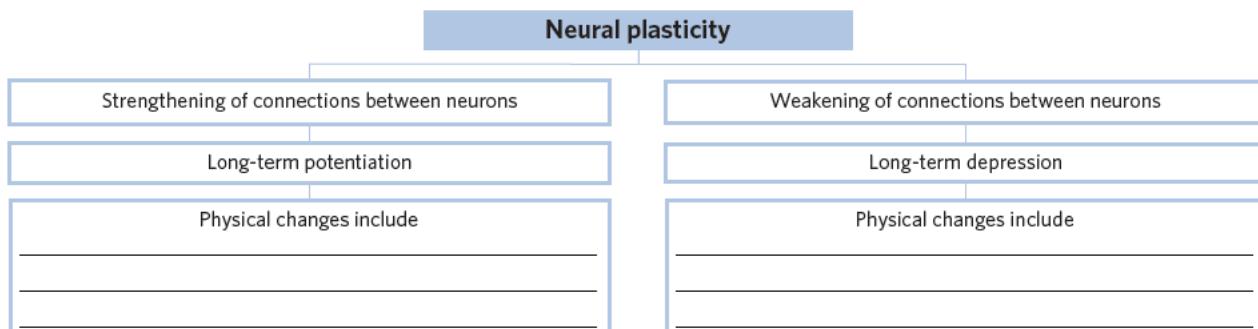
To remember the role of long-term potentiation, remember the rhyme 'neurons that fire together, wire together'; the more that neurons are coactivated and told to fire the same message together, the more strengthened their connection will become, and the more efficient the neural pathway they are part of will be at firing.

## Theory summary

In this lesson, you have learned about how important the brain's ability to change (neural plasticity) is to memory formation and learning. Specifically, you learned about how synaptic plasticity, through the processes of long-term potentiation and long-term depression, helps the brain to learn and form new memories. You should now be able to explain what occurs during long-term potentiation and depression at a neural level, the effect that each has, as well as why both processes are essential to learning and memory.

## 4A Activities

1



Adapted from Edrolo and S.Crocket, 2017.

# 4A QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |                       |                          |
|-----------------------|--------------------------|
| • neural plasticity   | • long-term potentiation |
| • synaptic plasticity | • long-term depression   |
- a the long-lasting strengthening of connections between neurons \_\_\_\_\_
- b the ability for connections between neurons to strengthen, weaken and form \_\_\_\_\_
- c the ability for the brain to alter its structures in response to experiences \_\_\_\_\_
- d the long-lasting weakening of the responsiveness of neurons \_\_\_\_\_

## Exam-style questions

### Remember and understand

### Question 2 (1 MARK)

When memories are formed during learning, long-term potentiation occurs when

- A synapses are strengthened between neurons that are coactivated.
- B new neurons are formed and connected.
- C postsynaptic neurons are stimulated at a low intensity and neural connections are strengthened.
- D postsynaptic neurons are stimulated at a high intensity and neural connections are weakened.

### Question 3 (1 MARK)

In terms of learning, which of the following is true of long-term potentiation and long-term depression?

- A Long-term potentiation is more important for learning than long-term depression.
- B Long-term depression is more important for learning than long-term potentiation.
- C Long-term potentiation and long-term depression are equally important because their combination ensures optimal use of synaptic connections required for learning.
- D Long-term potentiation and long-term depression are equally important because long-term potentiation ensures the right postsynaptic neurons are stimulated, while long-term depression ensures the right presynaptic neurons are stimulated.

### Question 4 (3 MARKS)

Identify a function of long-term depression in learning and describe the neural processes that occur to allow for this function.

### Apply and analyse

#### **Use the following information for questions 5-7.**

Hafez was obsessed with magic tricks and card shuffling as a child. He spent days on end learning new shuffling techniques and improved each day. As a teenager, Hafez didn't like magic or card shuffling anymore, and didn't practice for years. Now, as a father of two children, Hafez wants to show them some different ways to shuffle cards. He noticed that while his shuffling isn't as good as it used to be, the skill has come back to him relatively quickly.

### Question 5 (1 MARK)

In terms of neural plasticity, what is the name of the process responsible for Hafez improving each day when practicing card tricks and shuffling?

- A long-term potentiation
- B long-term depression
- C myelination
- D synaptic pruning

**Question 6** (1 MARK)

In terms of neural plasticity, what is the name of the process responsible for Hafez's declined skills in shuffling and card tricks as a teenager?

- A** long-term potentiation
- B** long-term depression
- C** demyelination
- D** brain shrinkage

**Question 7** (1 MARK)

The fact that, as an adult, Hafez was able to pick up the shuffling skill relatively quickly was most likely due to

- A** the restrengthening of previously formed synapses.
- B** the creation of new synapses.
- C** the weakening of previously formed synapses.
- D** long-term depression.

**Question 8** (2 MARKS)

Duncan works as the head of a technology company and regularly concerns himself with improving the efficiency of his employees. He noticed that the efficiency of his workers' typing on their computer was not as high as it could be. One day, Duncan came across a new typing method which was said to increase the typing speed and accuracy of its users. He asked his employees to trial the method over a period of eight weeks, and to record whether there was a noticeable increase in their typing speed and accuracy.

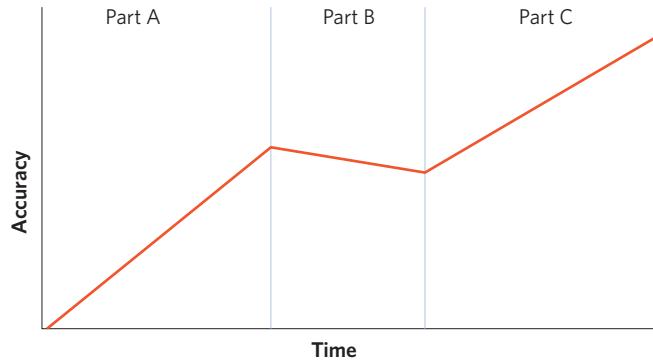
In terms of neural plasticity, describe the role of long-term potentiation and long-term depression when Duncan's employees learn the new typing method.

Adapted from VCAA 2017 sample exam SAQ4a

**Question 9** (5 MARKS)

Orla started learning archery five years ago and her aims at the target are getting more and more accurate as she practices every week. Except for a one-year period when she travelled overseas and practiced the sport of shooting instead of archery, Orla's accuracy has been consistently improving.

- a** In terms of neural plasticity, explain the process responsible for Orla's rise in archery accuracy at parts A and C of the graph. (3 MARKS)
- b** Describe the role of long-term depression in Orla's decline in archery accuracy at part B of the graph. (2 MARKS)

**Questions from multiple lessons****Use the following information for questions 10 and 11.**

Fareed used to hate playing golf with his uncles, as he was never able to hit the ball accurately. However, as an adult, he thoroughly enjoys golf for leisure as he has become much better. On the weekends when Fareed feels stressed about work, he will often go to the driving range to hit some golf balls.

**Question 10** (1 MARK)

Fareed hitting golf balls on the weekend is an example of

- A** coping flexibility.
- B** avoidance coping.
- C** problem-focused coping.
- D** approach coping.

**Question 11** (1 MARK)

In terms of neural plasticity, which of the following processes was likely responsible for Fareed's increased golf skills?

- A long-term potentiation
- B long-term depression
- C synaptic pruning
- D neurotransmission

**Question 12** (3 MARKS)

Long-term potentiation results in an increased strength of neural connections that are repeatedly coactivated. In terms of the lock-and-key process, outline the processes involved in this strengthening of neural connections.

**Question 13** (5 MARKS)

Pia is a competitive gymnast who regularly performs new routines and undergoes gradings. When she was younger and more inexperienced, Pia would get very nervous and worked up at gradings. She would practice for months on end and often be so worn out by the time of the grading that she could no longer practice and was too sick to perform well. Now as an adolescent, Pia has mastered many of the skills required for most of her routines, and picks up new skills with greater ease. She feels less stressed when she has a grading, not having to put as much effort into levelling up as she already has many of the skills required.

- a In terms of Selye's General Adaptation Syndrome, explain why Pia could not perform well on some of her grading assessments when she was younger. (2 MARKS)
- b In terms of processes of neural plasticity behind memory, explain why Pia likely feels less stressed when it comes to gymnastic gradings as an adolescent. (3 MARKS)

**Key science skills****Question 14** (3 MARKS)

A researcher was interested in investigating long-term depression and the relevant time frames involved. Particularly, she wanted to understand more about the time it takes for non-activated postsynaptic neurons to be eliminated from a particular pathway or circuit. To do this, she took brain scans of rats over several weeks and examined their neural circuits.

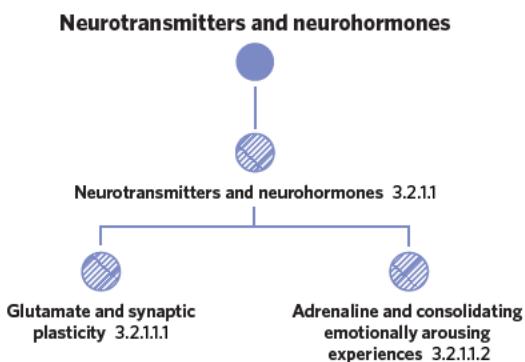
- a What is one reason the researcher would want to use rats instead of humans in this experiment? (1 MARK)
- b Would the researcher be able to generalise the findings of this experiment to humans? Justify your response. (2 MARKS)

# 4B NEUROTRANSMITTERS AND NEUROHORMONES

In this chapter, you are learning all about the basis for learning and memory at the neural level. In the last lesson, you learned how communication between neurons and the connections they create are essential for the formation of memories and learning. In this lesson, you will learn how two different chemical substances sent from neurons underlie learning and memory formation in different ways.

4A. Long-term potentiation and long term depression	4B. Neurotransmitters and neurohormones
<b>Study design dot point</b>	
<ul style="list-style-type: none"> <li>the role of neurotransmitters and neurohormones in the neural basis of memory and learning (including the role of glutamate in synaptic plasticity and the role of adrenaline in the consolidation of emotionally arousing experiences).</li> </ul>	
<b>Key knowledge units</b>	
Glutamate and synaptic plasticity (Neurotransmitters and neurohormones)	3.2.1.1.1
Adrenaline and consolidating emotionally arousing experiences (Neurotransmitters and neurohormones)	3.2.1.1.2

**In this lesson, you will be learning** about two chemical substances involved in the neural foundations of learning and memory. Specifically, you will learn about the role of **glutamate in synaptic plasticity** and **adrenaline in consolidating emotionally arousing experiences**.



## Neurotransmitters and neurohormones 3.2.1.1

### OVERVIEW

Neurotransmitters and neurohormones are two chemical substances released by neurons that are essential to learning and memory formation.

### THEORY DETAILS

The substances sent out and secreted from neurons serve a variety of roles in learning and memory formation. As you've learned, **neurotransmitters** help to communicate messages between neurons, often regarding the information being learned and consolidated. In the last lesson, 4A: Long-term potentiation and long-term depression, you learned that structural and functional changes occur between neurons depending on the rate and intensity at which messages are sent. This demonstrates another role of neurotransmitters in helping form the structural and functional changes in the brain necessary for learning and memory.

**Neurohormones** are another type of chemical substance secreted by neurons. In contrast to neurotransmitters, neurohormones are not received by other neurons, but are released into the bloodstream before being carried to other cells. This is shown in figure 1. While neurohormones also function to communicate messages around the body which are essential for learning and memory, they do not send them to adjacent neurons.

**Neurotransmitter** a chemical substance that carries information between neurons

**Neurohormone** a chemical substance sent from neurons into the bloodstream

**Table 1** Points of difference between neurotransmitters and neurohormones

Neurotransmitters	Neurohormones
• Are sent to adjacent neurons	• Are released into the bloodstream before being carried to other neurons and cells
• Because neurotransmitters bind directly to a postsynaptic neuron, they can have a more immediate effect	• Neurohormones can take longer to have an effect once released from a neuron as their target cells are more widespread than target cells of neurotransmitters
• Neurotransmitters are excitatory or inhibitory	• Neurohormones don't have an excitatory or inhibitory distinction
• The immediate effects of neurotransmitters are more short-lived	• Neurohormones act for longer periods of time

**Want to know more?**

Some substances, such as dopamine, can act as both a neurotransmitter and a neurohormone depending on their function at a specific time and where they are sent to.

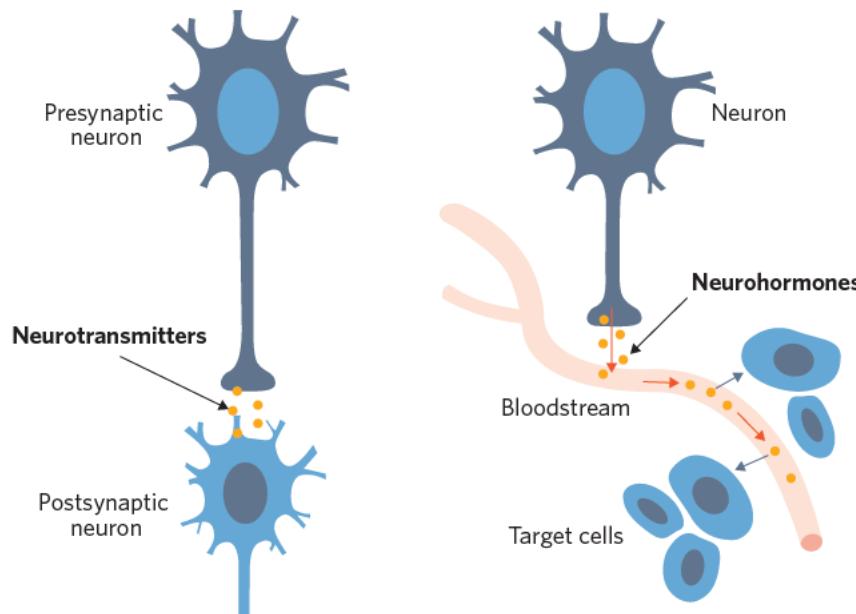


Figure 1 Neurotransmitters and neurohormones can be differentiated by the places into which they are released

To demonstrate your understanding of the role of neurotransmitters and neurohormones in learning and memory, you should be familiar with two specific substances and their roles:

**Glutamate** the primary excitatory neurotransmitter

**Adrenaline (also known as epinephrine)** a neurohormone that increases physiological arousal and contributes to the consolidation of emotionally arousing memories

Glutamate and synaptic plasticity 3.2.1.1	Adrenaline and consolidating emotionally arousing experiences 3.2.1.2
<p>As you've already learned, glutamate is the primary excitatory neurotransmitter in the nervous system. By exciting postsynaptic responses, it plays an essential role in encouraging long-term potentiation during learning. This demonstrates the role of glutamate in synaptic plasticity, as the presence of glutamate helps to create the necessary structural foundations of new memories that are consolidated during learning.</p>	<p>Adrenaline is a neurohormone that is released in times of emotional arousal and stress. Its release in these times prompts heightened physiological reactions such as an increased blood circulation. Aside from preparing the body to respond to stress in the fight-flight-freeze response, adrenaline also plays a fundamental role in consolidating emotionally arousing experiences. This is due to adrenaline being released during times of emotional arousal, activating the brain regions responsible for consolidating emotional experiences in long-term memory. This is essential for learning, as having emotional associations with certain experiences can help people to avoid harmful stimuli.</p> <p>During an emotionally arousing experience:</p> <ol style="list-style-type: none"> <li>1. Adrenaline (epinephrine) is released</li> <li>2. Adrenaline stimulates the release of noradrenaline (norepinephrine)</li> <li>3. This activates the amygdala, which is primarily responsible for the consolidation of emotional memories <ul style="list-style-type: none"> <li>• The hippocampus works with the amygdala to consolidate these memories in long-term memory</li> </ul> </li> </ol>



You already learned about how glutamate functions as the primary excitatory neurotransmitter in lesson **2D: Neurotransmitters**.

You are now connecting this information to learnings from the last lesson **4A: Long-term potentiation and long-term depression**, by understanding how its excitatory effects helps to create neural pathways.

### *Useful tip*

When describing the role of the amygdala and hippocampus in emotional memories, do not state that they are 'storage sites' for these memories. Rather, explain that they are involved in the consolidation of emotionally arousing memories.

**Want to know more?**

Adrenaline can also act as a neurotransmitter, however this is beyond the scope of VCE psychology. When tested on adrenaline, describe its role as a neurohormone only.



 In lesson **6B: Memory and the brain**, you will learn more specifically about the brain regions involved in consolidating memories, including the hippocampus and the amygdala.

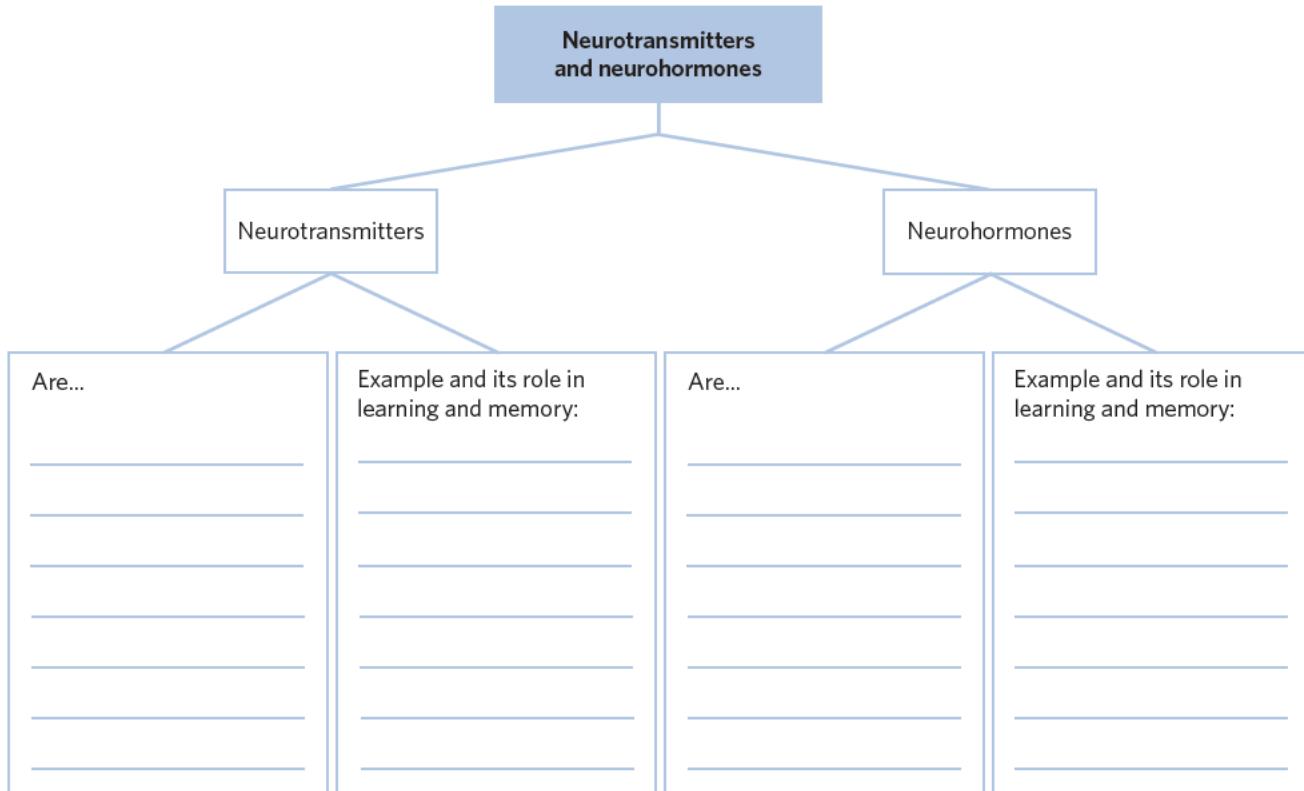
You will also see the importance of adrenaline in the consolidation of the conditioned fear response in lesson **5B: The Little Albert experiment**.

## Theory summary

In this lesson, you have learned about the importance of neurotransmitters and neurohormones to learning and memory. You should now be able to describe the difference between each type of substance, as well as understand the roles of glutamate in synaptic plasticity and adrenaline in consolidating emotionally arousing experiences.

4B Activities

- 1** Fill in the diagram to summarise your learnings from this lesson.



# 4B QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- Neurotransmitter      • Neurohormone      • Glutamate      • Adrenaline
- a A substance sent to a postsynaptic neuron to carry information \_\_\_\_\_
- b An excitatory neurotransmitter essential to long-term potentiation \_\_\_\_\_
- c A substance sent into the bloodstream to carry information \_\_\_\_\_
- d A neurohormone essential for activating the stress response and released during emotional experiences \_\_\_\_\_

## Exam-style questions

### Remember and understand

#### Question 2 (1 MARK)

Glutamate plays a role in synaptic plasticity by

- A exciting postsynaptic neurons, making them more likely to fire and strengthen connections.
- B inhibiting postsynaptic neurons, making them less likely to fire and weaken connections.
- C exciting presynaptic neurons, making them more likely to fire and strengthen connections.
- D inhibiting presynaptic neurons, making them less likely to fire and weaken connections.

#### Question 3 (1 MARK)

Which of the following best describes the classification of adrenaline and its role?

Classification	Role
A	A neurotransmitter Helps to excite postsynaptic neurons.
B	A neurotransmitter Helps to consolidate emotionally arousing experiences.
C	A neurohormone Helps to excite postsynaptic neurons.
D	A neurohormone Helps to consolidate emotionally arousing experiences.

#### Question 4 (1 MARK)

Using examples, explain the key difference between neurotransmitters and neurohormones.

### Apply and analyse

**Use the following information for questions 5 and 6.**

Niahm's dog Dynamite has figured out that whenever he hangs out under the dinner table in the evenings, he will receive many crumbs to eat. He learned this after many weeks of hanging under the table at dinner time, noticing just how much food Niahm and her family drop on the floor.

#### Question 5 (1 MARK)

Which neurotransmitter was essential in Dynamite learning to hang out under the table?

- A GABA
- B glutamate
- C adrenaline
- D noradrenaline

**Question 6** (1 MARK)

One day, Niahm's dad grew sick of Dynamite hanging around their feet during dinner, so he got a spray bottle of water and sprayed Dynamite when he started sniffing around on the floor. Dynamite hates water, and got so scared of the spray that he never came under the dinner table again. Which neurohormone was most likely released in Dynamite when he was sprayed with water?

- A glutamate
- B GABA
- C adrenaline
- D acetylcholine

**Question 7** (2 MARKS)

Gough loves to spend time gardening every day in his backyard which is near the creek. One day when Gough was pruning one of his hedges, a snake emerged and slithered quickly by his feet. Gough was so scared that he yelled in fear and was so caught off guard that he had to sit down and calm down. Now, whenever Gough walks by that same hedge, he feels anxious as he remembers his fearful experience.

Describe the role of the neurohormone primarily involved in the consolidation of Gough's fearful memory of the snake.

Adapted from VCAA 2017 exam SAQ3a

**Questions from multiple lessons****Question 8** (1 MARK)

In terms of the lock-and-key process, glutamate

- A acts as a key that must fit into the right lock or receptor site.
- B acts as a key that must fit into the right lock or axon terminal.
- C acts a lock that must be opened by the right key or neurohormone.
- D acts as a lock that must be opened by the right key or neurotransmitter.

**Question 9** (4 MARKS)

Hien used to learn Russian in high school. One day when travelling, Hien met a Russian man and tried to have a conversation with him in Russian. The man he spoke to understood nothing of what Hien said, and Hien felt extremely embarrassed. After this experience, Hien didn't speak Russian for years, remembering the bad experience whenever anything to do with Russian language and culture came up in his life. Instead, Hien decided to learn French. The other day, Hien was by himself and tried to speak Russian, however could not remember anything of the language.

- a Name and explain the role of the neurohormone most likely involved in the consolidation of Hien's memory of the experience with the Russian man. (2 MARKS)
- b In terms of neural plasticity, how might long-term depression have contributed to Hien forgetting how to speak Russian? (2 MARKS)

**Question 10** (5 MARKS)

Abbi got lost in a supermarket as a child and can still remember it vividly years later. She remembers being with her dad one minute, and then the next being alone and lost for what felt like hours. Abbi remembers feeling stranded and terrified, and not being able to move in fear. She stood in the yoghurt section for a few minutes before wandering around to find her dad.

- a In terms of Selye's General Adaptation Syndrome, identify and describe the stage Abbi was in when she stood in the yoghurt section. (2 MARKS)
- b Name the neurohormone responsible for Abbi being able to remember the supermarket experience years later. (1 MARK)
- c In terms of Lazarus and Folkman's Transactional Model of Stress and Coping, explain how Abbi likely appraised the stressor of being lost during primary appraisal. (2 MARKS)

**Key science skills**

**Use the following information for questions 11-13.**

A researcher was studying the long-term effects of learning to play guitar on synaptic plasticity. She noticed an increased efficiency of neural transmission at synapses involved in guitar playing the more her participants practiced. She recorded the efficiency of neurons by noting down the speed and number of neural transmissions using brain scanning technology.

**Question 11** (1 MARK)

In terms of neural plasticity, the process responsible for the increased efficiency of neural transmission at synapses was

- A pruning.
- B inhibition.
- C long-term potentiation.
- D long-term depression.

**Question 12** (1 MARK)

Which of the following was most likely involved in learning to play guitar?

- A Glutamate, an important neurotransmitter in learning.
- B Glutamate, an important neurohormone in learning.
- C Adrenaline, an important neurotransmitter in learning.
- D Adrenaline, an important neurohormone in learning.

**Question 13** (1 MARK)

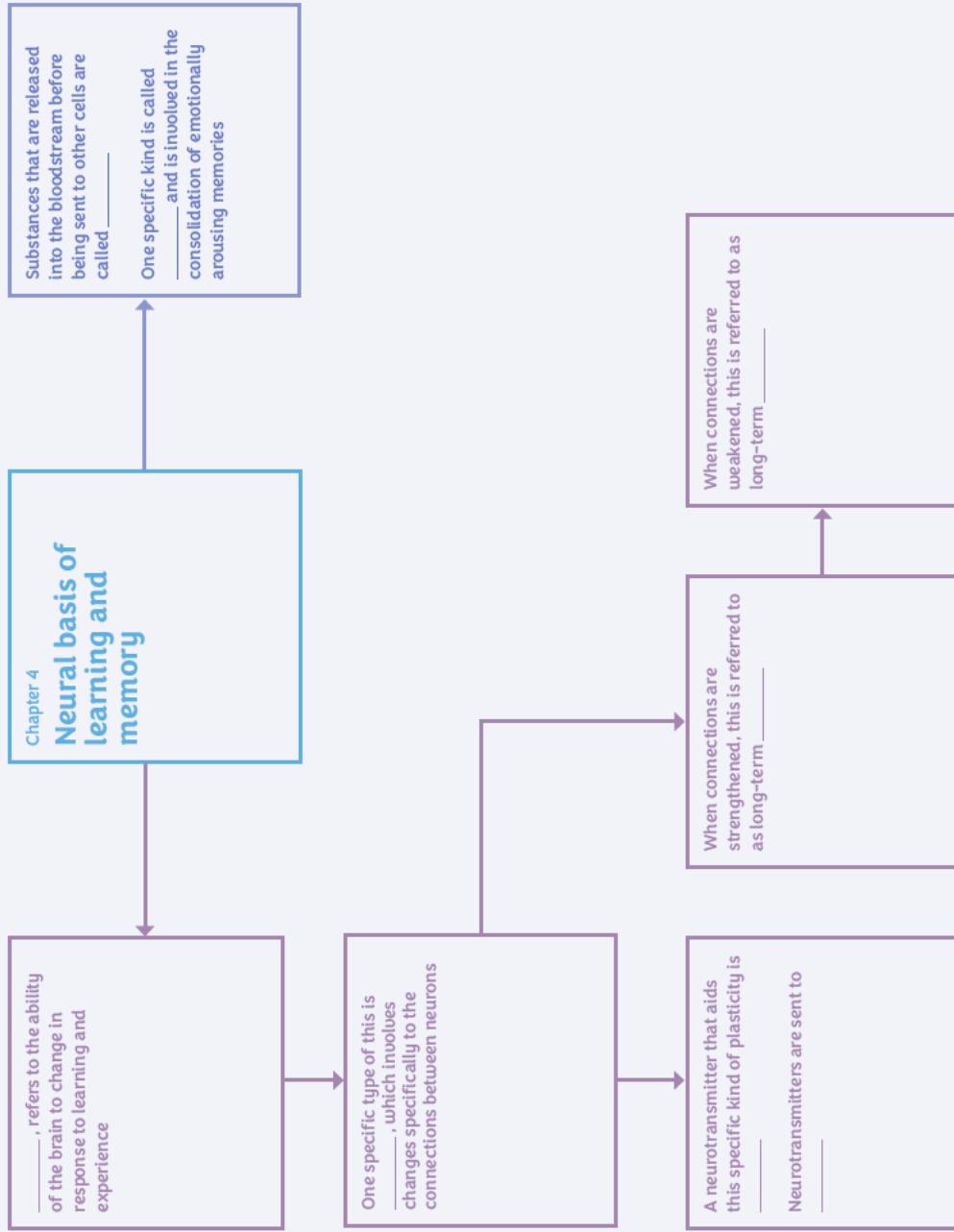
Keeping track of the efficiency of neurons is an example of

- A subjective qualitative data.
- B objective qualitative data.
- C subjective quantitative data.
- D objective quantitative data.

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own.  
This includes all concepts from the chapter.



### Review activity 2: Example bank

Fill in the table with your own notes.

Key terminology	Your own definition	Example
Neural plasticity		
Synaptic plasticity		
Long-term potentiation		
Long-term depression		
Neurotransmitter		
Neurohormone		
Glutamate		
Adrenaline		

## CHAPTER TEST

### Multiple choice questions

Use the following information for questions 1 and 2.

Kylie began gymnastics as a child. When she started learning her first floor routine, she found it difficult to complete and struggled to finish, however as she practised she was able to perform more gracefully and with fewer mistakes. Kylie recently competed in her first gymnastics competition. She was very nervous in performing her routine but knew she would do her best. After performing, she felt exhilarated and happy at having competed in her first competition.

**Question 1** (1 MARK)

In terms of neural plasticity, the process responsible for Kylie's increased ability as she practised her floor routine was

- A approach-focused coping.
- B long-term depression.
- C learning.
- D long-term potentiation.

Adapted from VCAA 2018 exam MCQ9

**Question 2** (1 MARK)

With reference to primary appraisal in Lazarus and Folkman's Transactional Model of Stress and Coping, Kylie likely appraised her first competition as

- A difficult.
- B a challenge.
- C irrelevant.
- D harm/loss.

**Question 3** (1 MARK)

A key difference between neurotransmitters and neurohormones is

- A neurotransmitters are released into the synaptic gap, while neurohormones are released into the bloodstream.
- B neurotransmitters are excitatory, while neurohormones are inhibitory.
- C neurotransmitters are inhibitory, while neurohormones are excitatory.
- D neurotransmitters are released across an individual's lifetime, while neurohormones are released during puberty only.

**Question 4** (1 MARK)

The primary excitatory and primary inhibitory neurotransmitters in the nervous system are, respectively,

- A adrenaline, GABA.
- B GABA, glutamate.
- C glutamate, adrenaline.
- D glutamate, GABA.

**Question 5** (1 MARK)

Which of the following best describes long-term depression?

- A A long-lasting increase in neural communication following a lack of activation of a synaptic pathway.
- B A long-lasting decrease in neural communication following a subthreshold activation of a synaptic pathway.
- C A long-lasting decrease in neural communication following increased activation of a synaptic pathway.
- D An inhibitory effect on a postsynaptic neuron, making it more likely to fire an action potential.

***Use the following information for questions 6-8.***

Bobby was asked on a date to the movies by Bella, who he'd liked for a really long time. Before the date, Bobby was really nervous and noticed his palms were sweating and felt as though his heart would beat out of his chest. Bella however, was relaxed and looking forward to seeing Bobby and the movie.

**Question 6** (1 MARK)

Immediately before seeing the movie, which nervous system was dominant for Bobby and Bella?

- A The autonomic and the somatic nervous system, respectively.
- B The parasympathetic and the sympathetic nervous system, respectively.
- C The sympathetic and parasympathetic nervous system, respectively.
- D The central and the peripheral nervous system, respectively.

**Question 7** (1 MARK)

Which neurotransmitter or neurohormone was likely released as Bobby experienced stress before the date?

- A GABA, as a neurotransmitter into the synaptic gap.
- B Glutamate, as a neurotransmitter into the synaptic gap.
- C Adrenaline, as a neurohormone into Bobby's bloodstream.
- D Glutamate, as a neurohormone into Bobby's bloodstream.

**Question 8** (1 MARK)

Despite being nervous before their date, Bobby knew most of Bella's interests and believed he could make conversation with her before and after the movie.

In terms of types of stress, it is likely that

- A Bobby was experiencing eustress, as he viewed the stressor of the date as positive.
- B Bobby was experiencing eustress, as he viewed the stressor of the date as negative.
- C Bobby was experiencing distress, as he viewed the stressor of the date as positive.
- D Bobby was experiencing distress, as he viewed the stressor of the date as negative.

**Question 9** (1 MARK)

Which of these is **not** a function of glutamate in synaptic plasticity?

- A Exciting a postsynaptic neuron making it more likely to fire.
- B Acting as an excitatory neurohormone released across the synaptic gap.
- C Acting as an excitatory neurotransmitter released across the synaptic gap.
- D Strengthening the synaptic connections of a neural pathway.

*Adapted from VCAA 2017 exam MCQ4*

**Question 10** (1 MARK)

Which of the following changes to neural connections is an individual likely to experience during long-term potentiation?

- A An increased number of connections at the synapse.
- B A decrease in the number of neurons firing.
- C A greater release of the excitatory neurotransmitter, GABA.
- D An increase in the number of neurons in the brain.

*Adapted from VCAA 2018 exam MCQ3*

**Short answer questions****Question 11** (4 MARKS)

When she was eight, Enya moved to Italy with her parents. When they arrived, neither Enya nor her parents spoke Italian. After six months, Enya was nearly fluent in the language, having picked it up quite quickly. After two years, Enya returned home and soon forgot how to speak Italian as she no longer needed to use it, instead focusing on improving her English literacy.

- a With reference to neural plasticity, describe the process that occurred in Enya's brain while she was learning Italian. (2 MARKS)
- b Referring to long-term depression, explain why Enya was unable to speak Italian two years after she returned home. (2 MARKS)

**Question 12** (6 MARKS)

Kevin wanted to learn the flute and has been taking lessons for two months. During this time, Kevin has greatly improved his tone and notation, and can even play basic pieces. During his most recent session, a drum-kit was knocked over, crashing loudly. Kevin was startled and realised after the crash that his heart rate had increased and that he was sweating profusely. This session has been Kevin's most memorable to date, and he can recall it in better detail than other sessions.

- a Identify the neural process that occurred during Kevin's practice as he improved his ability. (1 MARK)
- b Identify the primary neurotransmitter responsible for processes of learning and explain its role in Kevin learning the flute. (2 MARKS)
- c With reference to the role of adrenaline, explain why Kevin was able to recall the session when the drum-kit crashed in greater detail than other sessions. (3 MARKS)

**Question 13** (2 MARKS)

Outline one similarity and one difference between neurotransmitters and neurohormones.

**Key science skills questions****Question 14** (10 MARKS)

Dr Wylie wanted to test the effectiveness of adrenaline in the consolidation of memory. Participants were recruited via an online advertisement, offering an hourly rate for participation. Dr Wylie then paired individuals who responded to the advertisement based on their having similar cognitive capabilities concerning memory retention and recall. For each pair, Dr Wylie flipped a coin, allocating one member to the experimental condition and the other to the control condition. In the experimental condition, participants were required to memorise a series of 20 images in as much detail as possible while undergoing low-level electric shock treatment. In the control condition, participants were also required to memorise a series of 20 images but did not undergo electric shock treatment. The next day, participants were asked to list as many images in the correct order as possible. Dr Wylie scored participants' performance out of 20.

- a Identify the research design used and describe one benefit of this research design. (2 MARKS)
- b Describe the sampling method Dr Wylie used and identify a possible limitation of this method. (2 MARKS)
- c The results of Dr Wylie's study showed that, on average, participants in the experimental group recalled 15/20 images, while the participants in the control group recalled an average of 9/20.  
With reference to the role of adrenaline in the consolidation of memory, give a possible reason for the difference in each group's performance. (2 MARKS)
- d Identify a possible confounding variable in Dr Wylie's study and explain its effect on the results. (2 MARKS)
- e Identify whether the results of Dr Wylie's study demonstrate internal validity or not.  
Justify your response. (2 MARKS)



UNIT 3 AOS 2, CHAPTER 5

# 05

## Models to explain learning

### 5A Classical conditioning

- classical conditioning as a three-phase process (before conditioning, during conditioning and after conditioning) that results in the involuntary association between a neutral stimulus and unconditioned stimulus to produce a conditioned response including stimulus generalisation, stimulus discrimination, extinction and spontaneous recovery

### 5C Operant conditioning

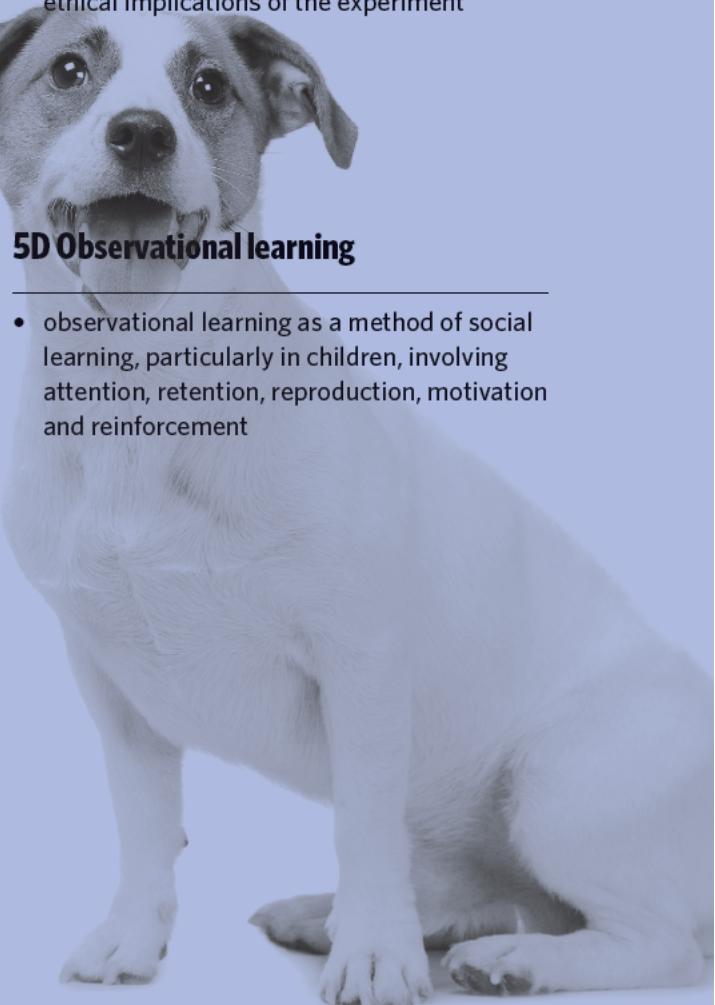
- operant conditioning as a three-phase model (antecedent, behaviour, consequence) involving reinforcers (positive and negative) and punishment (including response cost) that can be used to change voluntary behaviours, including stimulus generalisation, stimulus discrimination and spontaneous recovery (excluding schedules of reinforcement)

### 5B The Little Albert experiment

- the 'Little Albert' experiment as illustrating how classical conditioning can be used to condition an emotional response, including ethical implications of the experiment

### 5D Observational learning

- observational learning as a method of social learning, particularly in children, involving attention, retention, reproduction, motivation and reinforcement

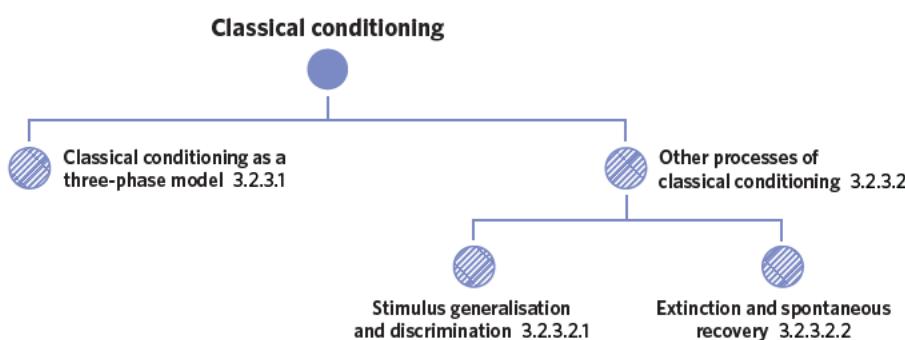


# 5A CLASSICAL CONDITIONING

In this chapter, you will be learning about different models of learning. Learning is a relatively permanent change in behaviour or knowledge that results from experience. It involves acquiring knowledge and skills through experience. This course covers three models of learning: classical conditioning, operant conditioning and observational learning. In this lesson, you will be focussing on classical conditioning.

5A. Classical conditioning	5B. The Little Albert experiment	5C. Operant conditioning	5D. Observational learning
<b>Study design dot point</b>			
<ul style="list-style-type: none"> <li>classical conditioning as a three-phase process (before conditioning, during conditioning and after conditioning) that results in the involuntary association between a neutral stimulus and unconditioned stimulus to produce a conditioned response including stimulus generalisation, stimulus discrimination, extinction and spontaneous recovery</li> </ul>			
<b>Key knowledge units</b>			
Classical conditioning as a three-phase model			3.2.3.1
Stimulus generalisation and stimulus discrimination (Other processes of classical conditioning)			3.2.3.2.1
Extinction and spontaneous recovery (Other processes of classical conditioning)			3.2.3.2.2

**In this lesson, you will be learning about classical conditioning.** Classical conditioning is a type of learning by which organisms come to associate stimuli, and, consequently, to anticipate events.



## Classical conditioning as a three-phase model 3.2.3.1

### OVERVIEW

Classical conditioning is a type of learning by which organisms come to associate stimuli, and, consequently, to anticipate events. The learner plays a passive role in classical conditioning, meaning only involuntary responses can be learned this way.

**Classical conditioning** a model of learning in which organisms learn through the involuntary association of two or more stimuli

### THEORY DETAILS

Classical conditioning is understood as a three-phase model: before, during and after conditioning. These are outlined in figure 1.

Within the three stages, you will notice that the key concepts relating to classical conditioning can be categorised as either stimuli or responses:

- Stimuli refer to any object, environment or event that precede an action.
- Responses refer to actions that follow a stimulus.

It is important to be able to identify how specific stimuli and responses interact, and the order in which they occur.

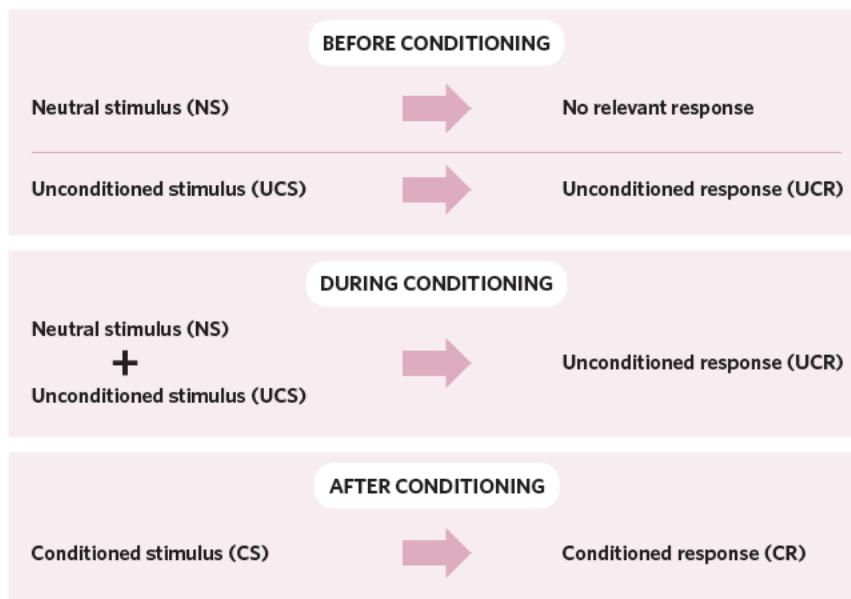


Figure 1 Three-phase model of classical conditioning

### Before conditioning

- The **neutral stimulus (NS)** is a stimulus that does not initially elicit a response. The stimulus can be anything, such as an image, a sound, or a smell.
- The **unconditioned stimulus (UCS)** is a stimulus that elicits an involuntary response. This means that the UCS does not need to be learned, it automatically produces a response.
- The response it produces is known as an **unconditioned response (UCR)**, which is a natural (or unlearned) behaviour in response to the unconditioned stimulus.
- It can also be referred to as an involuntary behaviour because it occurs without conscious awareness.

### During conditioning

- The neutral stimulus is paired with the unconditioned stimulus to produce an unconditioned response.
- During this pairing, the timing and order of the presentation of the stimuli are important for conditioning to occur.
- Typically, the neutral stimulus should be presented almost immediately before the unconditioned stimulus and there should only be a brief interval between the presentation of the two (0.5 seconds).
- This ensures that the organism comes to associate the neutral stimulus with the unconditioned response originally produced by the unconditioned stimulus.

### After conditioning

- After multiple pairings of the neutral stimulus and the unconditioned stimulus, the neutral stimulus now becomes the **conditioned stimulus (CS)**.
- This means that the organism has learned to respond to the conditioned stimulus in the same way that they originally responded to the unconditioned stimulus.
- This new learned response is called the **conditioned response (CR)**, which occurs in response to the conditioned stimulus.

**Neutral stimulus (NS)** a stimulus that does not initially elicit a response

**Unconditioned stimulus (UCS)** a stimulus that elicits a reflexive response

**Unconditioned response (UCR)** a natural (unlearned) behavior to a given stimulus

**Conditioned stimulus (CS)** a stimulus that elicits a response due to its being paired with an unconditioned stimulus

**Conditioned response (CR)** a response caused by the conditioned stimulus

#### Useful tip

During conditioning, it is important that the neutral stimulus is presented prior to the UCS. If the UCS is presented before the NS, the learner will simply produce a response to the UCS and ignore the presence of the NS. As a result no association will occur.

## CASE STUDY

### Pavlov's dogs

Our knowledge of classical conditioning comes from the work of Ivan Pavlov and his experiments. Pavlov was a scientist who was studying dogs' digestive systems. In his studies with dogs, Pavlov surgically implanted tubes inside dogs' cheeks to collect saliva. He then measured the amount of saliva produced in response to various foods.

Over time, Pavlov observed that the dogs began to salivate not only at the taste of food, but also at the sight of food, at the sight of an empty food bowl, and even at the sound of the laboratory assistants' footsteps. Salivating to food in the mouth is reflexive, so no learning is involved. However, dogs don't naturally salivate at the sight of an empty bowl or the sound of footsteps.

To explore these unusual responses, Pavlov designed a series of experiments to see which stimuli would cause the dogs to salivate. He was able to train the dogs to salivate in response to stimuli completely unrelated to food, such as the sound of a bell, a light, and a touch on the leg. Through his experiments, Pavlov realised that an organism has two types of responses to its environment: (1) unconditioned (unlearned) responses, or reflexes, and (2) conditioned (learned) responses.

### Summary of Pavlov's experiment

- In Pavlov's experiments, the dogs salivated each time meat powder was presented to them.
- The meat powder in this situation was an unconditioned stimulus (UCS).
- The dogs' salivation to the meat powder was an unconditioned response (UCR).
- Pavlov would sound a tone (like ringing a bell) and then give the dogs the meat powder.
- The sound of the bell was the neutral stimulus (NS).
- Prior to conditioning, the dogs did not salivate when they heard the bell because the sound of the bell had no association for the dogs.
- When Pavlov paired the bell with the meat powder over and over again, the previously neutral stimulus also began to elicit salivation from the dogs.
- Therefore, the neutral stimulus became the conditioned stimulus (CS).
- Eventually, the dogs began to salivate to the sound of the bell alone, just as they previously had salivated at the sound of the assistants' footsteps.
- The behaviour caused by the conditioned stimulus is called the conditioned response (CR).

In the case of Pavlov's dogs, they had learned to associate the tone (CS) with being fed, and they began to salivate (CR) in anticipation of food.

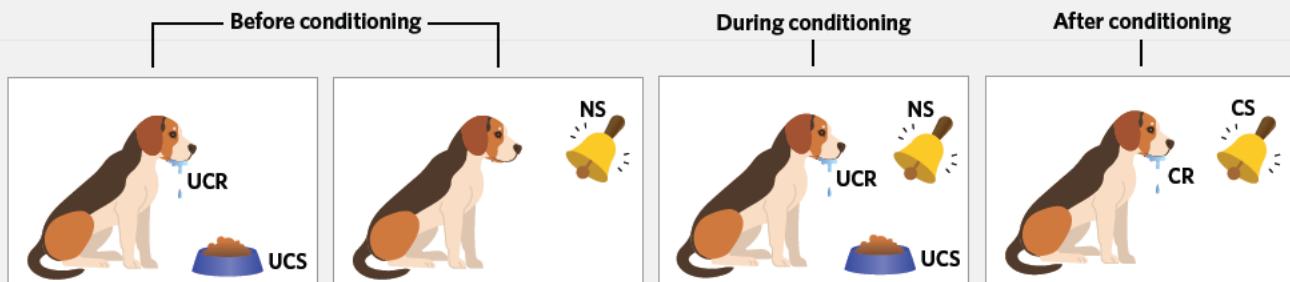


Figure 2 Three phases of classical conditioning as shown through Pavlov's experiment

### Useful tip

- The 'N' in NS stands for 'neutral', but can also help you to remember that it elicits 'N' for 'no response'
- For written responses, whenever you refer to a response (such as the UCR and CR), you must specify what the response is to in order to receive full marks. For example, 'salivation in response to food (UCR)' compared to 'salivation in response to the bell (CR)'. In specifying this, it is important to remember that while the UCR and CR involve the same behaviour, they are not elicited by the same stimulus.
- Although Pavlov's experiments on dogs aren't in the study design, it is a good case study to know, as questions on this experiment have come up on exams in the past.

## Other processes of classical conditioning 3.2.3.2

### OVERVIEW

The process of an organism learning through classical conditioning is called acquisition. Once the learned response has been acquired it can also go through two other processes of extinction and spontaneous recovery, which you will learn about in this part of the lesson. Moreover, once a response has been learned there are two other processes of classical conditioning that can occur: stimulus generalisation and stimulus discrimination.

### THEORY DETAILS

#### Extinction and spontaneous recovery 3.2.3.2.1

There are distinct processes of classical conditioning: acquisition, extinction and spontaneous recovery. In the first part of this lesson, you learned about acquisition. You will also need to know about extinction and spontaneous recovery in detail, in order to respond to questions on these processes in the exam.

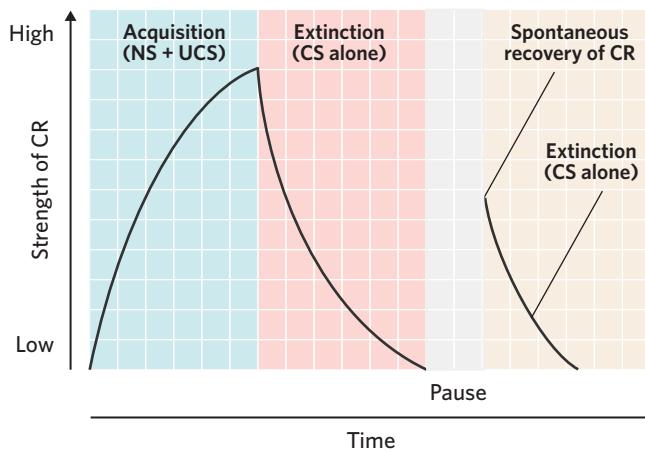


Figure 3 Curve of acquisition, extinction, and spontaneous recovery.

**Acquisition** is the initial period of learning in classical conditioning. It is when an organism learns to associate a neutral stimulus with an unconditioned stimulus. After acquisition the neutral stimulus becomes a conditioned stimulus, capable of eliciting the conditioned response in the absence of the unconditioned stimulus.

**Extinction** is the decrease in strength, and eventual disappearance of the conditioned response when the unconditioned stimulus is no longer presented with the conditioned stimulus. When presented with the conditioned stimulus alone, the organism's conditioned response becomes weaker and weaker, and is finally extinguished. In classical conditioning terms, this process is known as a gradual weakening and disappearance of the conditioned response. A response is said to be extinguished when the conditioned stimulus consistently does not elicit the conditioned response for an extended period of time.

After extinction, **spontaneous recovery** may occur, indicating the return of a previously extinguished conditioned response following a rest period.

**Acquisition** the period of initial learning in classical conditioning in which the learner begins to associate a neutral stimulus with an unconditioned stimulus so that the neutral stimulus will begin to elicit the conditioned response

**Extinction** when the conditioned response no longer occurs for an extended period of time

**Spontaneous recovery** the return of a previously extinguished conditioned response

### CASE STUDY

#### Pavlov's dogs

Extinction was also explored by Pavlov in his experiments with dogs. Pavlov found that when he repeatedly presented the bell (conditioned stimulus) without the meat powder (unconditioned stimulus), extinction occurred: the dogs stopped salivating in response to the bell. However, after a couple of hours of resting from this extinction training, the dogs again began to salivate when Pavlov rang the bell. This behaviour is an example of spontaneous recovery.

### Stimulus generalisation and stimulus discrimination 3.2.3.2.2

Once a learned response has been acquired (or conditioned), the organism can display either **stimulus discrimination**: where the conditioned response is exhibited only in the presence of the specific conditioned stimulus, or **stimulus generalisation**: where the conditioned response is also exhibited when other stimuli, which are similar to the conditioned stimulus, are present.

It is important for organisms to be able to distinguish between different stimuli. For example distinguishing between sounds that predict a threatening event and sounds that do not can allow an animal to respond appropriately, such as by running away if the sound is threatening. When the learner demonstrates the conditioned response to the original conditioned stimulus, but not to other similar stimuli, it is called stimulus discrimination. In classical conditioning terms, the organism demonstrates the conditioned response only to the original conditioned stimulus.

By contrast, when an organism demonstrates the conditioned response to stimuli that are similar to the conditioned stimulus, it is called stimulus generalisation. The more similar a new stimulus is to the original conditioned stimulus, the more likely the organism is to demonstrate the conditioned response.

**Stimulus discrimination** the process in which an organism only demonstrates the conditioned response to the conditioned stimulus and not to stimuli similar to it

**Stimulus generalisation** a process in which the learner demonstrates the conditioned response to stimuli that are similar to the conditioned stimulus

#### CASE STUDY

##### Pavlov's dogs

In Pavlov's experiments, stimulus discrimination was demonstrated when the dogs distinguished between the tone that sounded before they were fed and other tones (e.g. a doorbell), responding only to the one they had learned to associate with food. This ability to discriminate was useful to them because the other sounds did not predict the arrival of food.

If stimulus generalisation had occurred, the dogs would have salivated in response to many tones that were similar to the conditioned tone, incorrectly thinking that these tones also predicted the arrival of food.

### Theory summary

In this lesson, you have learned how classical conditioning works as a three-phase process, including the stages of before, during and after conditioning. You should now be able to classify the different types of stimuli (UCS, NS, CS) and responses (UCR, CR) and determine how they fit into the three stages of classical conditioning. You should also have an understanding of the acquisition process of a classically conditioned response, and how it might be extinguished and spontaneously recovered. It is also important that you are able to explain and provide examples of stimulus discrimination and generalisation.

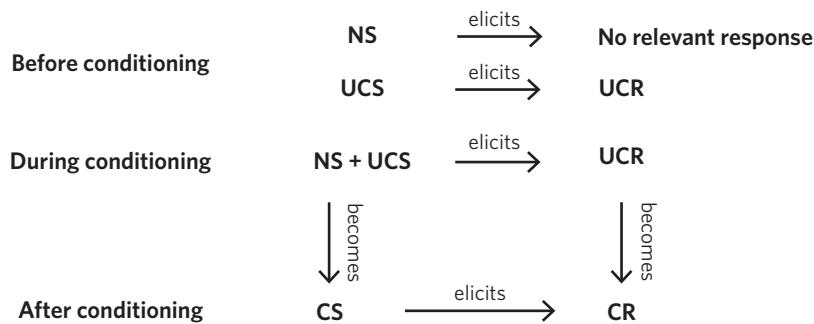


Figure 4 The relationship between the stages of classical conditioning, stimuli and responses

### 5A Activities

- For the following scenarios, identify the stimuli and responses and organise these terms into the three-stage model of classical conditioning.
  - Miss Tan is conducting an experiment with the psychology students in her class. To conduct her experiment she asks half the students in the class to be her experimenters and the other half to be participants. The experimenters are instructed to tap the pencil against the table and then blow into the participants' eyes to make them blink.

- b** Jose the cat feels afraid whenever he hears the loud rumble of the vacuum cleaner. Now, whenever he sees the silver machine he jumps and hisses even when it isn't turned on.
- c** Gena wants to classically condition Christian to like the TV show that she is currently watching. She knows eating grapes makes Christian happy, so she always prepares grapes for him to eat when they sit down to watch the show.
- d** Catherine wants her son to stop biting his fingernails. To achieve this, she paints her son's fingernails with a bitter tasting nail polish that makes him cringe and gag.
- e** The first time Emily went to the park near her house she was swooped by a bird. Now, whenever she has to pass by the park on her walk home from school, she feels afraid and her heart begins to pound.
- 2** Using the same scenarios as mentioned in the previous activity, identify the UCR and CR and specify the difference between the two. For example, if the scenario is that of Pavlov's Dog experiment the UCR is 'salivating in response to the meat powder' whereas the CR is 'salivating in response to the sound of the bell.'

	UCR	CR
a		
b		
c		
d		
e		

- 3** Determine whether the subject in each scenario is experiencing stimulus generalisation, stimulus discrimination, extinction or spontaneous recovery.
- a** Hillary barked in excitement when she saw the blue bag in which her owner kept her dog treats. However, when her owner brought out his blue lunch box Hillary did not bark.
- b** Ethan is spending the summer holidays at his grandmother's house. His grandmother has a very loud doorbell that startles him when he first hears it. After a few weeks, his reaction to the doorbell progressively decreases until he no longer reacts when he hears the sound.
- c** When Ethan returns to visit his grandmother a few months later the sound of the doorbell startles him again.
- d** Pavlov's dogs were classically conditioned to salivate to a tone. If the dogs began to salivate to the sound of a doorbell this would be called...

## 5A QUESTIONS

### Theory review questions

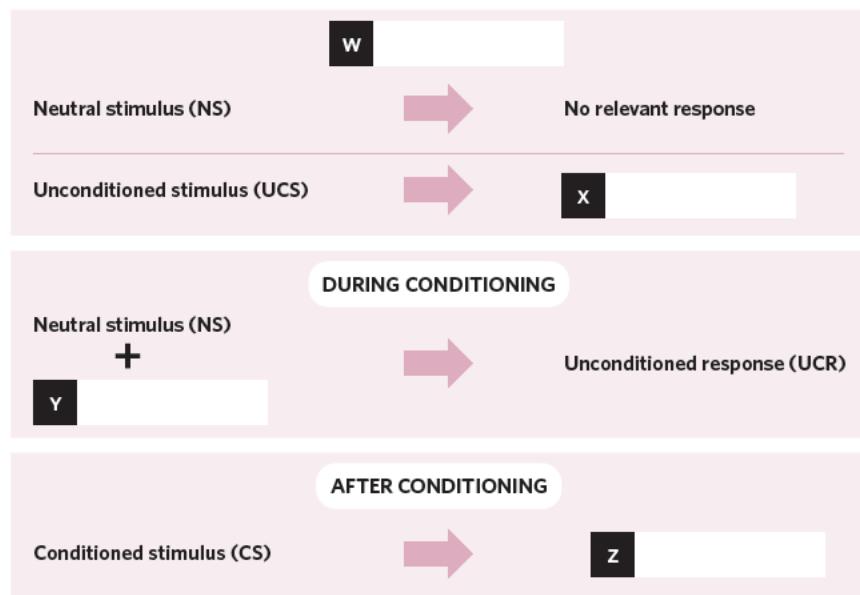
#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                          |                          |                        |                           |
|--------------------------|--------------------------|------------------------|---------------------------|
| • Classical conditioning | • Unconditioned response | • Acquisition          | • Stimulus discrimination |
| • Neutral stimulus       | • Conditioned stimulus   | • Extinction           | • Stimulus generalisation |
| • Unconditioned stimulus | • Conditioned response   | • Spontaneous recovery |                           |
- a** A learning process in which two or more stimuli are paired and become associated \_\_\_\_\_
- b** When the conditioned stimulus no longer produces the conditioned response \_\_\_\_\_
- c** The stimulus that produces an unconditioned or unlearned response \_\_\_\_\_
- d** An unlearned response to a stimulus \_\_\_\_\_
- e** The stimulus that initially does not elicit a relevant response \_\_\_\_\_
- f** The period of learning during which the unconditioned stimulus and neutral stimulus are repeatedly paired \_\_\_\_\_
- g** A stimulus that produces a learned response \_\_\_\_\_
- h** When stimuli similar to the conditioned stimulus also produce the conditioned response \_\_\_\_\_
- i** A learned response \_\_\_\_\_
- j** When only the specific conditioned stimulus produces the conditioned response \_\_\_\_\_
- k** After a period of extinction, the conditioned stimulus elicits the conditioned response again \_\_\_\_\_

**Question 2**

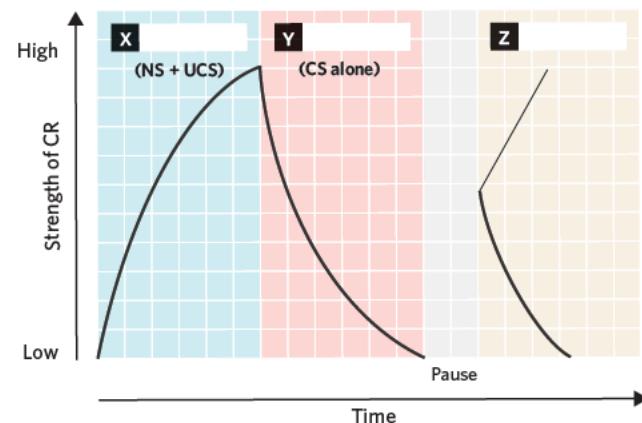
Match the letter in the gaps to the correct corresponding label.



	W	X	Y	Z
A	Unconditioned response	Before conditioning	Unconditioned stimulus	Conditioned response
B	Unconditioned stimulus	Unconditioned response	Before conditioning	Conditioned response
C	Before conditioning	Unconditioned response	Unconditioned stimulus	Conditioned response
D	Before conditioning	Unconditioned stimulus	Unconditioned response	Conditioned response

**Question 3**

Which of the following labels are correct?



	X	Y	Z
A	Acquisition	Spontaneous recovery	Extinction
B	Acquisition	Extinction	Spontaneous recovery
C	Spontaneous recovery	Acquisition	Extinction

**Question 4**

The following steps describe Pavlov's experiments with dogs. Put the steps in the correct order and determine which stage of classical conditioning they occur in.

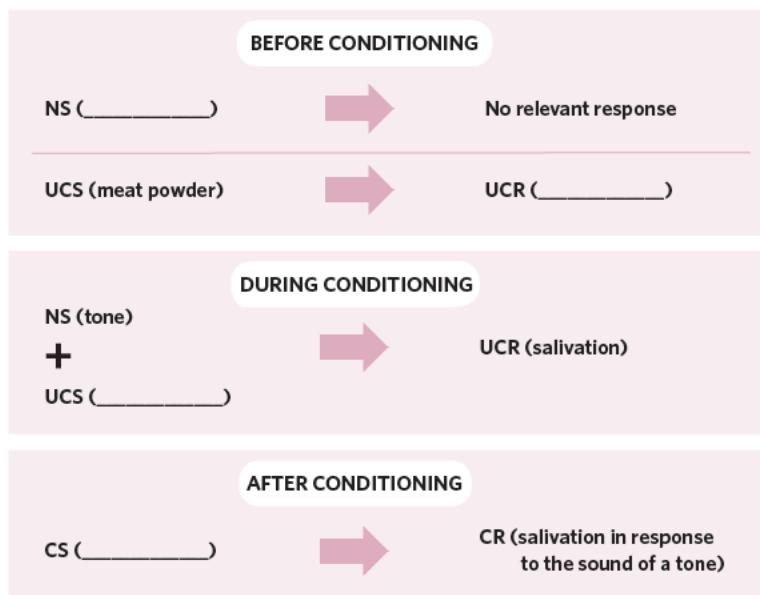
**Stages of classical conditioning:**

- Before conditioning
- During conditioning
- After conditioning

Steps (incorrect order)
Pavlov presented the meat powder and the sound of the tone together several times, each time the dogs would salivate in response.
Pavlov checked to see that the sound of the tone did not make the dogs salivate.
The sound of the tone alone caused the dogs to salivate.
Pavlov checked to see that the meat powder did cause the dogs to salivate.

**Question 5**

Fill in the blanks to outline the three phases of classical conditioning that occurred in Pavlov's experiment.

**Exam-style questions***Remember and understand***Question 6** (1 MARK)

The neutral stimulus is

- A** the stimulus that gives an unconditioned response.
- B** the stimulus that gives no relevant response.
- C** when multiple stimuli are paired so an association is formed.
- D** a neutral response to a stimulus.

**Question 7** (1 MARK)

Stimulus generalisation can be said to have occurred when

- A** the learned behaviour is only seen in response to the conditioned stimulus.
- B** the conditioned response changes over time.
- C** the neutral stimulus no longer elicits the conditioned response.
- D** stimuli similar to the conditioned stimulus also elicit the conditioned response.

**Question 8** (1 MARK)

Following a period of extinction, the conditioned stimulus elicits the conditioned response again. This is an example of

- A** extinction occurring.
- B** extinction not occurring.
- C** spontaneous recovery occurring.
- D** spontaneous recovery not occurring.

**Question 9** (1 MARK)

Jasmine wanted to train her dog to come to her every time she whistled. She did this by whistling every time she fed him so that he began to associate the sound of the whistle with the expectation of being fed. In this scenario the expectation of being fed to the sound of Jasmine whistling is the

- A** conditioned stimulus.
- B** conditioned response.
- C** stimulus generalisation.
- D** stimulus discrimination.

**Question 10** (2 MARKS)

Katherine trained her dog to come to her by blowing a whistle every time she fed him, so her dog began to associate the sound of the whistle with expecting to be fed. One day she lost the whistle that she trained her dog with and tried to call him using another whistle but he didn't come to her.

- a Name the process of classical conditioning that explains why Katherine's dog didn't come to her when she used this new whistle. (1 MARK)
- b If Katherine's dog had responded to the sound of the new whistle, what would this process of classical conditioning be called? (1 MARK)

**Apply and analyse****Question 11** (1 MARK)

Mikayla was walking home during a thunderstorm when a loud burst of thunder made her jump. Her reaction of jumping in response to the thunder is an example of an unconditioned response because

- A thunder is an example of a conditioned stimulus.
- B it is a learned response.
- C the response is voluntary.
- D the response is involuntary.

**Question 12** (3 MARKS)

Dr Chanto wanted to classically condition a monkey to fear apples. Every time the monkey reached for the apple an iron bar was struck behind the monkey's back producing a loud sound that made the monkey scared. Using the language of classical conditioning, define extinction and outline the extinction phase of Dr Chanto's experiment.

**Question 13** (4 MARKS)

In Pavlov's experiments, he found that the timing of the presentation of stimuli was crucial to how quickly the dogs learned to create the associations. He found that the optimal timing was when the neutral stimulus (NS) was presented about half a second before the unconditioned stimulus (UCS) was presented.

- a Explain why the timing of this presentation is important. (2 MARKS)
- b Explain why the order of the presentation of the stimuli is important. (2 MARKS)

**Questions from multiple lessons****Question 14** (1 MARK)

Which of the following neurohormones are involved in the consolidation of a conditioned fear response?

- A glutamate
- B adrenaline
- C melatonin
- D serotonin

**Question 15** (2 MARKS)

Hannah has been classically conditioned to fear bull ants because she was bitten several times when she was a kid playing in her backyard. Each of these times Hannah was in a lot of pain when she was bitten. In terms of neural plasticity, describe the role of long-term potentiation in Hannah learning to fear bull ants.

**Question 16** (3 MARKS)

Liam has a fear of clowns. When he was younger he was at a circus when a clown popped several balloons near him causing him to startle and cry. Ever since then he has been afraid of clowns. Outline the role of adrenaline in Liam's development of his fear of clowns.

**Key science skills****Question 17** (2 MARKS)

Cej conducted an experiment for a homework assignment to see if she could train her cat to come to her when she whistled. She classically conditioned her cat by whistling every time she fed it. After a week of whistling while feeding her cat, her cat now comes when she just whistles. In her experiment report Cej concluded that all cats can be successfully trained in this way.

Outline one caution Cej should take into account regarding the generalisability of her results.

**Question 18** (8 MARKS)

For his VCE psychology practical investigation, Quentin wanted to test whether the type of neutral stimulus used affected the speed of acquisition of a conditioned response. He recruited two Year 7 classes to participate in his study. Both classes had 24 students in them.

For one of the classes, 7A, he conditioned them to flinch every time they saw a picture of a crow projected on their wall. He did this by playing a loud screeching noise every time the picture of the crow was on the projected screen. For the other class, 7B, he conditioned them to flinch every time they saw a picture of a penguin projected on their wall. He used the same technique as he did for 7A to achieve this.

For both classes he also had a control condition of a blank white screen.

For each class he did 15 trials of pairing the neutral stimulus with the loud screeching noise. After these trials, he presented the picture of both the crow or the penguin to each class without the loud screeching noise and noted how many students flinched.

The results of his experiment are outlined in the table provided.

Stimulus	Number of students who flinched (class 7A)	Number of students who flinched (class 7B)
Blank white screen	0	0
Picture of penguin	7	21
Picture of crow	23	9

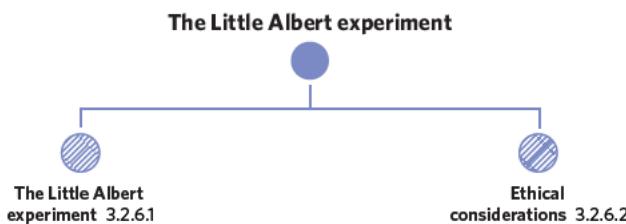
- a Identify the independent and dependent variables in Quentin's experiment. (2 MARKS)
- b Describe another sampling method Quentin could have used to conduct his experiment. (3 MARKS)
- c Using the language of classical conditioning, explain why seven students from class 7A flinched when they were presented with the picture of the penguin despite being conditioned to flinch in response to the picture of the crow. (3 MARKS)

# 5B THE LITTLE ALBERT EXPERIMENT

So far in this chapter, you have learned about classical conditioning as a model of learning. In this lesson, you will be looking at a historical case study of classical conditioning that helped psychologists continue to better understand how organisms can learn an emotional response through the involuntary association of stimuli. This case study is called the Little Albert experiment.

5A. Classical conditioning	5B. The Little Albert experiment	5C. Operant conditioning	5D. Observational learning
<b>Study design dot point</b>			
<ul style="list-style-type: none"> <li>the 'Little Albert' experiment as illustrating how classical conditioning can be used to condition an emotional response, including ethical implications of the experiment</li> </ul>			
<b>Key knowledge units</b>			
The Little Albert experiment			3.2.6.1
Ethical considerations			3.2.6.2

In this lesson, you will be learning about a historical case study of classical conditioning: **The Little Albert experiment**. You will be learning about how this experiment was conducted, how it contributed to our modern understanding of classical conditioning, as well as the **ethical considerations** that now prevent this experiment from being replicated.



## The Little Albert experiment 3.2.6.1

### OVERVIEW

The Little Albert experiment is a prominent case study of classical conditioning. In the experiment, a little boy was conditioned to fear a white rat. This experiment has been important in the development of the modern psychological understanding of learned emotional responses.

### THEORY DETAILS

In the previous lesson, you learned about classical conditioning as a model of how humans and animals can come to associate stimuli. One of the most notable experiments on classical conditioning occurred in 1920, run by John B Watson and Rosalie Rayner. Known as the Little Albert experiment, the experimenters used classical conditioning to condition a baby boy to fear a white rat.

Watson was a psychologist inspired by the work of Ivan Pavlov, whose work with dogs you learned about in the previous lesson. Watson established a subfield of psychology, known as behaviourism, which suggests that all behaviours are learned from the environment. In his experiments, he set out to establish this understanding by showing that emotions, such as fear, can be learned through environmental stimuli.

In 1920, he was working at the psychology department at Johns Hopkins University, where he met an employee of the campus hospital, Little Albert's mother. Watson offered Little Albert's mother a sum of money for her son to participate in his experiments. At the time, Little Albert was about 9 months old.

### The experiment:

- Initially, Little Albert was presented with various neutral stimuli, including a rabbit, a dog, a monkey, different masks and a white rat.
- He did not show any fear response to these stimuli.
- Watson and Rayner would present Little Albert with the white rat, and immediately after strike a hammer against a metal bar behind Little Albert's head.
- The loud noise made by the hammer and metal bar would frighten Little Albert, causing him to cry.
- They repeatedly paired the loud sound with the white rat, until the presence of the white rat alone elicited a fear response from Little Albert.

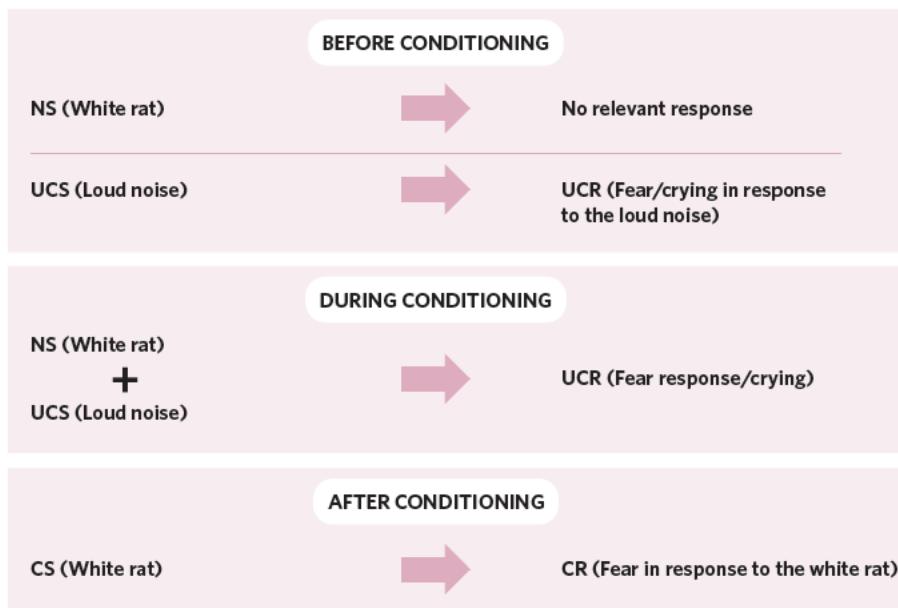


Figure 1 The three-stage process of classical conditioning that occurred in the Little Albert experiment.

After conditioning, it was evident that Little Albert had acquired the conditioned response of fear, in response to the presence of the white rat. Not only that, but he also demonstrated stimulus generalisation in that his fear response was extended to all white or furry stimuli, such as a rabbit, a dog, and even a white mask.

Little Albert's mother moved away with him before the experiment ended. This meant that Watson and Rayner did not get the chance to extinguish this fear response. There is little knowledge about the ongoing impacts of this experiment on Little Albert's life. It is known, however, that he passed away at age six in 1925, due to causes unrelated to the experiment.

### Implications for modern psychology

Unlearned emotional responses, like any unconditioned response, are important for survival. Little Albert's fear response to the loud noise of the hammer striking the metal bar is an adaptive quality as that noise could indicate danger. In these experiments, Watson and Rayner established that emotional responses could also be learned, or conditioned. These responses are called **conditioned emotional responses**, where the learner shows an involuntary emotional response to a stimulus that is not otherwise naturally occurring.

This body of work has contributed to psychologists' modern understanding of the development of phobia (which will be further explored in chapter 13) and implicit emotional memories (explored in chapter 6).

Stimulus generalisation can also explain the development of phobia, where a child who experiences a fearful situation might associate that stimulus with fear and then generalise that fear in response to other stimuli. For example, a child who received a painful injection during an unpleasant visit to the doctor may come to fear needles and generalise this fear to other sharp objects, such as sewing pins.

**Conditioned emotional responses** an emotional response to a stimulus that doesn't naturally produce that response, learned through the process of classical conditioning

## Ethical considerations 3.2.6.2

### OVERVIEW

Although the Little Albert experiment was pivotal to our modern understanding of classical conditioning, it has never been replicated since. This is because there are now ethical considerations psychologists must account for when working with human subjects, that Watson and Rayner did not observe in their experiment.

### THEORY DETAILS

As you learned in lesson 1E: Ethical considerations, modern psychologists must adhere to a rigorous set of ethical guidelines in order to perform experiments, particularly experiments that involve human subjects.

This ethical code was not established at the time when Watson and Rayner conducted their experiment. By today's standards, the Little Albert experiment would not meet the following ethical considerations and would not have been approved by an ethics committee:

- **Participant rights:** Given his age, Little Albert was not able to advocate for himself. In modern experiments involving young children, parents are able to advocate for their rights. There is no record of Little Albert's mother being present during the experimental trials, and so it is reasonable to infer that she was not able to exercise his participant rights in this experiment.
- **Withdrawal rights:** Within all experiments, participants should be able to freely choose to leave the experiment. When Little Albert showed distress during the experimental trials, the experimenters did not take this as a wish to withdraw and instead persisted with agitating him for the purposes of the experiment.
- **Confidentiality:** Although Little Albert's real name was hidden for his privacy, there are widely available public records of the experiment, including videos that identify him, therefore breaching confidentiality.
- **Informed consent:** Although his mother did consent for his participation in the experiment, it is unclear whether this was informed. It is likely that she did not know the full details of the experiment and as such was not able to make an informed decision when consenting.
- **Debriefing:** In this experiment, debriefing should have included the experimenters extinguishing Little Albert's conditioned fear response. However, because his mother moved away with him before the conclusion of the experiment, this never occurred.
- **No-harm principle:** Participants in any psychological experiments should not experience any psychological or physiological harm. During the experiment, Little Albert was put under great psychological distress. Further, as his fear response was never extinguished, the lasting effects of his conditioned response may have caused ongoing psychological harm.
- **Beneficence:** Although the experiment did contribute to our modern understanding of classical conditioning, arguably, the benefits of the research did not outweigh the harm that it caused Little Albert.

### Useful tip

One way to remember some of the ethical considerations that were breached in the Little Albert experiment is by using the acrostic "Baby Was Not Informed", where the first letter of each word stands for an ethical consideration:

- Beneficence
- Withdrawal rights
- No-harm principle and
- Informed consent.



To revise ethical considerations in psychological research, turn back to lesson 1E: Ethical considerations.

### Want to know more?



"Little Albert" is a pseudonym that was used to protect the identity of the baby boy who was the subject of the experiment. However, many video recordings were taken of the experiments. These videos can still be found using a quick search of 'Little Albert' on YouTube.

**Figure 2** The experiments performed on Little Albert were recorded and parts of the video footage are still available today. This is a still image from one of the recordings that demonstrates Little Albert's fear response being generalised to other furry stimuli, such as this rabbit.

## Theory summary

In this lesson, you have learned about the Little Albert experiment as a case study of classical conditioning. You should be able to outline the stages of classical conditioning as it occurred in the experiment, referring to the NS, UCS, UCR, CS and CR. You should be able to discuss the ethical implications of this experiment with reference to the ethical guidelines that were breached.

# 5B QUESTIONS

## Theory review questions

### Question 1

Use the key term from the lesson to fill in the blanks.

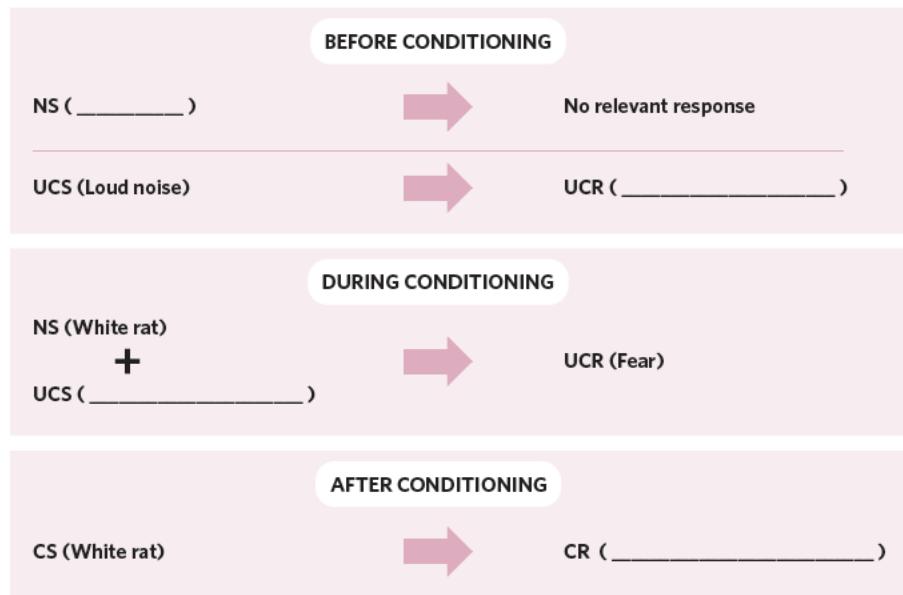
- No-harm principle
- Informed consent
- Withdrawal rights
- Beneficence
- Debriefing/deconditioning

By modern standards, the Little Albert experiment breached many ethical guidelines:

- a \_\_\_\_\_ was not given by Little Albert's mother, as she did not know the nature or details of the experiment.
- b \_\_\_\_\_ were not exercised, as Little Albert was not allowed to leave the experiment, despite displaying severe distress.
- c \_\_\_\_\_ did not occur, because Little Albert's mother moved away with him before the conclusion of the study. As such, the long-term effects of the experiments are unknown.
- d The \_\_\_\_\_ was not observed, because Little Albert experienced psychological harm.
- e \_\_\_\_\_ was not observed, because the benefits of the experiment did not outweigh the harm caused to the participant.

### Question 2

Fill in the blanks to outline the three phases of classical conditioning that occurred in the Little Albert experiment.



**Exam-style questions****Apply and analyse****Question 3** (1 MARK)

With regard to current ethical standards, which of the following guidelines was not observed in the Little Albert experiment?

- A Withdrawal rights when Little Albert demonstrated severe distress.
- B Informed consent, as Little Albert was too young to properly give consent.
- C Deception, as Little Albert and his mother were deceived about the nature of the experiments.
- D Confidentiality, as the Little Albert experiment is now widely known and studied.

**Question 4** (1 MARK)

With reference to classical conditioning, the unconditioned response in the Little Albert experiment was

- A fear in response to the white rat.
- B fear in response to stimuli that were white or furry, such as a white mask or a rabbit.
- C fear in response to the loud noise of the hammer striking the metal bar.
- D fear in response to the experimenters.

**Question 5** (1 MARK)

If stimulus discrimination had occurred, Little Albert would only respond with fear to

- A the white rat.
- B the loud noise of the hammer striking the metal bar.
- C stimuli that is white.
- D the experimenters.

**Question 6** (2 MARKS)

Identify and explain one current ethical standard that was not observed in the Little Albert experiment.

**Questions from multiple lessons****Question 7** (1 MARK)

Which of the following neurohormones was primarily involved in Little Albert learning to fear white rats?

- A Glutamate
- B Adrenaline
- C GABA
- D Serotonin

**Question 8** (1 MARK)

Identify the nervous system that was dominant when Little Albert was fearful of the white rat.

**Question 9** (2 MARKS)

In terms of the biological processes of stress, list two nervous system changes that Little Albert would have experienced when he saw the white rat after conditioning.

**Question 10** (4 MARKS)

Suppose Watson and Rayner had the opportunity and were able to successfully extinguish Little Albert's fear response.

- a Describe the role of long-term depression in the extinction of Little Albert's learned fear response. (2 MARKS)
- b Explain how spontaneous recovery might have occurred following Watson and Rayner extinguishing this response. (2 MARKS)

**Key science skills****Question 11** (2 MARKS)

Outline a limitation of the experimental design used by Watson and Rayner in the Little Albert experiment.  
Justify your response.

**Question 12** (2 MARKS)

In Watson and Rayner's experiment on Little Albert, they collected data by writing down descriptions of their observations.  
Identify the type of data that Watson and Rayner collected and outline one limitation of this data type.

**Question 13** (4 MARKS)

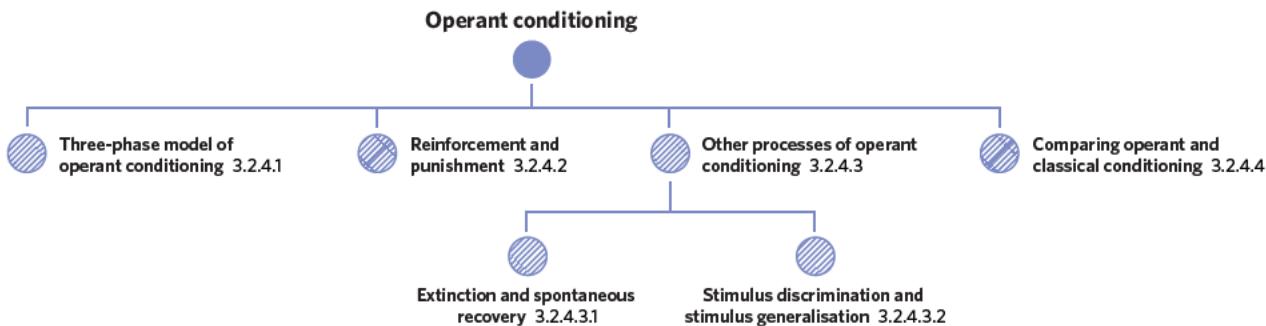
Comment on the validity of results obtained in the Little Albert experiment, referring to both internal and external validity.

# 5C OPERANT CONDITIONING

So far in this chapter, you have learned about classical conditioning as a model of learning, as well as a historical case study that highlights this. In this lesson, you will be learning about another model of learning where the learner is active, rather than passive, in their learning. This model is called operant conditioning.

5A. Classical conditioning	5B. The Little Albert experiment	5C. Operant conditioning	5D. Observational learning
<b>Study design dot point</b>			
<ul style="list-style-type: none"> <li>operant conditioning as a three-phase model (antecedent, behaviour, consequence) involving reinforcers (positive and negative) and punishment (including response cost) that can be used to change voluntary behaviours, including stimulus generalisation, stimulus discrimination and spontaneous recovery (excluding schedules of reinforcement)</li> </ul>			
<b>Key knowledge units</b>			
Three-phase model of operant conditioning			3.2.4.1
Reinforcement and punishment			3.2.4.2
Extinction and spontaneous recovery (Other processes of operant conditioning)			3.2.4.3.1
Stimulus discrimination and stimulus generalisation (Other processes of operant conditioning)			3.2.4.3.2
Comparing operant and classical conditioning			3.2.4.4

In this lesson, you will be learning about **operant conditioning**, which is another type of learning involving association. This time, the association is between a stimulus, a behaviour the learner performs and the consequence the learner receives as a result.



## Three-phase model of operant conditioning 3.2.4.1

### OVERVIEW

Operant conditioning is another type of learning involving association. This time, learning occurs through the association between a stimulus, a behaviour performed and the resulting consequence.

As such, operant conditioning can be thought of as a model of learning in which the learner actively operates on their environment, where learning occurs secondary to the consequences they receive.

### THEORY DETAILS

Operant conditioning can also be understood as learning that occurs through three phases: antecedent, behaviour and consequence.

#### Three-phase model: A-B-C

The three-phase model of **operant conditioning** divides the learning of a response into three distinct steps. A helpful mnemonic to remember these is the acronym ABC. Figure 1 outlines each step.

**Operant conditioning** learning through the association of a behaviour and the consequence it receives

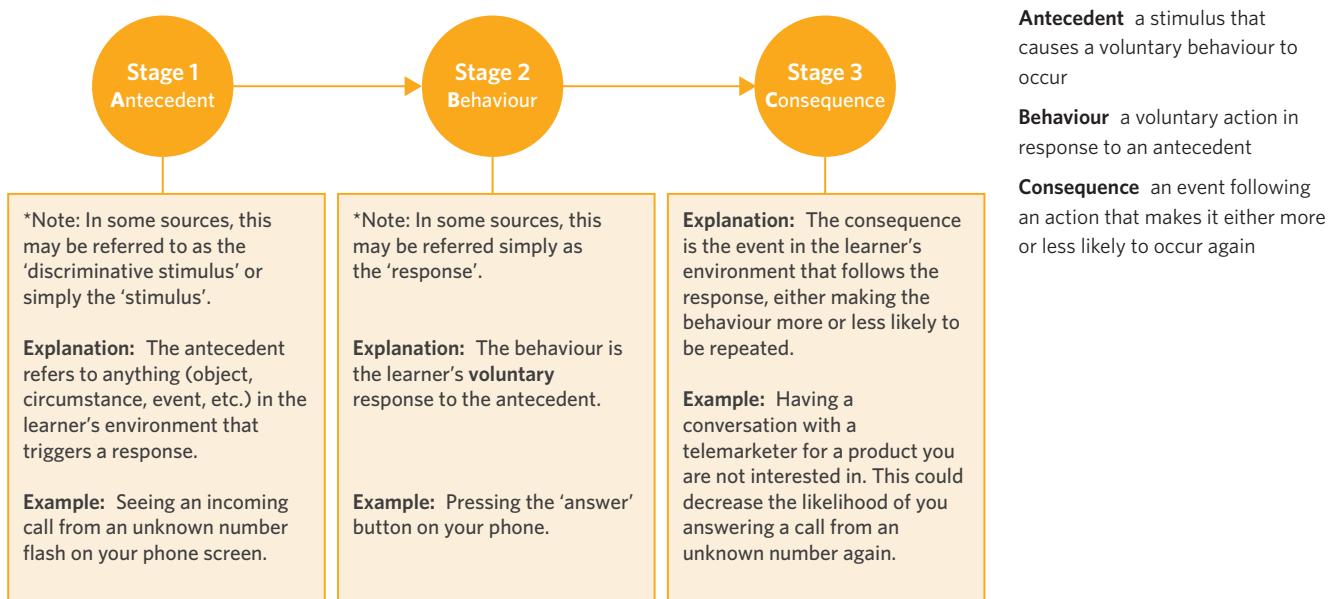


Figure 1 ABC model of operant conditioning

#### Useful tip

- There are many similarities between classical and operant conditioning, however it is important to know their differences.
- In classical conditioning the three-phase model is before, during and after conditioning, whereas in operant conditioning it is the antecedent, behaviour and consequence.
- One of the key differences between classical conditioning and operant conditioning is that while the response in classical conditioning is involuntary, the response/behaviour in operant conditioning is voluntary, that is, the learner chooses to perform the behaviour.

## Reinforcement and punishment 3.2.4.2

### OVERVIEW

The 'consequence' phase of the three-phase model can be explored in further detail. This stage determines the likelihood of the behaviour occurring again.

### THEORY DETAILS

The third phase of operant conditioning is the consequence. Consequences can be broadly categorised into:

- those that *increase* the learner's desire to repeat the behaviour: **reinforcement**, and
- those that *decrease* the learner's desire to repeat the behaviour: **punishment**.

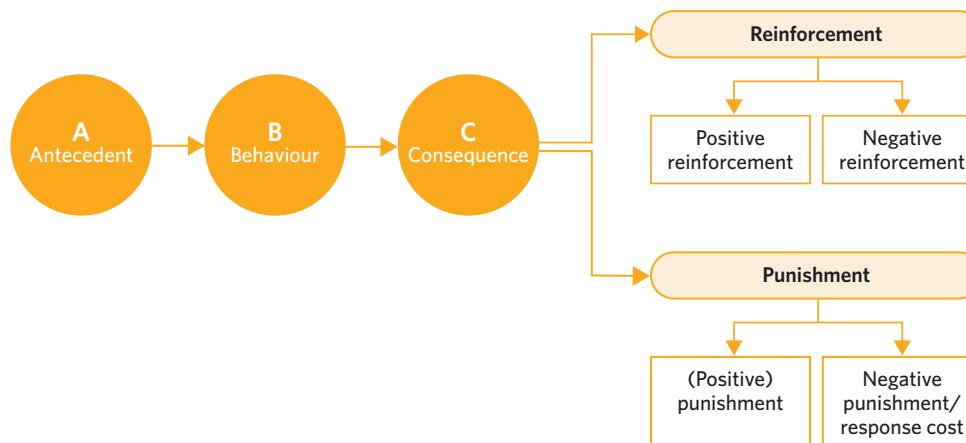


Figure 2 The consequence stage can be further categorised as reinforcement or punishment

## Reinforcement

**Reinforcement** may be thought of as a rewarding consequence for a behaviour. This explains why it increases the likelihood of the behaviour occurring again. A reinforcer is any stimulus that strengthens or increases the frequency of a response that it follows.

There are two types of reinforcement you should be familiar with:

- Positive reinforcement
- Negative reinforcement

The first is **positive reinforcement**. Here, ‘positive’ may be thought of in the mathematical ‘addition’ sense, as opposed to something that is ‘good’. For example, when a child does the dishes, positive reinforcement refers to the addition of a desirable consequence, such as giving the child a lolly, thereby increasing the likelihood that the child will repeat this behaviour.

The second type is **negative reinforcement**, again not to be confused with something ‘bad’ but rather the ‘subtraction’ of something to produce a desirable circumstance. For example, a child that does their homework before 8pm may be relieved of their chores for that evening. In this sense, negative reinforcement refers to the removal of an undesirable stimulus to produce a desirable outcome, thereby increasing the likelihood that the child will repeat this behaviour.

## Punishment

**Punishment** may be thought of as an undesirable consequence for a behaviour. This explains why it decreases the likelihood of the behaviour occurring again.

Punishment too may be divided into two types:

- **Positive punishment**
- Negative punishment, usually referred to as **response cost**

Positive punishment refers to the ‘addition’ of an unwanted stimulus. For example, if a child does not submit their homework, they may receive a poor grade from their teacher (an undesirable consequence).

Alternatively, punishment may also involve the removal of a desirable stimulus. This is referred to as ‘response cost’, because the learner’s ‘response’ comes at the ‘cost’ of something they desire. For example, a child who fails to finish their chores may lose their internet and games privileges.

**Table 1** Summary of types of reinforcement and punishment

	Increases the behaviour	Decreases the behaviour
<b>Something is added (+)</b>	Positive reinforcement	Positive punishment
<b>Something is taken away (-)</b>	Negative reinforcement	Response cost (negative punishment)

### Useful tip

Most VCAA questions on operant conditioning require the use of distinct terminology. Often, a question might be phrased as ‘Using the language of operant conditioning, explain...’. This means that the key terms antecedent, behaviour and consequence are essential for gaining full marks.

If the question asks about a consequence, be sure to specify the exact type of reinforcement or punishment involved and whether it will make the behaviour more or less likely to occur again.

## Other processes of operant conditioning 3.2.4.3

### OVERVIEW

Just as in classical conditioning, a behaviour that has been learned through operant conditioning can become extinguished over time, and might spontaneously reappear again. The learner can also display stimulus discrimination and stimulus generalisation when presented with similar or different antecedents for the learned behaviour.

**Reinforcement** a type of consequence that makes the behaviour more likely to occur again

**Positive reinforcement** when a stimulus is added in order to encourage a behaviour to occur again

**Negative reinforcement** when a stimulus is removed in order to encourage a behaviour to occur again

**Punishment** a type of consequence that makes the behaviour less likely to occur again

**Positive punishment** when a stimulus is added in order to discourage a behaviour from occurring again

**Response cost (also known as negative punishment)** when a stimulus is removed in order to discourage a behaviour occurring again

## THEORY DETAILS

### Extinction and spontaneous recovery 3.2.4.3.1

**Extinction** is when the conditioned behaviour no longer occurs. In the context of operant conditioning, this is when the behaviour is not shown despite the presence of the antecedent. This can occur when the learner exhibits the behaviour several times without it being followed by the consequence.

**Spontaneous recovery** occurs when a learned behaviour reappears (in the presence of the antecedent) after a period of extinction.

#### Example:

The example in figure 3 illustrates how extinction and spontaneous recovery may occur when teaching a dog how to sit on command. In this example, the command ‘sit’ is the antecedent, the dog sitting is the behaviour, and the dog receiving a treat is the consequence. After this process is repeated several times, the dog learns that sitting on command will result in the reward of a treat.

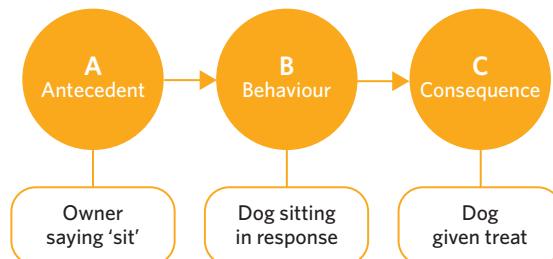


Figure 3 ABC model of example

At this point, the dog has been conditioned to sit on command. However, if the dog no longer received the desirable consequence of the treat after sitting, this lack of reinforcement could lead to extinction of the learned behaviour in response to the antecedent, resulting in the dog ignoring the command ‘sit’.

Following the extinction of the dog’s conditioned behaviour and a rest period, the dog may once again display the learned response to the antecedent and sit on command. This is known as spontaneous recovery, wherein a learned behaviour reappears in response to an antecedent, in the hope of producing the desired consequence, after a period of extinction.

### Stimulus discrimination and stimulus generalisation 3.2.4.3.2

As in classical conditioning, the learner can also display stimulus discrimination and stimulus generalisation in operant conditioning.

In operant conditioning, **stimulus discrimination** occurs when a learned behaviour does *not* occur in presence of an antecedent similar to the one present when the behaviour was first learned. This may be the result of expecting a certain consequence. For example, a dog who learns to sit on command may not perform the ‘sit’ behaviour for another person if they do not expect a treat in return. This means they are ‘discriminating’ between who (or what) will provide the reinforcement.

Alternatively, **stimulus generalisation** occurs when the learned behaviour occurs in the presence of antecedents similar, though not identical, to the original antecedent. In this case, the dog may sit for many people, or even in response to words other than ‘sit’. This occurs in the hope that the learned behaviour to similar antecedents will provide the same desirable consequence as the original antecedent.

### Comparing operant and classical conditioning 3.2.4.4

#### OVERVIEW

As you have probably noticed, classical and operant conditioning are similar in that they are both learning through forms of association. This can make it tricky to distinguish between the two in an exam.

#### THEORY DETAILS

Table 2 summarises the key differences to look out for when considering if an example is operant or classical conditioning.

**Extinction** when the conditioned behaviour no longer occurs in response to an antecedent, for an extended period of time

**Spontaneous recovery** when the behaviour occurs in response to the antecedent again, following a period of extinction

#### Useful tip

- Extinction requires the behaviour not to occur for several trials or a period of time in the presence of the antecedent.
- Spontaneous recovery **must** follow a period of extinction, not just a period of inactivity.

**Stimulus discrimination** when the behaviour occurs in response to a specific antecedent only

**Stimulus generalisation** when the behaviour occurs in response to a similar, but different, antecedent

**Table 2** Comparing classical and operant conditioning

Feature	Classical conditioning	Operant conditioning
<i>This three-phase model of learning involves</i>	before conditioning, during conditioning and after conditioning.	antecedent, behaviour and consequence.
<i>Learned through association of</i>	the repeated presentation of the unconditioned stimulus (UCS) with the neutral stimulus (NS).	a behaviour in response to a certain antecedent, and the consequence it receives.
<i>The order and timing during learning</i>	The unconditioned stimulus (UCS) must be presented 0.5 seconds <b>after</b> the neutral stimulus (NS).	The consequence occurs <b>after</b> the behaviour. It can be presented soon after the behaviour or there can be a delay.
<i>The learner is</i>	passive.	active.
<i>The nature of the response is</i>	involuntary and unconscious.	voluntary and conscious.
<i>Stimulus generalisation occurs when</i>	stimuli that are similar to the conditioned stimulus (CS) triggers the conditioned response (CR).	the learned behaviour occurs in the presence of an antecedent similar to the antecedent present during learning.
<i>Stimulus discrimination occurs when</i>	stimuli that are similar to the conditioned stimulus (CS) does not trigger the conditioned response (CR).	the learned behaviour does not occur in the presence of an antecedent similar to the antecedent present during learning.
<i>Extinction may occur because</i>	the conditioned stimulus (CS) is repeatedly presented alone and so its association with the unconditioned stimulus (UCS) is lost.	the learned behaviour no longer receives the desirable consequence.
<i>Spontaneous recovery occurs when</i>	the conditioned response (CR) reappears after a period of extinction.	the learned behaviour to a certain antecedent reappears, after a period of extinction.

## Theory summary

In this lesson, you have learned about the three-phase model of operant conditioning as a model of voluntary learning. You should now be able to describe and provide examples for each stage, and distinguish between the different types of consequences. Remember, it is important to be able to distinguish between operant and classical conditioning on the basis of stimulus generalisation, stimulus discrimination, extinction and spontaneous recovery.

## 5C Activities

- 1 Copy the following table in your books, and fill out the “ABC” for each scenario. Be sure to specify the type of consequence occurring.

Scenarios:

- I Keira wants her boyfriend James to take her out on dates more often. Whenever she and James stay home for the night, Keira complains she is bored. One night recently, James took her out to the movies and Keira thanked him several times and bought him popcorn.
- II Abe is in a band with Bill, and hates when Bill improvises when they perform. One day they had a show in front of a lot of people and Bill improvised his own verse without warning the rest of the band. After the set, Abe scolded Bill and said it was the worst rendition of their song yet.
- III Lizzie and Dora live in a shared apartment. Dora is very clean and doesn't like the way Lizzie cleans the kitchen, as she often leaves bits of food everywhere. After Lizzie cooks, she attempts to clean the kitchen but it is still fairly dirty. The next morning, Dora doesn't offer to make Lizzie a coffee as she usually does.
- IV Martha always asks her son George to help wash their enormous dog Chew. One day Chew came home from the creek with mud all in his fur. George ran Chew a bath and washed him. Martha was so impressed with George's initiative that she said he didn't have to cook dinner that night, even though it was his turn.
- V Lola hates doing maths homework, but has decided to buckle down for year 12 and force herself to do it. Whenever she does half an hour of maths homework without looking at her phone or computer, she gives herself a chocolate caramel.

	Scenario characters	Antecedent	Behaviour	Consequence and type
I	Keira and James			
II	Abe and Bill			
III	Lizzie and Dora			
IV	Martha and George			
V	Lola			

## 5C QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                          |                           |                           |
|--------------------------|---------------------------|---------------------------|
| ▪ Antecedent             | ▪ Stimulus generalisation | ▪ Stimulus discrimination |
| ▪ Extinction             | ▪ Negative reinforcement  | ▪ Spontaneous recovery    |
| ▪ Behaviour              | ▪ Punishment              | ▪ Active and voluntary    |
| ▪ Consequence            | ▪ Positive punishment     | ▪ Passive and involuntary |
| ▪ Reinforcement          | ▪ Operant conditioning    |                           |
| ▪ Positive reinforcement | ▪ Response cost           |                           |
- a A form of learning in which associations are created between the behaviour and consequence \_\_\_\_\_
- b A stimulus that causes a voluntary behaviour to occur \_\_\_\_\_
- c A voluntary response to an antecedent \_\_\_\_\_
- d A stimulus following the behaviour that either increases or decreases the likelihood of it occurring again \_\_\_\_\_
- e The type of learning involved in operant conditioning \_\_\_\_\_
- f The general term that describes any stimulus that increases the likelihood of a behaviour occurring again \_\_\_\_\_
- g A type of consequence that involves adding a stimulus to encourage a behaviour to occur again \_\_\_\_\_
- h A type of consequence that involves taking away a stimulus to encourage a behaviour to occur again \_\_\_\_\_
- i A type of consequence that discourages a behaviour from occurring again \_\_\_\_\_
- j A type of consequence that involves taking a stimulus away to discourage a behaviour from occurring again \_\_\_\_\_
- k When the learner distinguishes between antecedents, and only responds to specific antecedents with specific behaviours \_\_\_\_\_
- l When the learner responds to similar antecedents with the same behaviour \_\_\_\_\_
- m This occurs when the behaviour is not followed by the consequence over a period of time \_\_\_\_\_
- n This occurs following a period of extinction, where the learner responds to the antecedent with the behaviour again \_\_\_\_\_
- o The type of learning involved in classical conditioning \_\_\_\_\_
- p The addition of an undesirable consequence used to discourage behaviour \_\_\_\_\_

#### Question 2

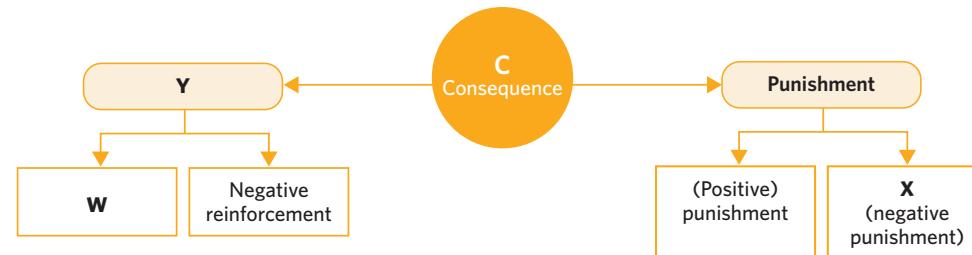
The steps in the three-phase model of operant conditioning in order are

- A behaviour, antecedent, consequence.
- B antecedent, consequence, behaviour.
- C antecedent, behaviour, consequence.
- D consequence, antecedent, behaviour.

**Question 3**

Which option correctly labels the types of consequences in operant conditioning?

	W	X	Y
A	Reinforcement	Positive reinforcement	Response cost
B	Response cost	Reinforcement	Positive reinforcement
C	Positive reinforcement	Response cost	Reinforcement

**Exam-style questions***Remember and understand***Question 4** (1 MARK)

In operant conditioning, extinction may occur because

- A the behaviour is not followed by the consequence previously associated with it.
- B the behaviour is generalised to other similar situations.
- C only reinforcement is used.
- D punishment is not used.

**Question 5** (1 MARK)

In operant conditioning, the nature of the response and the role of the learner are, respectively,

- A voluntary, active.
- B involuntary, passive.
- C voluntary, passive.
- D involuntary, active.

**Question 6** (2 MARKS)

Outline how spontaneous recovery occurs in operant conditioning.

*Apply and analyse***Question 7** (1 MARK)

Clarence has learned to choose which parent he should ask to play soccer with him depending on who seems more tired. What is Clarence's behaviour an example of?

- A positive reinforcement
- B response cost
- C stimulus generalisation
- D stimulus discrimination

**Use the following scenario for questions 8–10.**

Three year old Megan always cries when her mother tries to buckle her into her car seat. One evening, Megan's mother gave her a chocolate and was then relieved to be able to finish buckling Megan into her seat in peace and quiet.

**Question 8** (1 MARK)

In terms of the three-phase model of operant conditioning, if the antecedent stimulus in this scenario is considered to be the mother buckling Megan into her seat, then the behaviour would be

- A Megan eating the chocolate.
- B Megan crying.
- C Megan quietly buckling herself into the seat.
- D Megan stopping the kicking and screaming.

**Question 9** (1 MARK)

In many situations, parents and children can reinforce each other.

If the antecedent stimulus is now considered to be Megan crying, then the operant response or behaviour would be her mother

- A giving Megan a chocolate.
- B continuing to buckle Megan into her car seat.
- C being relieved that Megan has stopped crying.
- D asking Megan to stop crying.

**Question 10** (1 MARK)

In terms of operant conditioning, the relief experienced by Megan's mother when Megan stops crying after she has received the chocolate is an example of

- A punishment.
- B response cost.
- C reinforcement.
- D negative reinforcement.

**Question 11** (3 MARKS)

Explain the key difference between reinforcement and punishment in operant conditioning and provide an example of each.

**Question 12** (3 MARKS)

Ginny has a parrot called Red who she wants to teach to squawk on command. Using the language of the three-phase model of operant conditioning, name each phase and provide examples as to how Ginny might teach Red this trick.

Phase 1:

Phase 2:

Phase 3:

**Question 13** (3 MARKS)

Jeremy competes in a high-level maths competition. On the last two occasions that he won the competition, he used his gold pen. Jeremy now uses his gold pen every time he competes, believing it to be his 'lucky pen'.

Using the language of operant conditioning, explain how Jeremy has learned to use his lucky gold pen every time he competes.

**Questions from multiple lessons****Use the following scenario for questions 14 and 15.**

Skye is a very small and clever dog. When she was a puppy, she learned that the loud buzz of the lawnmower is followed by a big green machine that chases her. Now, when she hears the loud buzz of the lawnmower, Skye begins to tremble even before she sees the machine coming around the corner. Skye has also learned that when she hears the lawnmower, she can run through the dog door into the house, where she feels safe.

**Question 14** (1 MARK)

Skye's response of trembling when she hears the sound of the lawnmower and her response of running indoors are, respectively, examples of

- A classical conditioning, operant conditioning
- B operant conditioning, classical conditioning
- C operant conditioning, observational learning
- D observational learning, classical conditioning

**Question 15** (1 MARK)

In this scenario, a distinction can be made between the types of learning because Skye's trembling at the sound of the lawnmower

- A is a voluntary response, whereas running indoors is a reflexive response.
- B is an involuntary response, whereas running indoors is a voluntary response.
- C indicates an active participant, whereas running indoors indicates a passive participant.
- D reflects the process of stimulus generalisation, whereas running indoors reflects the process of stimulus discrimination.

**Question 16** (4 MARKS)

Judd is in year 12 and is preparing for his VCE exams. Throughout the year, he has been practising meditation any time that he begins to feel stressed. For example, before his last psychology SAC he could feel his palms becoming clammy and his heartbeat racing. He practised a five minute meditation and began to feel calm.

- a With reference to the nervous systems, explain why practising meditation would help Judd feel calm. (2 MARKS)
- b Using the language of operant conditioning, identify the type of consequence that meditation leads to. Justify your response. (2 MARKS)

**Question 17** (5 MARKS)

Dylan taught his dog Simba how to jump through a hoop. He did this by holding a hoop on the ground and rewarding Simba with a treat each time he walked through the hoop. Dylan then lifted the hoop higher and higher off the ground and gave Simba a treat each time he jumped through it. Now when they have guests over, Simba excitedly runs around when he sees Dylan going to get the hoop to show Simba's trick.

Explain how both operant and classical conditioning are occurring in this scenario.

**Key science skills****Question 18** (8 MARKS)

Kurt wanted to test whether positive reinforcement or negative reinforcement was more effective in changing someone's behaviour long term. In order to do this he recruited two groups of people. One group were given a lolly for every question answered correctly, and another group were let out of class one minute earlier for every correct question.

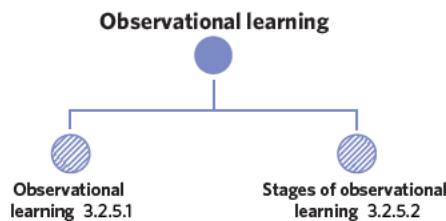
- a Identify the independent and dependent variables in Kurt's experiment. (2 MARKS)
- b Write a possible hypothesis for Kurt's experiment. (3 MARKS)
- c Name the experimental design Kurt used. (1 MARK)
- d Explain why using a repeated-measures design for this experiment would not work. (2 MARKS)

# 5D OBSERVATIONAL LEARNING

So far in this chapter, you have learned about two frameworks that explain how organisms learn: classical and operant conditioning. Now, you will be learning about a third framework that focuses on learning through observation. In particular, you will learn how this framework relates to children and the way in which they pick up new behaviours.

5A. Classical conditioning	5B. The Little Albert experiment	5C. Operant conditioning	5D. Observational learning
<b>Study design dot point</b>			
▪ observational learning as a method of social learning, particularly in children, involving attention, retention, reproduction, motivation and reinforcement			
<b>Key knowledge units</b>			
Observational learning			3.2.5.1
Stages of observational learning			3.2.5.2

In this lesson, you will be learning about a model of social learning called **observational learning**. You will be learning about the **five stages** that this type of learning involves, as well as how it contributes to our modern understanding of how children learn new skills and behaviours.



## Observational learning 3.2.5.1

### OVERVIEW

Observational learning emphasises that children learn through the environment around them, specifically through watching (the observation of) other people's actions.

### THEORY DETAILS

While the classical and operant conditioning frameworks of learning emphasise the association between different stimuli, observational learning theory emphasises the social environment in which organisms learn. **Observational learning** (also referred to as social learning, vicarious conditioning or modelling) highlights that young children, in particular, learn new behaviours through watching (observing) the actions of others.

Have you ever been at a family dinner and seen young children mimicking their parents or others around them? This occurs because when children see people they admire performing certain behaviours and receiving positive consequences, they, as a result, realise that they too may be rewarded for reenacting that behaviour.

Observational learning is also known as 'modelling' because the person who the learner is observing is 'modelling' (or demonstrating) the behaviour to be learned. The **model** is the person who is demonstrating the behaviour. Observational learning helps to explain how children learn new behaviours, as well as values and attitudes through the observation of the people around them.

**Observational learning** (also known as **social learning**, **vicarious conditioning**, or **modelling**) a type of learning that occurs through watching the actions of a model and the consequences that their actions receive

**Model** the individual who is performing the behaviour that is being watched/observed

**Want to know more?**

Observational learning is also known as vicarious conditioning because, unlike in operant conditioning, the learner does not need to experience the consequence directly. If the learner observes another person's behaviour, they can learn whether or not to repeat that behaviour 'vicariously', through observing the consequence it receives.

For example, if a child sees one of their peers in class get a reward for volunteering a response to a question, they learn that this positive reinforcement occurs for that behaviour. The next time their teacher asks for someone to volunteer, the learner might volunteer a response in the hope of receiving this positive reinforcement. This is due to having learned this connection between the behaviour and consequence, despite not experiencing the consequence directly themselves when the learning took place.

**Useful tip**

One way of remembering the 'model' in observational learning is thinking of a 'role-model'. The model doesn't have to be a real person, it can even be a fictitious character in a book or on TV. In fact, Bandura (1963) identified three types of models: live (where the behaviour is demonstrated by a person), verbal (where the model doesn't perform the behaviour, just describes it) or symbolic (where the model is a character, real or fictional, such as from a book, film or tv show).

The key thing to remember is that learners are more likely to be motivated to reproduce the behaviours of models that they identify with or look up to. That is, the closer the relationship between the model and the learner, or the more the learner perceives the model as having desirable qualities, the more likely it is that they will be motivated to learn through observational learning.



Image: Fizkes/Shutterstock.com

**Figure 1** Observational learning occurs when a learner imitates the behaviours of a model. This type of learning is most common in children.



Image: Piyawat Nandeenopparit/Shutterstock.com

**Figure 2** Animals can also learn through observational learning. Here, a monkey has observed humans drinking from bottles and is demonstrating the same behaviour.

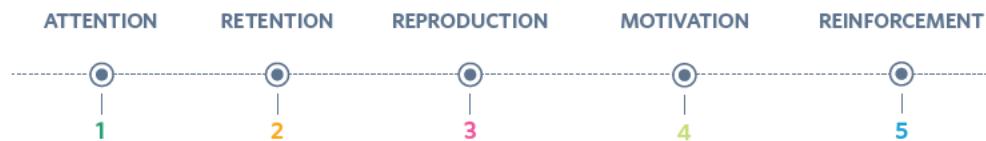
## Stages of observational learning 3.2.5.2

### OVERVIEW

There are five stages of observational learning that a learner must go through in order to successfully learn a behaviour through social learning. These are: attention, retention, reproduction, motivation and reinforcement. A learner must go through each stage in order for learning to be successful.

### THEORY DETAILS

The five stages of observational learning are represented in figure 3.



**Figure 3** The five stages of observational learning

#### Attention

The first stage of observational learning involves the learner paying active attention and focussing on the actions of the model. If the learner is not paying active attention, it is unlikely they will retain the information required to later reproduce the behaviour.

#### Retention

In the retention stage, the learner is storing the information that they have just observed as a mental representation. This means this information is stored within the relevant brain structures for the learner to access later on.

#### Reproduction

The reproduction stage requires that the learner has both the mental and physical capabilities required to reproduce the behaviour. For example, even if you pay attention to, and are able to retain the image of a model rock-climber, you might not have the physical ability to successfully reproduce the behaviour of climbing a cliff face.

**Attention** the first stage of observational learning. Learners must actively focus on the model in order to learn

**Retention** the second stage of observational learning. The learner must create a mental representation and remember (retain) the behaviour the model has demonstrated

**Reproduction** the third stage of observational learning. The learner must have the physical and mental capabilities to reproduce the observed behaviour

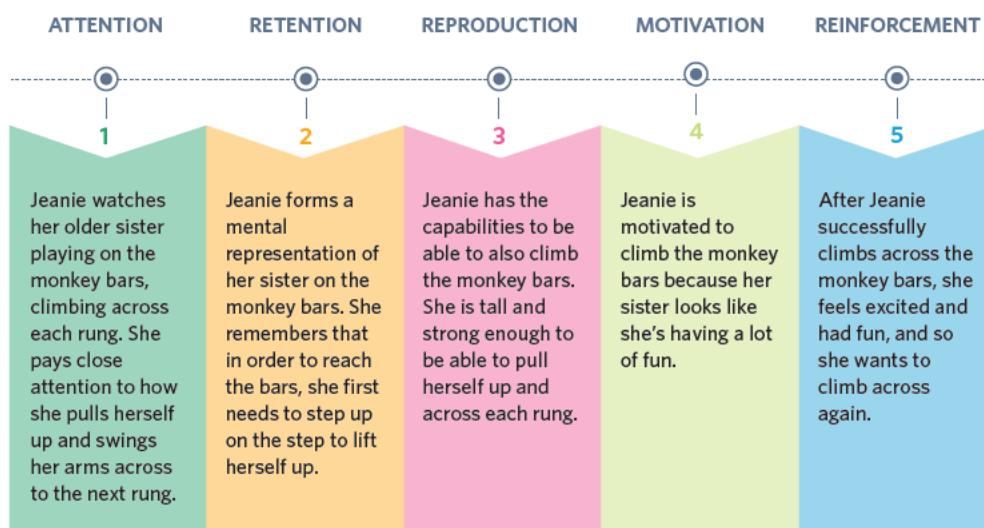
## Motivation

One aspect that distinguishes observational learning from classical and operant conditioning is that in observational learning, the learner has the most active role. In order for observational learning to be successful, the learner must first be motivated to perform the behaviour. This motivation can be either intrinsic (motivation from within the individual, such as the desire to do well in a test) or extrinsic (motivation that is external to the individual, such as a reward from a parent for doing well).

## Reinforcement

Once the learner has successfully performed the behaviour, receiving the consequence of reinforcement increases the likelihood the learner will repeat the behaviour. This reinforcement can come in many forms, whether it is self-reinforcement (through factors internal to the learner) or external reinforcement. Reinforcement can also occur vicariously, where the learner is reinforced indirectly through hearing or observing the consequence of another's behaviour. This can influence the learner's motivation, and increase the likelihood of the learner demonstrating the behaviour, despite not experiencing reinforcement directly.

### Example:



While children may learn many behaviours, skills, attitudes and values through observational learning, it has been shown to be an effective technique in some types of learning more than others. It is particularly behaviours that are procedural and follow a certain sequence of movements that are best learned through observational learning. This is because the learner carefully observes these sequences of actions, making them more likely to be able to reproduce them. However, skills that are more complex and require declarative knowledge, such as learning to drive, generally cannot be learned by observational learning alone and require more detailed instruction.

### Want to know more?

One of the most notable studies on observational learning was Bandura's studies on children and aggressive behaviour, conducted in 1961. Collectively, these experiments are known as the 'Bobo doll experiments'. In these experiments, Bandura wanted to investigate whether violent social behaviours could be learned through observation.

In these experiments, the participating children were exposed to either an aggressive adult model, who displayed aggressive and violent behaviours towards a bobo doll, or a non-aggressive model, who played with the doll in a quiet and subdued manner. There was also a third control condition, where the participating children were not exposed to any model.

The results of the experiments showed that children who were exposed to the aggressive model displayed more violent behaviours towards the bobo dolls in comparison to the other conditions.

Today, Bandura's findings remain at the centre of modern debates concerning the impact of exposing children to violence, such as violent television programs or video games.

**Motivation** the fourth stage of observational learning. The learner must want to reproduce the behaviour in order for learning to occur

**Reinforcement** the fifth stage of observational learning. If the learner receives a desirable consequence for their behaviour, they are more likely to reproduce the behaviour again in the future

### Useful tip

The stages of attention, retention, reproduction and motivation all occur before the learner performs the behaviour. This is one of the reasons why learners are most active when learning through observational learning. The only stage that occurs after the behaviour is reinforcement.



One way of remembering the five stages of observational learning in order is through the narrative chain "All Rude Rodents Munch Raspberries" where the beginning letter of each word stands for a stage of observational learning: **A**ttention, **R**etention, **R**eproduction, **M**otivation, **R**einforcement.



Image: Light-Dew/Shutterstock.com

## Theory summary

In this lesson, you have learned about the third theory of learning: social learning theory, or observational learning. This theory outlines how children learn through observation, specifically through the five stages of attention, retention, reproduction, motivation and reinforcement. You should now be able to describe these five stages, as well as identify which stage a learner has achieved or not achieved in a given scenario. You should also be able to compare and contrast the three models of learning: classical conditioning, operant conditioning and observational learning to identify which model of learning is most relevant in a given scenario.

## 5D Activities

- Fill in the following table to compare classical conditioning, operant conditioning and observational learning.

	Classical conditioning	Operant conditioning	Observational learning
Stages			
Role of learner			
Role of consequence			
An example or case study			

## 5D QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                          |                |              |
|--------------------------|----------------|--------------|
| ▪ Social learning theory | ▪ Model        | ▪ Attention  |
| ▪ Retention              | ▪ Reproduction | ▪ Motivation |
| ▪ Reinforcement          |                |              |
- a The learner must actively focus on the actions of the model \_\_\_\_\_  
 b A type of consequence that makes the learner more likely to perform the behaviour again \_\_\_\_\_  
 c A learner must have the mental and physical capabilities in order to perform a behaviour and successfully learn \_\_\_\_\_  
 d Either intrinsic or extrinsic, a learner must have this desire in order to want to reproduce the behaviour \_\_\_\_\_  
 e A mental representation of the actions the learner has just observed \_\_\_\_\_  
 f Also known as vicarious conditioning or modelling, this theory emphasises the role of observation in children learning \_\_\_\_\_  
 g The individual whose behaviour is watched by the learner \_\_\_\_\_

#### Question 2

Put the stages of observational learning in the correct order:

- |                 |                |             |
|-----------------|----------------|-------------|
| ▪ Reinforcement | ▪ Reproduction | ▪ Attention |
| ▪ Retention     | ▪ Motivation   |             |



**Exam-style questions****Remember and understand****Question 3** (1 MARK)

In observational learning, the stage of reproduction involves

- A the learner copying the behaviour of the model.
- B the learner demonstrating what they have learned.
- C the learner receiving reinforcement for their behaviour.
- D the learner having the physical and mental ability to perform the behaviour.

**Question 4** (1 MARK)

A learner is more likely to learn through observational learning when

- A the model is more similar to themselves.
- B they want to learn a new skill.
- C they have more self-belief and confidence.
- D there is an adult supervising.

**Question 5** (1 MARK)

Describe the role of retention in observational learning.

**Apply and analyse****Question 6** (1 MARK)

Aliza is six years old. At a recent birthday party, she watched as her friend sang her favourite song and everyone at the party clapped for her. Later that night, she went home and practised singing her favourite song and performed it for her parents who were very excited and applauded loudly when she finished.

In terms of observational learning, Aliza practising her own favourite song demonstrates

- A retention, as she was praised by her parents.
- B reproduction, as she had the physical and mental ability to sing.
- C motivation, as she watched her friend sing.
- D reinforcement, as she wanted to also receive praise for singing.

**Question 7** (1 MARK)

Sheldon wanted to learn how to swim, and so he watched videos on the internet to learn. He took careful notes and received encouragement from his friends, however, when he went to the pool for the first time he was unable to swim.

Which aspects of observational learning did Sheldon likely achieve?

- A attention, retention, motivation, reproduction
- B attention, retention, motivation, reinforcement
- C motivation, attention, reproduction, reinforcement
- D motivation, retention, reproduction, reinforcement

*Adapted from VCAA 2017 exam MCQ12*

**Question 8** (1 MARK)

Ms Lam had to teach a brain dissection in her psychology class. In order to prepare, she watched videos online of a demonstration of this dissection. What two elements of observational learning does watching the online dissection reflect?

- A attention and retention
- B retention and motivation
- C retention and reinforcement
- D motivation and reinforcement

*Adapted from VCAA 2017 sample exam MCQ18*

**Question 9** (4 MARKS)

Cairo is working in a retirement home where there is a group of ladies who knit every day. He wants to learn how to knit but is unable to ask the ladies to teach him because they only speak Vietnamese and he doesn't. Instead, he decides to sit next to them and pay close attention to how they knit in order to try and learn.

- a** Outline the role of attention and reproduction in Cairo learning how to knit. (2 MARKS)
- b** Describe how vicarious reinforcement might occur in this scenario. (2 MARKS)

**Questions from multiple lessons****Question 10** (1 MARK)

Which of the following processes is relevant in both observational learning and operant conditioning to produce the desired behaviour?

- A** positive reinforcement
- B** consequences
- C** positive punishment
- D** stimulus discrimination

**Use the following information for questions 11 and 12.**

Pierce is 15 months old and his parents want to teach him to eat healthy food. They do this by showing him when they eat broccoli and smiling after every bite they take. Every time that he eats a piece of broccoli they smile and clap.

**Question 11** (1 MARK)

The strategy used by Pierce's parents demonstrates elements of

- A** classical conditioning only.
- B** operant conditioning only.
- C** observational learning and social learning.
- D** observational learning and operant conditioning.

**Question 12** (1 MARK)

When Pierce sees his mum clapping when his dad eats a piece of broccoli, this is an example of

- A** reproduction.
- B** retention.
- C** vicarious reinforcement.
- D** vicarious punishment.

**Question 13** (2 MARKS)

Explain one similarity between operant conditioning and social learning theory.

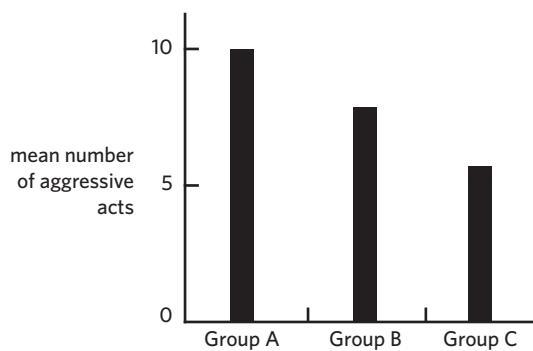
**Key science skills****Question 14** (5 MARKS)

In an investigation into aggression in children, three groups of children were exposed to different conditions:

- The first group (Group A) observed adults, who were well-known sports stars, behaving aggressively towards some toys
- The second group of children (Group B) observed adults, who were unknown to them, behaving aggressively towards some toys
- The third group of children (Group C) were a control group, and observed adults playing with the toys in a non-aggressive manner

Each group was then left to play with the toys. The number of aggressive acts the children in each group committed was observed. The results are indicated on the chart.

Adapted from VCAA 2017 sample exam MCQ19



- a Describe the purpose of the control group in an experiment. (1 MARK)
- b What conclusion might the researcher come to, based on the results of this investigation? (2 MARKS)
- c Explain why Group A displayed more aggressive acts than Group B. (2 MARKS)

**Question 15** (8 MARKS)

Dr Gentry wanted to test if social learning theories also applied to fish. She is studying cleaner fish, which are fish that have been observed to eat parasites off larger fish. She collected a sample of cleaner fish who had not exhibited the behaviour of 'cleaning'. She allocated her sample of fish into two groups. In the experimental condition, the fish were played a video of other cleaner fish eating parasites off salmon. In the control condition, the fish were not exposed to any videos.

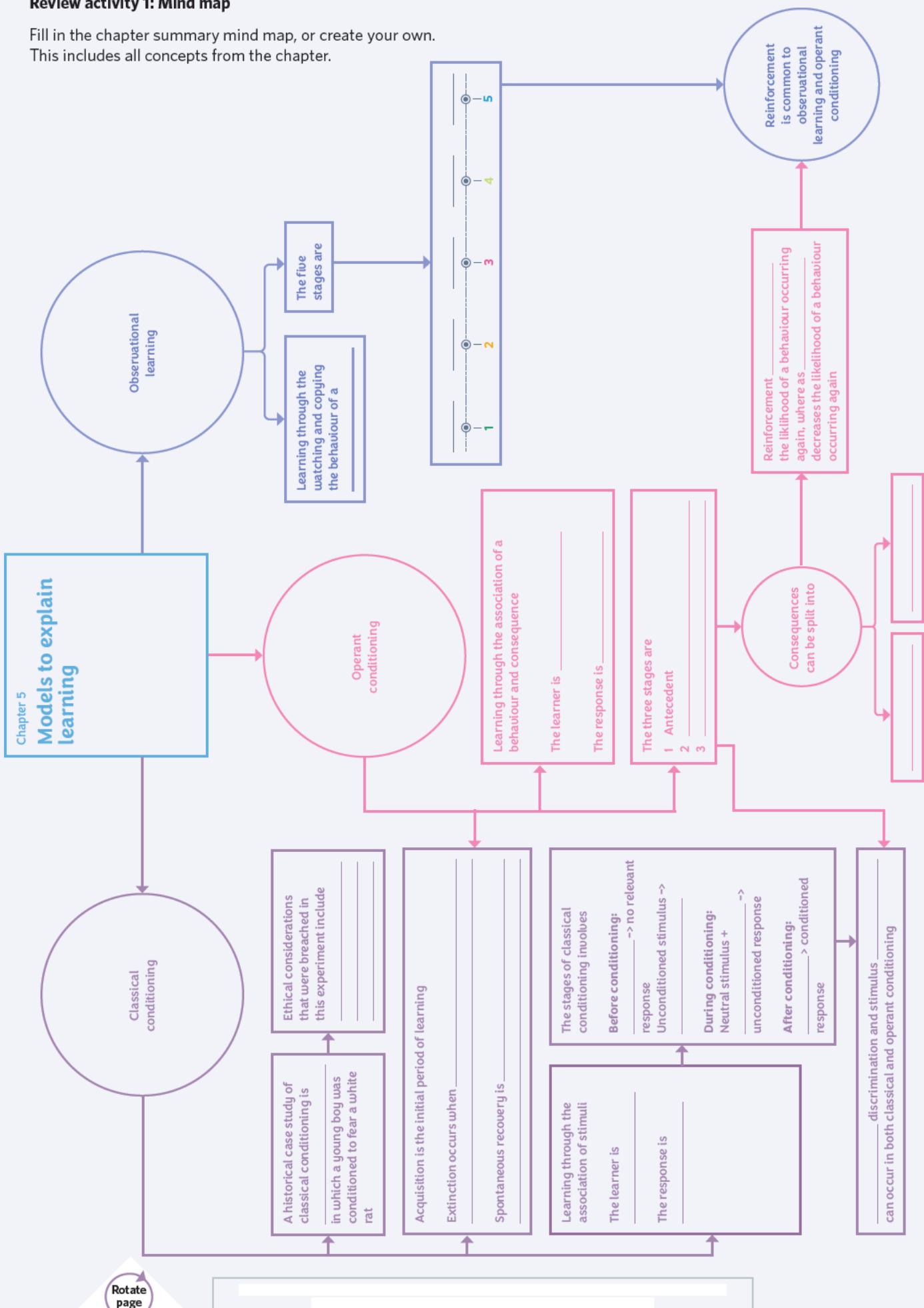
- a Outline the role of attention, retention and reproduction for the fish in the experimental condition to learn the cleaning behaviour. (3 MARKS)
- b Write a research hypothesis for this experiment. (3 MARKS)
- c Name the experimental design that Dr Gentry has used. (1 MARK)
- d Describe one advantage of this experimental design. (1 MARK)

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own.

This includes all concepts from the chapter.



**Review activity 2: Example bank**

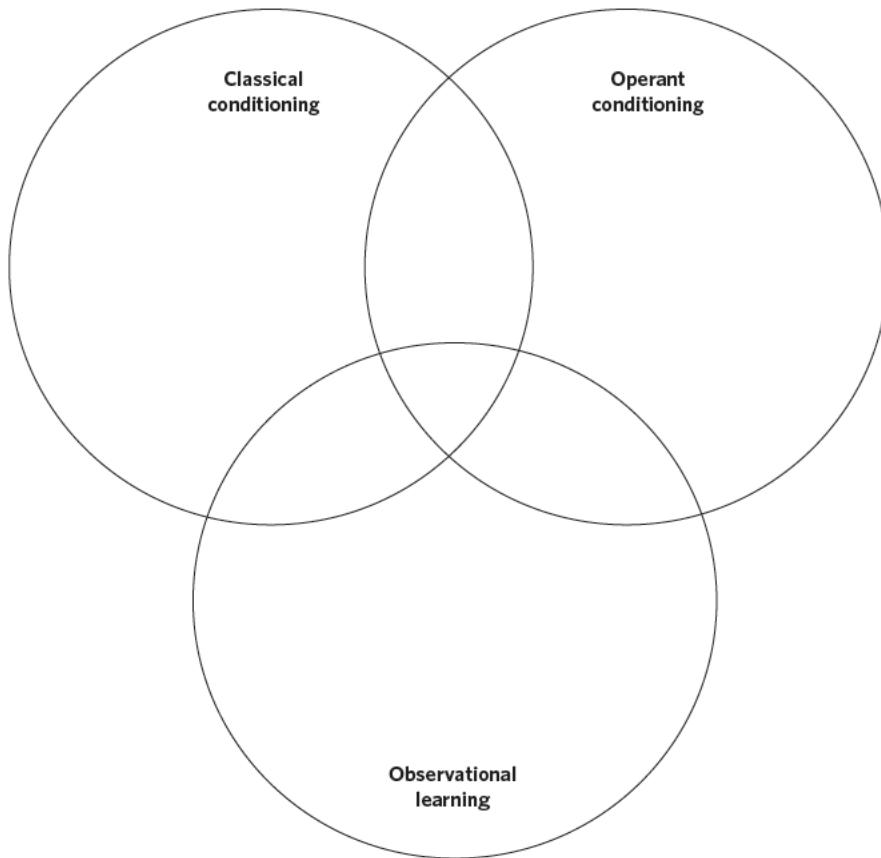
Fill in the table with your own notes.

Key terminology	Your own definition	Example
Classical conditioning		
Neutral stimulus		
Unconditioned stimulus		
Unconditioned response		
Conditioned stimulus		
Conditioned response		
Acquisition		
Extinction		
Spontaneous recovery		
The Little Albert experiment		
Operant conditioning		
Antecedent		

Key terminology	Your own definition	Example
Behaviour		
Consequence		
Reinforcement		
Punishment		
Response cost		
Observational learning		
Attention stage		
Retention stage		
Reproduction stage		
Motivation stage		
Reinforcement stage		

**Review activity 3: Venn diagram**

Fill in the venn diagram, thinking of as many differences and similarities between classical conditioning, operant conditioning and observational learning as possible.



## CHAPTER TEST

**Multiple choice questions****Question 1** (1 MARK)

With reference to operant conditioning, which of the following is seen as discouraging bad behaviour instead of encouraging good behaviour?

- A positive reinforcement
- B classical conditioning
- C negative reinforcement
- D punishment

**Question 2** (1 MARK)

A key difference between classical and operant conditioning is that in operant conditioning

- A stimulus discrimination is common, while in classical conditioning it is rare.
- B the learner is active, while in classical conditioning they are passive.
- C learning is passive, while in classical conditioning it is active.
- D stimulus generalisation is rare, while in classical conditioning it is common.

**Question 3** (1 MARK)

In which of the models of learning is the learner most active?

- A Operant conditioning
- B Observational learning
- C Classical conditioning
- D Trial and error learning

**Question 4** (1 MARK)

Jing watched his brother fold a paper plane and an origami swan. He then folded his own paper plane but was unable to fold an origami swan.

Jing was unable to fold the origami swan because he was not able to complete which of the following stages of observational learning?

- A Motivation, because he did not want to play with an origami swan
- B Retention, because he was unable to remember all of the steps involved in folding an origami swan
- C Attention, because he did not have the capabilities to fold the swan
- D Reinforcement, because his brother did not praise him after he had folded the paper plane

**Question 5** (1 MARK)

One similarity between observational learning and operant conditioning is that

- A the learner is active in both models of learning, and the behaviour is voluntary.
- B the learner is passive in both models of learning, and the behaviour is voluntary.
- C the association that is formed is between two or more stimuli.
- D the association that is formed is between two stimuli only, the behaviour and the consequence.

**Question 6** (1 MARK)

To encourage her noisy year 12 students to work silently during their test, Mrs. Mackay set up the following system with them:

- Students caught talking during the test would be given after school detention.
- Students who worked quietly would receive a lolly at the end of class.

Giving students after school detention is an example of \_\_\_\_\_, whereas students receiving a lolly at the end of class is an example of \_\_\_\_\_.

- A positive reinforcement, response cost
- B negative reinforcement, positive reinforcement
- C punishment, negative reinforcement
- D response cost, positive reinforcement

**Question 7** (1 MARK)

In the Little Albert experiment, the ethical consideration of debriefing was breached when

- A Little Albert's fear of white rats was not deconditioned.
- B Little Albert showed distress, but the experimenters continued with the study.
- C Little Albert's mother received payment for Albert's participation in the study
- D Little Albert's mother was not aware of the nature and extent of the investigation.

**Question 8** (1 MARK)

Abbey is allowed to watch half an hour of television once she finishes her chores at home.

This is an example of what type of consequence?

- A positive reinforcement
- B negative reinforcement
- C response cost
- D punishment

**Question 9** (1 MARK)

In the Little Albert experiment, the UCS and the CR were respectively

- A the sound of the hammer striking the metal bar; fear of the loud noise.
- B the sound of the hammer striking the metal bar; fear of the white rat.
- C the white rat; fear of the white rat.
- D the white rat; fear of the loud noise.

**Question 10** (1 MARK)

In the Little Albert experiment, stimulus generalisation occurred when

- A Little Albert showed the fear response when presented with the white rat.
- B Little Albert cried when the metal bar was struck behind him.
- C Little Albert only showed the fear response when presented with the white rat.
- D Little Albert showed the fear response when presented with a white mask.

**Short answer questions****Question 11** (2 MARKS)

Using the language of classical conditioning, outline how extinction occurs.

**Question 12** (2 MARKS)

Identify and describe the brain structure that was primarily involved in Little Albert's acquisition of the conditioned fear response.

**Question 13** (3 MARKS)

Bridie was sitting in her garden when she felt something crawl onto her leg. She saw that it was a bee and brushed it away. Shortly after, she involuntarily kicked out her leg and then felt a stinging sensation that made her scream loudly in pain. She realised that she had been stung by a bee.

Following the bee sting, Bridie showed a fear response any time she saw a bee. One day when she was playing at school, an insect landed on her leg. Bridie immediately screamed loudly, brushed the insect away and kicked her leg out. She then realised it was a beetle, not a bee.

Using the language of classical conditioning, explain why Bridie reacted this way to the beetle landing on her leg.

*Adapted from VCAA 2017 exam SAQ4*

**Question 14** (3 MARKS)

Shaylee is 8 years old. Her parents want to teach her to properly groom their family pet dog.

Outline how Shaylee's parents might teach her this using operant conditioning.

**Question 15** (1 MARK)

What is the role of a consequence in operant conditioning?

**Question 16** (2 MARKS)

Compare the role of reinforcement in operant conditioning and observational learning.

**Question 17** (2 MARKS)

David wanted to learn how to bake a cake. He watched several videos on YouTube of people baking his favourite chocolate cake. On his way home from school, he bought all of the ingredients that he needed and got his sister to help him, telling her the instructions that he remembered from the videos he had watched. The cake looked delicious, but upon eating it David realised that he hadn't included sugar which made the cake taste bitter.

Using the language of observational learning, explain why David was unable to successfully bake the cake.

**Key science skills questions****Question 18** (5 MARKS)

A primary school teacher wanted to test whether children learned more quickly through operant conditioning or observational learning. She split her year one class of 20 students into two groups. Half of the class learned how to tie their shoelaces by watching an adult tie their shoelaces and then copying the behaviour, and the other half were instructed to tie their shoelaces and were rewarded with a sticker if they were able to do so successfully.

- a What is the sampling method used in this study? (1 MARK)
- b Identify and explain a potential confounding variable in this study. (2 MARKS)

After analysing the results, the teacher concluded that children learn faster through operant conditioning than observational learning.

- c Comment on the validity of these results. (2 MARKS)



# 06

UNIT 3 AOS 2, CHAPTER 6

## Process of memory

### 6A Atkinson-Shiffrin model of memory

- the multi-store model of memory (Atkinson-Shiffrin) with reference to the function, capacity and duration of sensory, short-term and long-term memory

### 6B Memory and the brain

- interactions between specific regions of the brain (cerebral cortex, hippocampus, amygdala and cerebellum) in the storage of long-term memories, including implicit and explicit memories

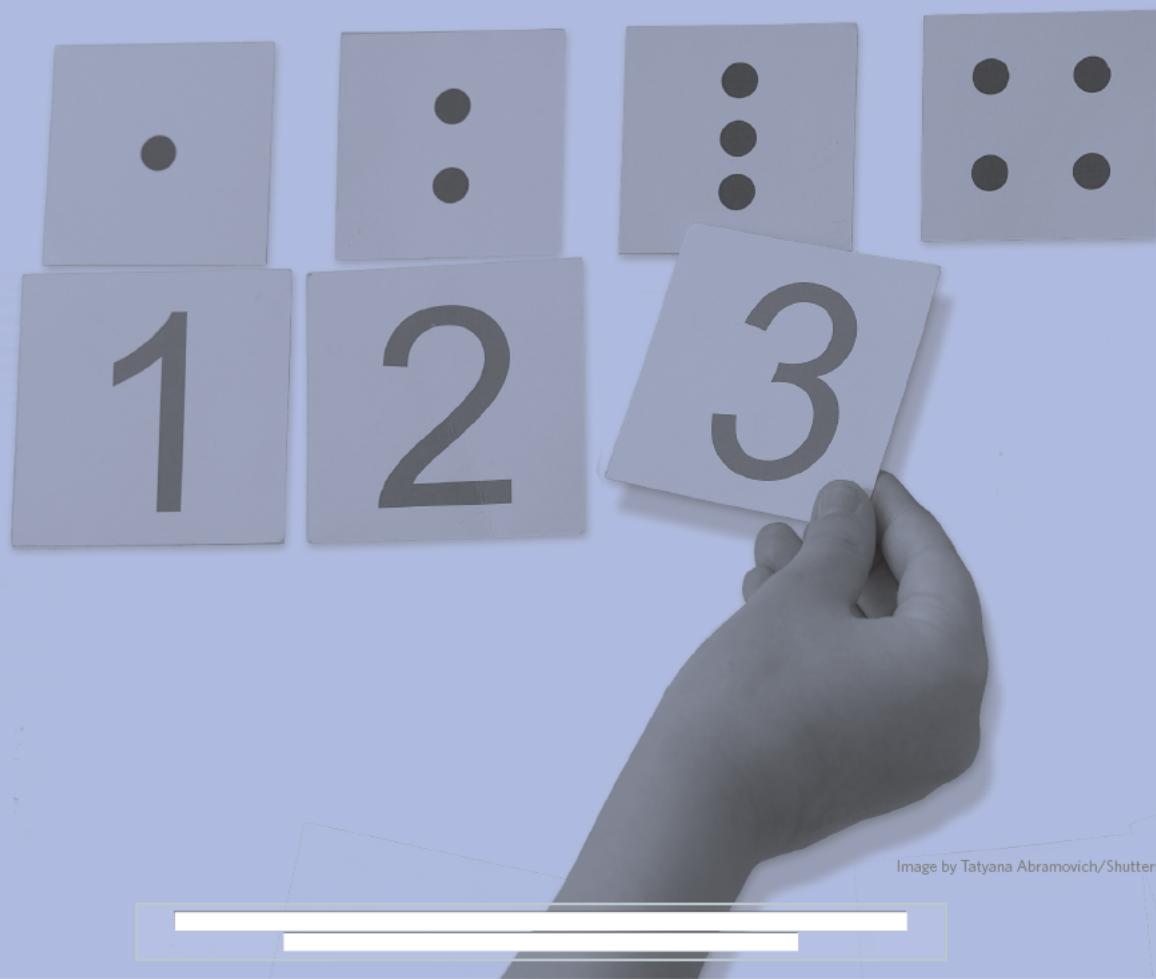


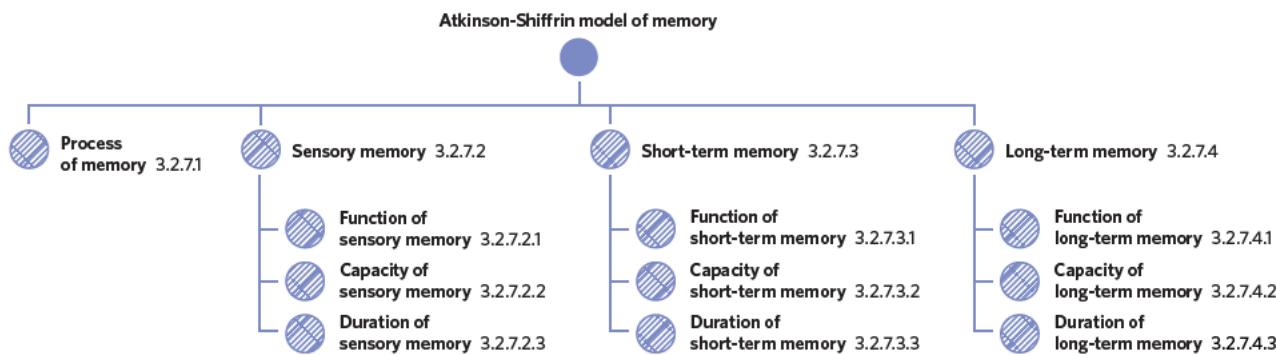
Image by Tatyana Abramovich/Shutterstock.com

# 6A ATKINSON-SHIFFRIN MODEL OF MEMORY

In this chapter, you will be learning about memory. Memory involves the process of encoding, storing and retrieving information. In this chapter, you will learn about the different types of memories and the areas of the brain involved in the storage of memories. Specifically, in this lesson, you will learn about the multiple stores of memory that are outlined in the Atkinson-Shiffrin model of memory.

6A. Atkinson-Shiffrin model of memory	6B. Memory and the brain
<b>Study design dot point</b>	
<ul style="list-style-type: none"> <li>the multi-store model of memory (Atkinson-Shiffrin) with reference to the function, capacity and duration of sensory, short-term and long-term memory</li> </ul>	
<b>Key knowledge units</b>	
Process of memory	3.2.7.1
Function of sensory memory (Sensory memory)	3.2.7.2.1
Capacity of sensory memory (Sensory memory)	3.2.7.2.2
Duration of sensory memory (Sensory memory)	3.2.7.2.3
Function of short-term memory (Short-term memory)	3.2.7.3.1
Capacity of short-term memory (Short-term memory)	3.2.7.3.2
Duration of short-term memory (Short-term memory)	3.2.7.3.3
Function of long-term memory (Long-term memory)	3.2.7.4.1
Capacity of long-term memory (Long-term memory)	3.2.7.4.2
Duration of long-term memory (Long-term memory)	3.2.7.4.3

**In this lesson, you will be learning about the Atkinson-Shiffrin model of memory.** This model is also referred to as the multi-store model of memory as it involves three memory stores: **sensory memory, short-term memory and long-term memory**. More specifically, you will learn about the function, capacity and duration of each of these stores.



## Process of memory 3.2.7.1

### OVERVIEW

The Atkinson-Shiffrin model of memory outlines three distinct memory stores, all of which have different functions, capacities and durations. The model also considers memory as a processing system which encodes, stores and retrieves information. These processes form the foundation of the multi-store memory process, and provides an explanation for the interactions between sensory memory, short-term memory and long-term memory.

## THEORY DETAILS

The process of **memory** involves the process of encoding, storing and retrieving learned information. The **Atkinson-Shiffrin multi-store model of memory** provides a framework for the process of memory, referring to the three stores of memory which are sensory memory, short-term memory and long-term memory. This process of memory involves movements between each memory store as a result of the functions of encoding, storage and retrieval.

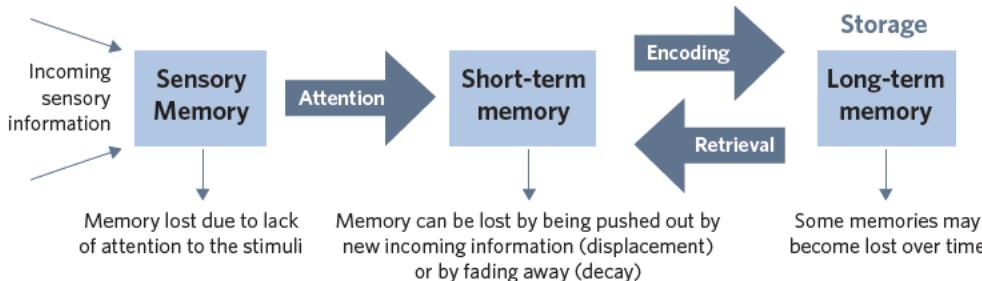


Figure 1 The Atkinson-Shiffrin model of memory

The process of **encoding** involves converting the raw information from external stimuli, which has been detected by one of the body's five senses (sight, smell, hearing, taste or touch), into a useable form which is stored for later use. This allows the information to be understood and manipulated by the neurons within the brain, forming connections and links with other pieces of information that were previously learned, remembered and stored. This converted information is then retained in the brain, and can then be accessed and used in the future. All of these steps make up the process of **storage**. In future, this stored information can be recovered and used. This is the process of **retrieval**.

An example of retrieval may be recalling the memory of an event that occurred a year ago or remembering a fact that you have previously learned.

### Sensory memory 3.2.7.2

#### OVERVIEW

The first memory store in Atkinson-Shiffrin's multi-store model of memory is sensory memory. Sensory memory retains information from the environment in its raw form. This is made up of iconic and echoic memory, as well as other types of sensory memory.

#### THEORY DETAILS

Every piece of information in your current environment has the potential to be processed by your **sensory memory**. Sensory memory stores information which has been detected by your senses for a very brief period of time. As such, sensory memory can be described as the entry point for memory, as all information which is later stored must first be detected by your senses.

Examples of the type of information that can be retained by sensory memory includes the words on this page, the sound of a bird chirping outside, even the tag of your clothing that you might feel rubbing against your skin. All of this information may enter your sensory memory via your senses if your senses detect it. At this stage, this information is an exact replica of that which is in your environment, meaning that it has not yet undergone the process of being encoded.

There are two different types of sensory memory which you need to learn in VCE psychology. The first type is iconic memory. **Iconic memory** temporarily stores visual information for a very brief amount of time. Every object in your line of vision enters your iconic memory if it is detected by your senses. Similarly, **echoic memory** temporarily stores auditory information or sound which is detected in the environment.

#### Want to know more?

In VCE psychology, the two types of sensory memory which you need to learn are echoic and iconic memory. However, there are other types of sensory memory which process stimuli detected by your other senses.

**Memory** the process of encoding, storing and retrieving learned information

**Atkinson-Shiffrin multi-store model of memory** a model of memory which outlines the flow of information in memory formation and retrieval through three separate stores of memory; sensory, short-term and long-term, each of which have a different function, capacity and duration

**Encoding** the process of converting raw information from stimuli into a useable form which can be stored in the brain

**Storage** retaining converted information so it can be accessed and used in the future

**Retrieval** accessing information which has previously been stored in the brain

**lesson link** If you need a refresher on the processes of memory and learning at a neuronal level, such as the concept of consolidation, return to lesson **4A: Long-term potentiation and long-term depression**, as well as lesson **4B: Neurotransmitters and neurohormones**.

**Sensory memory** store of memory which very briefly stores raw information detected by the senses

**Echoic memory** a type of sensory memory which temporarily stores auditory information

**Iconic memory** a type of sensory memory which temporarily stores visual information

**Memory device** To help remember the difference between iconic and echoic memory, you can remember that echoic memory involves an "echo" as it involves auditory information or sound, whereas iconic memory involves visual information, which can be remembered through the use of visual icons.



### Function of sensory memory 3.2.7.2.1

The function of sensory memory is to retain information which has been detected by the senses in its raw sensory form. This information can be from your external or internal environment. If the information has been attended to it is then encoded and transferred to short-term memory for processing, otherwise the memory is completely lost.

### Capacity of sensory memory 3.2.7.2.2

Sensory memory has a very large capacity which is often described as being unlimited. This is due to all stimuli in the environment having the potential to be detected by sensory memory.

### Duration of sensory memory 3.2.7.2.3

Have you ever asked someone to repeat what they said before suddenly remembering it before they had actually repeated themselves? The time that it takes for you to process what others have said is due to the duration of your echoic memory. The duration of echoic memory allows auditory information to be stored for 3 to 4 seconds, meaning you are able to remember what someone said a few seconds ago before your brain has processed the information.

Sensory memory is extremely brief, with a short duration of just 0.2 to 4 seconds. The duration of sensory memory allows for information to be stored for just enough time so that information which is meaningful can be identified and processed to short-term memory. Specifically, iconic memory lasts for about 0.2 to 0.4 seconds, whereas echoic memory is stored for about 3 to 4 seconds.

#### Want to know more?



Image: thenatchdl/shutterstock.com

The ability for movie 'stills' (the images used to create a movie) to flow is due to the duration of iconic sensory memory. This allows the 'stills' to seamlessly overlap, causing the fluid motion of a movie. If humans had an iconic memory duration of 0 seconds, images that make up movies would not flow in a sequence. Instead, images would continuously flash across the screen.

### Short-term memory 3.2.7.3

#### OVERVIEW

The second memory store in Atkinson-Shiffrin's multi-store model of memory is short-term memory. Information from an individual's internal or external environment which is attended to becomes present within the short-term memory store. This memory store is also known as your 'working memory'.

#### THEORY DETAILS

Information that has been consciously recognised and identified as meaningful or important moves from sensory memory into **short-term memory (STM)**. This information has been encoded from its raw form to a useable neural form for STM. STM is also known as 'working memory' because you are aware of all the information that you currently hold in this memory store, and are actively manipulating it, that is, 'working' on it.

The information in your short-term memory can arise both from your sensory or long-term memory. Information from your sensory memory, which you have paid attention to and chosen to respond to has consequently moved into your short-term memory. Similarly, information from your long-term memory that you choose to recall can also move to your conscious awareness, and hence exist within your short-term memory.

**Short-term memory (STM)**  
store of memory which holds information that is consciously being attended to and actively manipulated



Figure 2 Short-term memory can arise when information from sensory memory has been paid attention to or when information from long-term memory has been recalled

### Function of short-term memory 3.2.7.3.1

The function of short-term memory is to pay conscious attention to information. This involves actively manipulating the information which may have been received from sensory memory or from long-term memory. Manipulating information may involve updating, adding or changing the information in some way. This information is then encoded and moved to long-term memory, or lost if not transferred to long-term memory.

**For example:**

At the beach, you may see a large wave in front of you. This information has arisen from your senses, and has been encoded into your working, or short-term memory. Now in a useable form, you can actively manipulate this information. This may involve retrieving information from your long-term memory in which you remember a previous time where a large wave crashed on top of you and caused you to swallow a lot of water. Now in your working memory, you can connect this information to the wave in front of you and choose a response, which may involve running away from it or diving underneath it.

### Capacity of short-term memory 3.2.7.3.2

Short-term memory has a smaller capacity compared to sensory memory, only holding a fairly limited amount of information. Specifically,  $7 \pm 2$  items (or 5 to 9 items) can be held in the short-term memory store. This is the number of items that can be actively ‘worked on’ at any one time. There are, however, different techniques that you can use to increase the capacity of your short-term memory, such as breaking up lots of information into a smaller number of items.

#### Want to know more?

- If the information in your short-term memory is not processed and stored in long-term memory, it can be pushed out by new incoming information (which is known as displacement) or fade away on its own (which is known as decay).
- ‘Chunking’ is a process by which you can group smaller ‘chunks’ of information into larger ‘chunks’ in order to hold more information in STM. An example of this is remembering your mobile number which has 10 numbers, exceeding most people’s capacity to hold this in their STM. Instead people often ‘chunk’ their mobile number into 3 chunks, making it easier to work with.



In lesson **7D: Memory reconstruction** you will learn about your ability to reconstruct your memories that you have retrieved from your long-term memory.

#### Analogy

The information in your short-term memory has been attended to consciously. One way of thinking about this is to think of the analogy of a camera lens. The information that the lens focuses on can be understood as your working memory, as it displays the information you are actively paying attention to on the camera screen. There is other information that is not in your short-term memory at this time, just as there is information external to the camera screen that is not being displayed because the lens is not focusing on it.



### Duration of short-term memory 3.2.7.3.3

Information is only stored in short-term memory for a temporary period of time. This store generally has a duration of 18 to 30 seconds for most people. After 30 seconds, information which has not been encoded and processed into long-term memory is likely to be lost. More specifically, it is believed that information in short-term memory generally begins to fade between 18 to 20 seconds. However, it is possible for some information to remain in short-term memory for up to 30 seconds.

## Long-term memory 3.2.7.4

### OVERVIEW

Long-term memory is the third and final store of memory in Atkinson-Shiffrin’s multi-store model of memory. It is a relatively permanent memory store with a potentially unlimited amount of storage.

### THEORY DETAILS

Your **long-term memory (LTM)** contains all the information you retain from past events as well your knowledge of facts. All this information has been processed through the memory stores of sensory memory and short-term memory, before reaching long-term memory. These memories have undergone the process of being encoded, and exist in a useable form. This useable form facilitates the information to have been stored in the brain, forming neural connections with other pieces of stored information.



Your ability to remember information, particularly that in your short-term memory, can be influenced by factors such as context and state dependent cues, types of rehearsal, and the serial position effect. You will learn about these in lesson **7B: Factors affecting memory**.

**Long-term memory (LTM)** store of memory in which a potentially unlimited amount of information is stored for a relatively permanent amount of time

### Function of long-term memory 3.2.7.4.1

The function of long-term memory is to store information which can be retrieved for future use. This information is organised in different parts of the brain, processed into different types of long-term memories, and forms neural connections with other pieces of information already stored within the brain.

### Capacity of long-term memory 3.2.7.4.2

Human brains are capable of storing an extremely large, seemingly unlimited amount of information. In fact, researchers are still exploring the capacity of long-term memory due to uncertainty of the exact amount it is able to store. As the exact capacity of long-term memory has not been discovered by researchers, the capacity of long-term memory is described as *potentially unlimited*.

### Duration of long-term memory 3.2.7.4.3

The duration of long-term memory is understood as being *relatively permanent*. This is due to the belief that long-term memories can be stored almost indefinitely in an individual's brain. However, this may not always be true for all long-term memories, and research on the matter is still being conducted.

## Theory summary

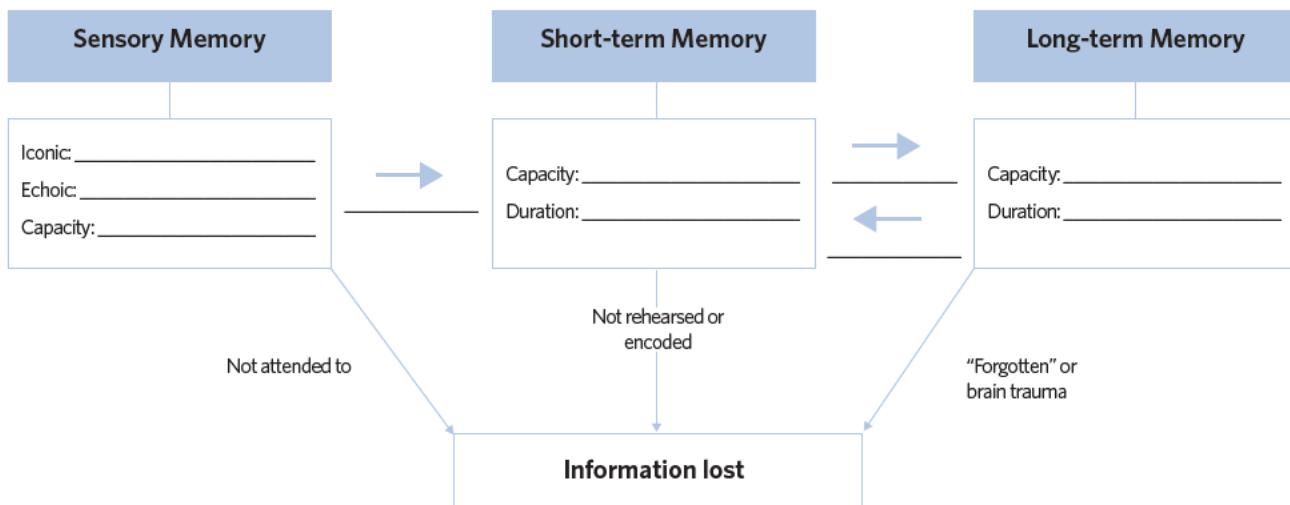
In this lesson, you have learned about the processes of memory, including encoding, storage and retrieval. You have also learned about the Atkinson-Shiffrin multi-store model of memory which includes the three memory stores of sensory memory, short-term memory and long-term memory. You have also learned about the function, duration and capacity of each of these stores. You should be able to describe how these different memory stores interact and how information is transferred between them.

Table 1 The duration and capacity of each memory store

	Sensory memory	Short-term memory	Long-term memory
Duration	0.2-4 seconds ▪ Iconic: 0.2 to 0.4 seconds ▪ Echoic: 3 to 4 seconds	18-30 seconds	Relatively permanent
Capacity	Unlimited	7± 2 items	Potentially unlimited

## 6A Activities

- 1 Complete this activity on the Atkinson-Shiffrin model of memory to consolidate your understanding of the multi-store model of memory.



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**lesson link** There are multiple different types of long-term memories, which you will explore in lesson 6B: **Memory and the brain**. In this lesson, you will also learn about the parts of the brain involved in the process of memory.

### Useful tip

When describing the capacity and duration of long-term memory, it is important that you understand and describe the capacity as being *potentially unlimited* and the duration as being *relatively permanent*.

# 6A QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |            |                  |                     |
|------------|------------------|---------------------|
| • Memory   | • Retrieval      | • Echoic memory     |
| • Encoding | • Sensory memory | • Short-term memory |
| • Storage  | • Iconic memory  | • Long-term memory  |
- a Raw information being processed into a useable form for storage \_\_\_\_\_
- b A type of sensory memory which temporarily stores auditory information \_\_\_\_\_
- c Store of memory which is potentially unlimited and can store information for a relatively permanent amount of time \_\_\_\_\_
- d The process of accessing information which has been previously stored \_\_\_\_\_
- e The process of encoding, storing and retrieving learned information \_\_\_\_\_
- f The store of memory which very briefly stores raw information detected by the senses such as sight, hearing and touch \_\_\_\_\_
- g A type of sensory memory which temporarily stores visual information \_\_\_\_\_
- h The store of memory which holds information that is consciously being attended to \_\_\_\_\_
- i The process of retaining converted information so it can be accessed and used in the future \_\_\_\_\_

## Exam-style questions

### Remember and understand

#### Question 2 (1 MARK)

Iconic memory has a duration of

- A 18-30 seconds, whereas echoic memory has a duration of 3-4 seconds.  
B 0.2-0.4 seconds, whereas echoic memory has a duration of 3-4 seconds.  
C 0.2-0.4 seconds, which is the same duration of echoic memory as they are both types of sensory memory.  
D 3-4 seconds, whereas echoic memory has a duration of 0.2-0.4 seconds.

Adapted from VCAA 2016 exam MCQ62

#### Question 3 (1 MARK)

The two types of sensory memory are

- A echoic memory and visual memory.  
B echoic memory and short-term memory.  
C auditory memory and iconic memory.  
D echoic memory and iconic memory.

#### Question 4 (1 MARK)

Which of the following is the correct sequence of memory stores involved in forming a new memory as described by the Atkinson-Shiffrin model of memory?

- A Long-term memory, sensory memory, short-term memory  
B Sensory memory, echoic memory, long-term memory  
C Sensory memory, short-term memory, long-term memory  
D Short-term memory, long-term memory, iconic memory

Adapted from VCAA 2012 exam 1 MCQ18

**Question 5** (1 MARK)

Which of the following correctly identifies the capacity of each of the three memory stores as outlined by the Atkinson-Shiffrin model of memory?

	<b>Sensory memory</b>	<b>Short-term memory</b>	<b>Long-term memory</b>
A	Unlimited	5 to 9 items	Restricted
B	0.2-4 seconds	18-30 seconds	Potentially permanent
C	Unlimited	7±2 items	Potentially unlimited
D	Potentially unlimited	4 to 9 items	Unknown

**Apply and analyse****Use the following information for questions 6 and 7.**

Faye's dad asked her to pick up the groceries on her way home from work. She quickly glanced at the list which included three items before running into the shop to grab them. While running into the shop, she immediately spotted the first item on her list.

**Question 6** (1 MARK)

According to the Atkinson-Shiffrin model, which of the memory stores was involved when Faye initially detected the first item on her list?

- A** Echoic memory
- B** Sensory memory
- C** Short-term memory
- D** Long-term memory

**Question 7** (1 MARK)

What is the duration of this memory store which was involved when Faye visually detected the three items on the shopping list?

- A** 0.2 to 4 seconds
- B** 18 to 30 seconds
- C** 0.2 to 0.4 seconds
- D** 1.8 to 3 seconds

**Question 8** (2 MARKS)

Aristotle was having a conversation with his school friend, Plato, about their experiences together from primary school, which they attended more than 10 years earlier. While talking, he remembered a funny story from year four and begun to start telling the story.

Identify and explain the process of memory which is involved in Aristotle remembering and telling his story from primary school.

**Question 9** (4 MARKS)

Shayla is a year six student who has been learning her times tables. To help her learn them, she has been listening to a voice recording which reads out each times table. In class, they have a competition where the teacher calls out a times table equation and the students try to call out the answer first.

Identify the stores of memory involved in Shayla storing information about times tables, as well as the store of memory involved in responding to her teacher in the class competition. Justify your response.

Adapted from VCAA 2017 exam MCQ11

**Questions from multiple lessons****Use the following information for questions 10-12.**

Johnnie was recently in a car crash. Even though the crash occurred three weeks earlier, he is still able to remember vivid details of the crash, including that the driver of the car who crashed into them was wearing a purple jacket with small sunflowers on it. After the crash, Johnnie was quite shaken up and has been scared to get in a car ever since.

**Question 10** (1 MARK)

Johnnie's ability to remember vivid details from the scene of the crash is due to

- A the process of sensory memory, which involves storing memory for future use.
- B the process of long-term memory, which involves paying attention to certain stimuli in your environment and processing this information for future retrieval.
- C the store of long-term memory, which contains information which has been encoded into a useable form and stored for future use.
- D the store of long-term memory, which involves paying attention to certain stimuli in your environment and processing this information for future retrieval.

**Question 11** (1 MARK)

Johnnie's ability to remember the event in such close detail is due to

- A the role of adrenaline, as it is an emotionally arousing event.
- B the role of cortisol, as it is an emotionally arousing event.
- C the role of GABA, as the event lead to experiences of long-term depression.
- D the role of adrenaline, as he didn't believe the event to be significant or stressful.

**Question 12** (1 MARK)

Johnnie's fear of now getting into cars is due to

- A the creation of an association due to observational learning.
- B the process of classical conditioning as the car is the UCS.
- C the process of operant conditioning as the car crash was the antecedent.
- D the creation of an association due to classical conditioning.

**Question 13** (3 MARKS)

Explain how long-term depression may impact the information stored in long-term memory.

**Key science skills****Question 14** (7 MARKS)

Caterina wanted to investigate whether listening to classical music enhanced the ability of high school students to recall information. As part of her VCE Psychology practical investigation, she decided to use 30 of her friends in her experiment. She randomly allocated her friends to either the control group, who did not listen to music while they read a list of word pairings, or the experimental group, who listened to classical music while reading a list of word pairings.

All participants had the opportunity to read the words for five minutes while either listening or not listening to music. After this, they were asked to verbally recall as many of the word pairings as they could remember. The number of word pairings they could recall was then recorded.

*Adapted from VCAA 2017 sample exam SAQ7*

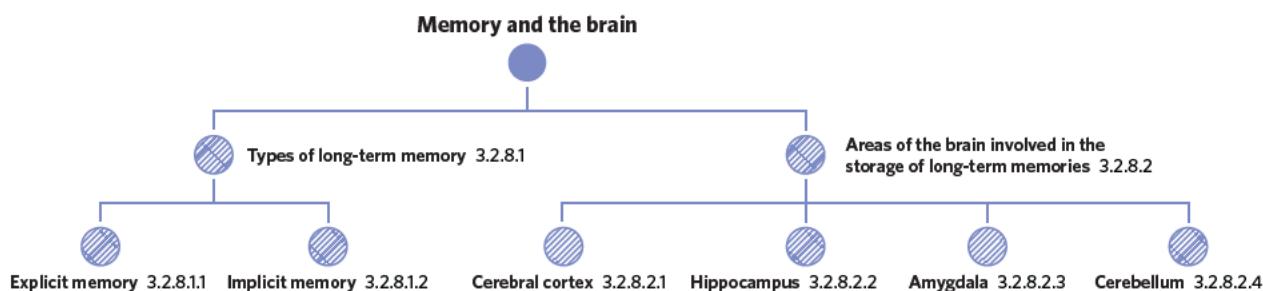
- a Outline whether the data Caterina collected was quantitative or qualitative. (1 MARK)
- b Identify the independent and dependent variable in Caterina's research investigation. (2 MARKS)
- c Explain whether the results of Caterina's study could be generalised to the population of high school students. Justify your response. (2 MARKS)
- d Identify the memory store which is the entry point of the music and outline the duration of this store. (2 MARKS)

# 6B MEMORY AND THE BRAIN

So far in this chapter, you have learned about the Atkinson-Shiffrin multi-store model of memory, as well as the processes of memory involved in this model, such as encoding, storing and retrieving memories. Now, you will learn about the interaction of different brain structures and the role these structures have in memory, particularly in the storage of long-term memories. You will also learn about the different types of long-term memories.

6A. Atkinson-Shiffrin model of memory	6B. Memory and the brain
<b>Study design dot point</b>	
<ul style="list-style-type: none"> <li>interactions between specific regions of the brain (cerebral cortex, hippocampus, amygdala and cerebellum) in the storage of long-term memories, including implicit and explicit memories</li> </ul>	
<b>Key knowledge units</b>	
Explicit memory (Types of long-term memory)	3.2.8.1.1
Implicit memory (Types of long-term memory)	3.2.8.1.2
Cerebral cortex (Areas of the brain involved in the storage of long-term memory)	3.2.8.2.1
Hippocampus (Areas of the brain involved in the storage of long-term memory)	3.2.8.2.2
Amygdala (Areas of the brain involved in the storage of long-term memory)	3.2.8.2.3
Cerebellum (Areas of the brain involved in the storage of long-term memory)	3.2.8.2.4

In this lesson, you will be learning about the role of different areas of the brain in the storage of long-term memory. Specifically, you will learn about the role of the **cerebral cortex**, **hippocampus**, **amygdala** and **cerebellum**. You will also learn about the different **types of long-term memories**, including **implicit** and **explicit memory**.



## Types of long-term memory 3.2.8.1

### OVERVIEW

The two types of long-term memory are implicit and explicit memory. Each of these types of long-term memory has different subcategories, with explicit memory comprising of semantic and episodic memory, and implicit memory comprising of procedural and classically conditioned memory.

### THEORY DETAILS

Long-term memory comprises of memories which can be retrieved for use at a later time. Within this memory store, long-term memory can be categorised into two types: implicit and explicit memory. It is important for you to understand the differences between these two types of memory, as well as the categories of memory which fall within these two types. This includes semantic and episodic memory as types of explicit memory, and procedural and classically conditioned memory as types of implicit memory.

**lesson link** In the previous lesson **6A: Atkinson-Shiffrin model of memory**, you learned about the function, duration and capacity of long-term memory. Return to this lesson if you need a refresher on these concepts.

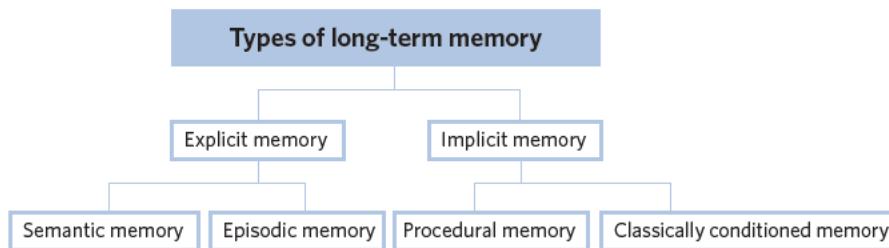


Figure 1 The different types of long-term memory

 To help you remember the difference between explicit and implicit memories, you can remember that you can EXplain EXplicit memory, or DEclare it because they are Declarative.

### Explicit memory 3.2.8.1.1

Memories that require conscious effort to retrieve are **explicit memories**. These memories are voluntarily retrieved from your long-term memory and brought into conscious awareness. Explicit memories are also known as *declarative* memories, which means that they can be *declared* or stated to someone else. This may involve you remembering that you had vegetable spring rolls for lunch and telling your friend about how delicious they were. The ability for you to verbally describe the type of spring roll, how it tasted and where you ate it demonstrates that it is an explicit memory.

Within explicit memory, there are two different types of memories you need to learn. These are semantic and episodic memories.

#### Semantic memory

**Semantic memory** is a type of explicit long-term memory which involves information of general knowledge and facts. Some examples of explicit memories include the knowledge that there are seven continents, that dogs bark and that three multiplied by three equals nine. These memories are declarative and can be verbally explained to others. It is important to understand that semantic memories do not involve knowledge of personal experiences as these are known as episodic memories.

#### Episodic memory

Memories of personal or autobiographical events are **episodic memories**. These memories are unique to each individual and their own personal experiences, which can become memories. Some examples of episodic memories include the memory of getting your driver's license, remembering details from when you went on holiday, and remembering what you ate for dinner last night.

### Implicit memory 3.2.8.1.2

**Implicit memories** are memories which can be retrieved without conscious effort. These memories are involuntarily retrieved, such as recalling the technique of how to kick a soccer ball during a match or recalling how scared you were after seeing an aggressive dog. In recall, this memory is not consciously retrieved, rather the technique is performed without conscious effort and the fear is retrieved involuntarily. These memories are non-declarative as they can be retrieved without being consciously considered or verbally stated.

#### Useful tip

It is important to be able to distinguish between explicit and implicit memories in scenarios. This is due to explicit memories often involving 'knowing that', such as "I know that Christmas day is the 25th of December", as opposed to implicit memories involving 'knowing how', such as "I know how to tie my shoelaces".

### Procedural memory

**Procedural memories** involve knowing *how* to do things and are supported by motor skills. They often involve different stages, such as the specific steps you learn when learning how to correctly kick a soccer ball or how to tie your shoelaces.

#### Classically conditioned memory

Have you ever remembered a time where you felt scared in vivid detail? It is often common for you to remember the emotional components associated with that memory, such as feeling extremely fearful, angry, or even excited and overjoyed. These memories may be unconsciously retrieved when triggered by a stimulus or event.

**Explicit memory (also known as declarative memory)** a type of long-term memory that can be consciously retrieved

**Semantic memory** a type of explicit memory which consists of general knowledge or facts

**Episodic memory** a type of explicit memory which involves a personal experience or event

**Implicit memory** a type of long-term memory that is retrieved unconsciously

 A helpful way to remember episodic memory is as an *episode* of your life, with all of the events that occur in your life forming a series of episodes.



Image: vic dd/shutterstock.com

 Procedural memories can often be formed through observing someone's actions, which becomes a memory you can later retrieve and reproduce. This involves the process of observational learning. For a refresher on this model of learning, return to lesson 5D: *Observational learning*.

**Procedural memory** a type of implicit memory which involves knowing how to carry out tasks, facilitated by motor skills

For example, a person who remembers the fearful experience of being attacked by a large dog some time ago may become immediately overwhelmed when later seeing a similarly large dog running towards them.

These vivid memories are **classically conditioned memories**, a type of implicit memory which involves an involuntary response to a stimulus which has repeatedly been associated with an emotionally arousing stimulus. This response is usually emotionally charged, commonly involving strong feelings of fear, disgust, elation and so on. These memories are retrieved without conscious effort and do not need to be consciously considered or verbally stated. Instead, classically conditioned memories are retrieved involuntarily and can be reflexive.

Classically conditioned memories may involve the formation of an involuntary fear response to a particular stimulus after it has been repeatedly associated with another fear-inducing stimulus. For example, if an individual repeatedly got yelled at by their parents and sent to their room when they helped themselves to cake as a child, they may start to involuntarily fear eating cake. This fear has been created due to classical conditioning, in which their parents yelling at them and sending them to their room created a fear response, such as getting shaking hands. This association may lead to this individual beginning to sweat or get shaking hands whenever they eat cake as an adult. Due to the memory being implicit and involuntary, this individual is likely to be unaware that they are activating the conditioned response which is stored within memory and are likely to respond reflexively.

## Areas of the brain involved in the storage of long-term memories 3.2.8.2

### OVERVIEW

There are multiple brain structures involved in the storage of long-term memory. The areas you need to learn as part of this course include the cerebral cortex, hippocampus, amygdala and cerebellum.

### THEORY DETAILS

There are multiple structures within the brain that are involved in the process of memory, and more specifically in the storage of long-term memories. For this course, you need to learn about the roles of the cerebral cortex, hippocampus, amygdala and cerebellum in relation to memory. It is also important for you to understand how these brain structures interact in the processing and storage of long-term memories.

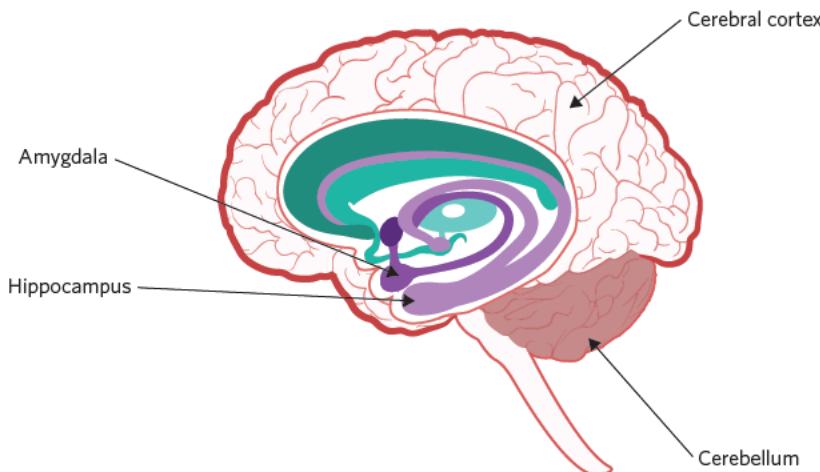


Figure 2 Brain structures involved in the storage of long-term memories

### Cerebral cortex 3.2.8.2.1

The **cerebral cortex** is the outermost layer of the brain with a thickness of about 2mm. Within the process of memory, it is primarily involved in storing long-term memories, particularly storing explicit memories. The cerebral cortex covers most of the brain's surface, with memories being stored in particular locations depending on the type of memory and where it was processed.

**Classically conditioned memory**  
a type of implicit memory which involves an involuntary response, such as fear, to a stimulus which has repeatedly been associated with an emotionally arousing stimulus

**lesson link** Return to lesson **5A: Classical conditioning** for a refresher on this process of learning and how this can be related to the acquisition of emotionally arousing memories. You also learned about an example of a conditioned emotional memory in lesson **5B: The Little Albert experiment**.

**lesson link** In lesson **4B: Neurotransmitters and neurohormones**, you learned about adrenaline and the consolidation of emotionally arousing memories. Return to this lesson for a refresher on the involvement of adrenaline and the amygdala and hippocampus in consolidating these emotional memories.



**lesson link** The processes of encoding, storing and retrieving information is explained in lesson **6A: Atkinson-Shiffrin model of memory**. Return to this lesson for a refresher on these terms to deepen your understanding of the role of each brain structure.

**lesson link** The neural processes of memory are explored in lesson **4A: Long-term potentiation and long-term depression**. Return to this lesson to refresh your memory on these processes.

**Cerebral cortex** a brain structure where long-term memories are stored

For example, memory of a song's melody may be partially stored in the auditory cortex, the part of the cerebral cortex involved in storing some aspects of auditory information. Due to the interaction of many structures of the brain, other aspects of the melody may be stored in other brain regions.

Due to long-term memories being stored in various locations within the cerebral cortex, neural connections are able to be formed between different memories. These links between memories attach meaning to memories and enhance your understanding of how different concepts and memories are interrelated.

#### Hippocampus 3.2.8.2.2

The **hippocampus** is located in the middle of the brain and is primarily involved in encoding explicit memories. Once this information has been converted into a useable form, it is stored within the cerebral cortex to be retrieved for later use. The hippocampus is also involved in the consolidation of explicit memories, with the amygdala signalling to the hippocampus to strengthen consolidation of a memory when it is significant.

##### **Want to know more?**

People who have damage to their hippocampus are often unable to form new memories, as the hippocampus is involved in the encoding of explicit memories.

#### Amygdala 3.2.8.2.3

Also located in the middle of the brain, the **amygdala** is involved in encoding and consolidating emotionally charged memories, such as classically conditioned memories. The amygdala is often described as the structure most responsible for emotionally arousing memory due to being heavily involved in strengthening these memories and contributing to them being encoded in vivid detail.

Once the amygdala detects an experience which is emotionally arousing, it signals to the hippocampus that it is meaningful, enhancing the strength of that memory during encoding. For this reason, the amygdala can be thought of as helping label the emotional components of memory such as fear.

#### Cerebellum 3.2.8.2.4

The **cerebellum** is a structure located at the base of the brain. It is involved in encoding implicit memories, particularly procedural memories. The cerebellum is also the storage site for implicit procedural memories, due to the cerebellum being involved in the processes of motor control, coordination and balance.

##### **Useful tip**

When writing a response on the interaction between brain structures, it is extremely important to pay close attention to the given scenario. As an example of this need to read closely, look at this past VCAA question from the 2017 exam.

Arlo is a keen basketballer who plays on indoor and outdoor courts. During an indoor grand final, she fell over and twisted her knee. Her team also lost the game. Now, whenever Arlo plays on an indoor court, she becomes emotional.

The brain area that is responsible for the storage of Arlo's implicit memory of how to play basketball is the

- A cerebral cortex.
- B hippocampus.
- C cerebellum.
- D amygdala.

*Reproduced from VCAA 2017 exam MCQ27*

Many students answered this question incorrectly, with only 46% of students choosing the correct answer, which is option C, the cerebellum. The cerebellum is correct due to the question referring to Arlo's memory of how to play (a procedural memory) rather than the emotional component of the scenario. Procedural memories are stored via connections between the cerebellum and other brain structures, therefore making option C correct.

##### **Want to know more?**

As well as storing long-term memories, the cerebral cortex is also involved in processing short-term memories. This may be helpful to enhance your understanding of the structure, but is not necessary to learn as part of the VCAA course.

##### **Hippocampus** a brain structure which encodes explicit memories

 The hippocampus is the first area of the brain which is impacted by Alzheimer's disease. This neurodegenerative disease, as well as other types of brain trauma will be explored in lesson **7A: Brain trauma and neurodegenerative disease.**

##### **Amygdala** a brain structure involved in encoding and consolidating emotionally charged memories

##### **Cerebellum** a brain structure which encodes and stores implicit procedural memories

## Theory summary

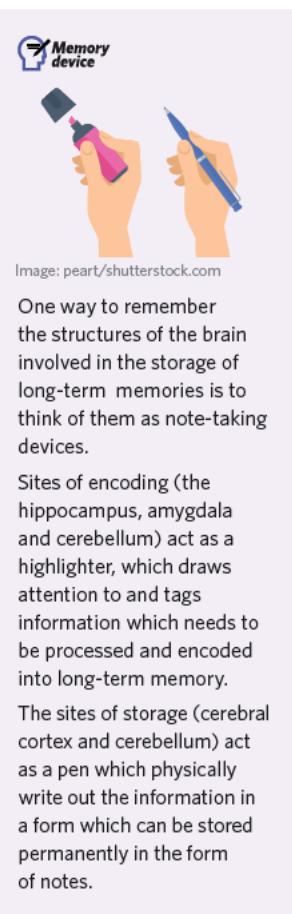
In this lesson, you have learned about the two categories of long-term memory: implicit and explicit memory. Specifically, you have learned that there are multiple types of memories within each category of long-term memory; with episodic and semantic memories being types of explicit memories and procedural and classically conditioned memories being types of implicit memories. These are referred to in table 1. You have also learned about the structures of the brain involved in the storage of long-term memory, including the cerebellum, cerebral cortex, hippocampus and amygdala. You should be able to understand the role of each of these structures in relation to memory, which is displayed in table 2, and understand how they interact.

**Table 1** Types of long-term memory

Explicit memory (Conscious retrieval)		Implicit memory (Unconscious retrieval)	
Semantic memory	Memory of facts and general knowledge	Procedural memory	Knowledge of how to carry out tasks involving motor skills
Episodic memory	Knowledge of personal experiences and events	Classically conditioned memory	Knowledge of stimuli or events which have been repeatedly associated with emotionally arousing stimuli

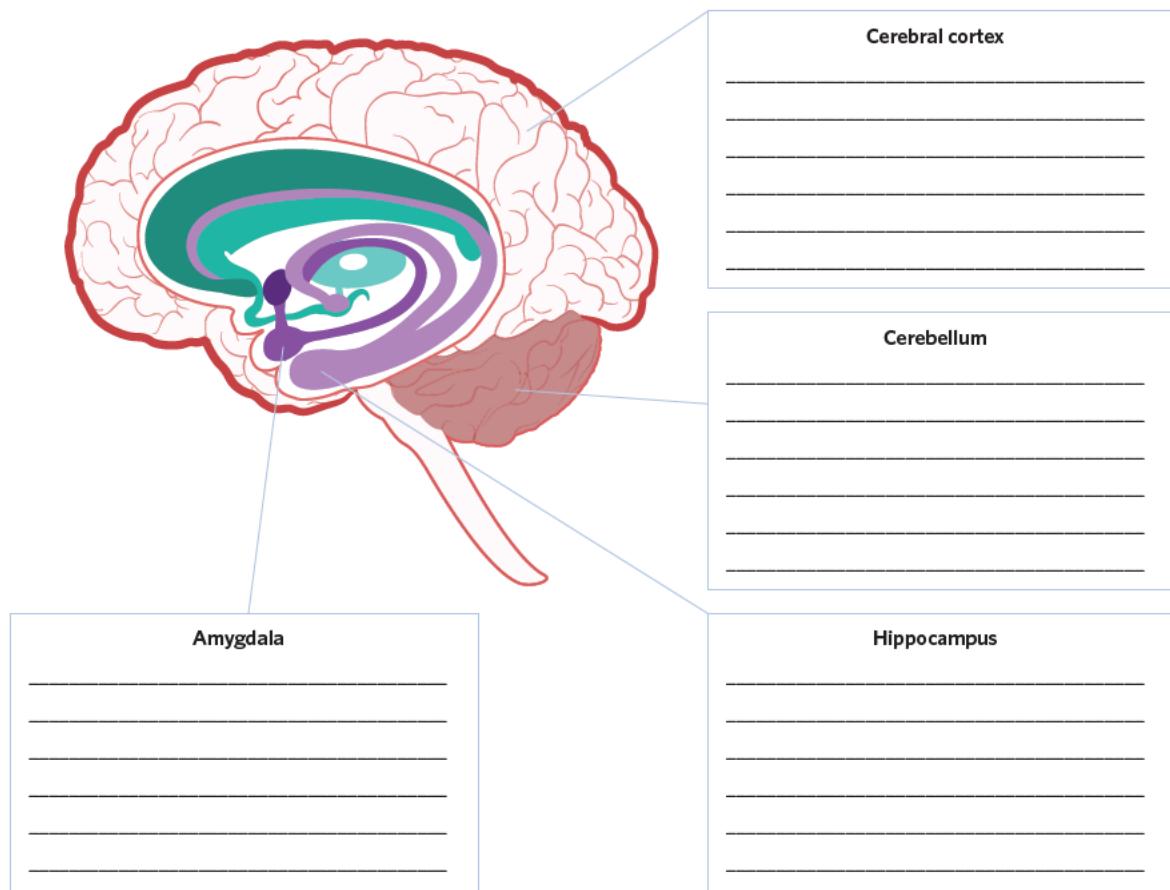
**Table 2** Structures of the brain involved in memory

Brain structure	Role in memory
Cerebral cortex	Stores long-term memories, particularly involved in the storage of explicit memories.
Amygdala	Involved in encoding and consolidating emotionally arousing memories, including conditional memories.
Hippocampus	Encodes explicit memories.
Cerebellum	Encodes and stores implicit procedural memories.



## 6B Activities

- 1 Complete this activity by filling out the function of each of the different parts of the brain in relation to memory.



Adapted from Edrolo and M.Adem, 2017.

# 6B QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |                   |                                  |               |
|-------------------|----------------------------------|---------------|
| • Explicit memory | • Procedural memory              | • Hippocampus |
| • Semantic memory | • Classically conditioned memory | • Cerebellum  |
| • Episodic memory | • Cerebral cortex                |               |
| • Implicit memory | • Amygdala                       |               |
- a A memory which is voluntarily brought into conscious awareness \_\_\_\_\_
- b A brain structure involved in encoding procedural memories \_\_\_\_\_
- c A brain structure which stores long-term memories \_\_\_\_\_
- d A type of explicit memory which involves an individual's personal experience \_\_\_\_\_
- e A memory which is retrieved unconsciously \_\_\_\_\_
- f The brain structure involved in encoding explicit memories \_\_\_\_\_
- g A brain structure which processes emotional memories \_\_\_\_\_
- h A type of memory which involves motor skills in order to have the knowledge of how to do something \_\_\_\_\_
- i A type of memory which involves the knowledge of facts and general knowledge \_\_\_\_\_
- j A type of implicit memory which involves an involuntary response, commonly fear, to a stimulus which has repeatedly been associated with an emotionally arousing stimulus \_\_\_\_\_

## Exam-style questions

### Remember and understand

### Question 2 (1 MARK)

Which type of long-term memory holds the knowledge that 'the sky is blue', 'the English alphabet has 26 letters', and '8-2 = 6'?

- A episodic memory
- B implicit memory
- C procedural memory
- D semantic memory

*Adapted from VCAA 2013 exam 1 MCQ21*

### Question 3 (1 MARK)

Which of the following is not an example of an explicit memory?

- A Knowing how to read the information on this page.
- B A teacher learning the names of her new students.
- C Learning a new bike route to take to work.
- D Remembering the author of your favourite book.

*Adapted from VCAA 2013 exam 1 MCQ43*

### Question 4 (1 MARK)

The brain structure which encodes memories which are retrieved without conscious awareness is the

- A cerebral cortex.
- B hippocampus.
- C cerebellum.
- D hypothalamus.

*Adapted from VCAA 2018 exam MCQ11*

**Question 5** (1 MARK)

Outline a difference between implicit and explicit memory.

**Question 6** (2 MARKS)

Describe a role of the hippocampus and cerebellum in relation to memory.

Adapted from VCAA 2014 exam SAQ1

**Apply and analyse****Question 7** (1 MARK)

Nancy learned how to ride a bike when she was a young child and used to ride to school every morning. As an adult, she believed she had forgotten how to ride a bike until she attempted the skill. She was surprised to find that she still knew how to ride a bike 30 years later.

This is due to her

- A iconic memory.
- B procedural memory.
- C episodic memory.
- D explicit memory.

Adapted from VCAA 2012 exam 1 MCQ31

**Question 8** (1 MARK)

Xander is a well-known AFL player. His understanding of how to effectively kick a goal and his knowledge of the rules of AFL respectively are examples of

- A explicit memory, implicit memory.
- B implicit memory, episodic memory.
- C procedural memory, non-declarative memory.
- D procedural memory, semantic memory.

**Question 9** (4 MARKS)

Theodore, a history teacher, taught his class all about the Russian revolution. He was able to remember all the key dates, figures and facts without even looking at any of his notes.

- a Identify the type of memory which allowed Theodore to remember facts about the Russian revolution. (1 MARK)
- b Explain which brain structure was involved when Theodore encoded this memory. Justify your response. (2 MARKS)
- c Identify where this memory would have been stored in the brain. (1 MARK)

**Questions from multiple lessons****Question 10** (1 MARK)

Emotionally arousing memories which involve fear can be created through the process of

- A observational conditioning.
- B classical conditioning.
- C storage.
- D the General Adaption Syndrome.

**Use the following information for questions 11 and 12.**

As a teenager, Dervla remembers a time as a child where her younger sister became lost at a beach. Ten years later, Dervla still remembers which beach they were at when this occurred.

**Question 11** (1 MARK)

For Dervla, this event is a/an

- A iconic memory.
- B episodic memory.
- C semantic memory.
- D procedural memory.

*Adapted from VCAA 2016 exam SAQ5*

**Question 12** (1 MARK)

The brain structure involved in encoding this memory is the

- A cerebellum.
- B cerebral cortex.
- C hippocampus.
- D corpus callosum.

**Question 13** (1 MARK)

Identify the type of long-term memory that Little Albert's conditioned emotional response represents.

**Question 14** (2 MARKS)

Watson and Rayner's experiments on Little Albert demonstrated that conditioned emotional memories could be learned.

Outline the role of the amygdala and cerebral cortex in the creation of these memories.

**Question 15** (4 MARKS)

Millie's mum is a dance instructor who has been trying to help Millie increase her flexibility so she could move into the advanced dance class. After repeatedly closely watching her mum teach a routine to an advanced dance class, during which she successfully encoded the steps involved, she finds that she is unable to perform the routine.

- a Identify the type of long-term memory involved in the dancers learning how to perform the dance routine. (1 MARK)
- b Using examples, outline the two stages of observational learning that Millie has achieved and a stage which she has not. (3 MARKS)

**Key science skills****Question 16** (5 MARKS)

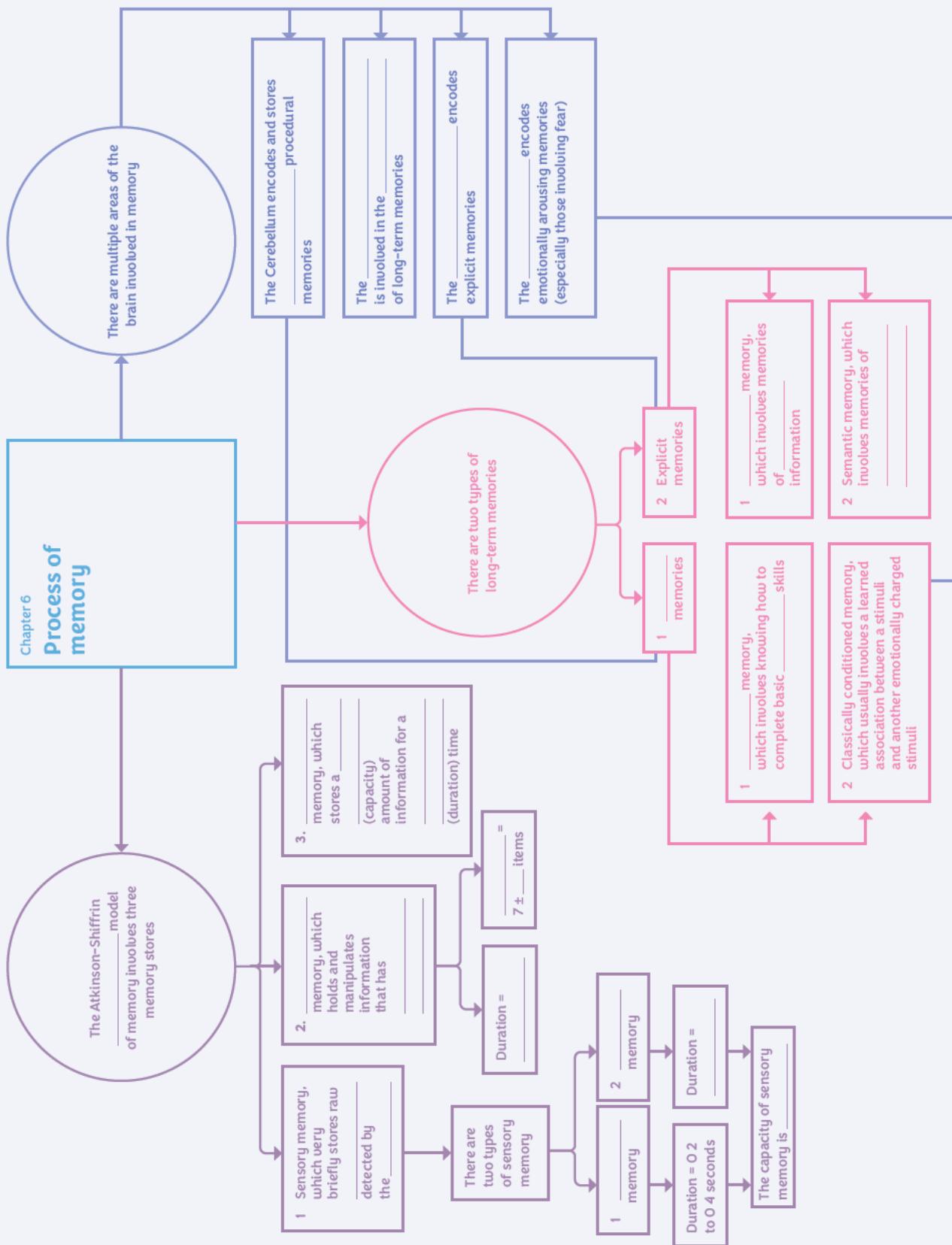
Dr Carey wanted to conduct a study investigating the effects of brain trauma on adults. To do this, she wanted to surgically damage the hippocampus of participants and interview them every three weeks, asking them questions on how the surgery impacted their everyday lives. An ethics committee denied the research study due to it being unethical.

- a Identify the type of data which Dr Carey would have recorded. (1 MARK)
- b Outline which type of long-term memory would be impacted by damage to the hippocampus. Justify your response. (2 MARKS)
- c Explain one ethical principle which Dr Carey's research would violate. Justify your response. (2 MARKS)

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own.  
This includes all concepts from the chapter.



**Review activity 2: Example bank**

Fill in the table with your own notes.

Key terminology	Your own definition	Example
Memory		
Encoding		
Storage		
Retrieval		
Sensory memory		
Echoic memory		
Iconic memory		
Short-term memory (STM)		
Long-term memory (LTM)		
Explicit memory		
Episodic memory		
Semantic memory		

Key terminology	Your own definition	Example
Implicit memory		
Procedural memory		
Classically conditioned memory		
Cerebral cortex		
Hippocampus		
Amygdala		
Cerebellum		

**Review activity 3: Create your own memory device for the Atkinson-Shiffrin multi-store model of memory and the brain regions involved in the storage of long-term memories**

In this chapter, you have learned memory devices and analogies to help you remember and understand the Atkinson-Shiffrin model of memory and the brain regions involved in the storage of long-term memories. For example, that echoic memory involves an echo as it detects sounds.

Try to come up with other ways to remember the concepts covered in this chapter. You can create an acronym, analogy, narrative or any other mnemonic device to help you remember the stores involved in the Atkinson-Shiffrin multi-store model of memory or the brain regions involved in the storage of long-term memories.

Things to turn into a mnemonic	Your mnemonics
The memory stores involved in the Atkinson-Shiffrin multi-store model of memory	
The different types of long-term memories (explicit and implicit)	
The brain regions involved in the storage of long-term memories, including implicit and explicit memories	

**Review activity 4: Notes from Vox 'Memory, explained'**

Go to the Vox profile on youtube ([youtube.com/voxdotcom](https://youtube.com/voxdotcom)) and find the video called *Memory, explained*, narrated by Emma Stone. (Vox, 2019)

Take notes on what is said about the following concepts. The video will also introduce you to concepts you will learn in the next chapter, including reconstruction of memory, eyewitness testimony and false memories.

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Implicit memory

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Explicit memory (including episodic and semantic memory)

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The role of the amygdala in memory

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The role of the hippocampus in memory

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Emotionally arousing memory

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## CHAPTER TEST

### Multiple choice questions

**Use the following information for questions 1 and 2.**

Alice and Olivia's favourite tea store announced a sale on 12 of their most popular flavours. On their way to the tea store, Alice and Olivia each tried to remember the 12 flavours.

**Question 1** (1 MARK)

---

Which of the following makes it unlikely that Alice and Olivia will be able to remember all 12 flavours?

- A The limited capacity of long-term memory.
- B The unlimited capacity of short-term memory.
- C The limited capacity of short-term memory.
- D The unlimited capacity of sensory memory.

**Question 2** (1 MARK)

---

Alice's memory of the conversation she had with Olivia on the way to the tea store and the memory of the name of a flavour of tea represents

- A a procedural episodic and procedural semantic memory, respectively.
- B a declarative episodic and declarative semantic memory, respectively.
- C a declarative semantic and declarative episodic memory, respectively.
- D a procedural episodic and declarative semantic memory, respectively.

**Question 3** (1 MARK)

Long-term memory

- A has a limited capacity and a relatively short duration.
- B has a capacity of  $7\pm 2$  items and a relatively permanent duration.
- C has a potentially unlimited capacity and a duration of 18-30 seconds.
- D has a potentially unlimited capacity and a relatively permanent duration.

**Question 4** (1 MARK)

The capacity and duration of sensory memory are

- A  $7\pm 2$  items and unlimited, respectively.
- B unlimited and 0.2-4 seconds, respectively.
- C unlimited and 3-4 seconds, respectively.
- D 3-4 items and 30 seconds, respectively.

**Question 5** (1 MARK)

The hippocampus

- A is the site of storage for long-term memory.
- B retrieves explicit declarative memory and has a role in the acquisition of a fear response.
- C encodes implicit procedural memory and has a role in coordinating motor movements and balance.
- D encodes explicit declarative memory and consolidates short-term memory into long-term storage.

**Question 6** (1 MARK)

Information that is not attended to

- A cannot be encoded by the amygdala.
- B will not move to short-term memory and into conscious awareness.
- C will be stored in long-term memory.
- D will not move to short-term memory and into unconscious awareness.

**Question 7** (1 MARK)

With reference to the Atkinson-Shiffrin multi-store model of memory, which of the following statements most accurately describes short-term memory?

- A A memory store where information is unconsciously manipulated, with a duration of  $7\pm 2$  items, and a capacity of 18-30 seconds.
- B A memory store where information is consciously manipulated, with a duration of  $7\pm 2$  items, and a capacity of 18-30 seconds.
- C A memory store where information is consciously manipulated, with a capacity of  $7\pm 2$  items, and a duration of 18-30 seconds.
- D A memory store where information is unconsciously manipulated, with a capacity of  $7\pm 2$  items, and a duration of 18-30 seconds.

**Question 8** (1 MARK)

An example of an explicit and implicit memory are, respectively,

- A knowing the capital city of Russia and knowing how to play the piano.
- B knowing how to listen to music and knowing how to ride a bike.
- C remembering a friend's birthday and learning someone's name for the first time.
- D knowing how to play the piano and being able to list the elements of the periodic table.

**Question 9** (1 MARK)

The recall of which of the following memories will be affected following damage to the cerebellum?

- A the name of a famous netballer
- B the rules of a netball game
- C a netball match in which an individual scored their first goal
- D how to throw a netball to score in a game

**Question 10** (1 MARK)

Bailey was conditioned to produce a fear response to his politics textbook. The type of memory this fear response represents and the region of Bailey's brain responsible for its consolidation are

- A explicit memory and the cerebellum, respectively.
- B procedural memory and the hippocampus, respectively.
- C implicit memory and the amygdala, respectively.
- D explicit memory and the cerebral cortex, respectively.

*Adapted from VCAA 2017 exam MCQ24*

**Short answer questions****Question 11** (3 MARKS)

Sarisha was staring out the window during class and was not paying attention. When the teacher asked her a question, Sarisha initially did not hear and asked her teacher to repeat the question. However, before the question was repeated, Sarisha realised what her teacher had asked her and was able to respond.

With reference to the duration of echoic sensory memory, explain why Sarisha was able to respond to the teacher's question, despite not initially hearing it.

**Question 12** (3 MARKS)

Outline the difference between semantic and episodic long-term memory, and provide an example of each.

**Question 13** (9 MARKS)

Tadhg walked his chihuahua around the block every evening. One day, he decided to take a different route. As he was walking, a much larger dog appeared and seemed about to attack them, scaring Tadhg and his dog greatly. Without thought, Tadhg picked up his chihuahua and ran as fast as he could away from the larger dog. After the event, Tadhg was surprised at how fast he had been able to run, as it was much faster than usual.

- a With reference to the fight-flight-freeze response, identify and explain which response Tadhg displayed. (2 MARKS)
- b With reference to Selye's General Adaptation Syndrome, identify which stage Tadhg was in when he ran away from the large dog and explain why he was able to run faster than normal. (2 MARKS)
- c In terms of operant conditioning, identify the type of consequence Tadhg's behaviour of choosing a different route received and explain the effect this consequence is likely to have on Tadhg repeating his behaviour in the future. (2 MARKS)
- d Identify the brain structure responsible for Tadhg's encoding of his encounter with the large dog as fearful and the type of long-term memory this experience represents. Justify your response. (3 MARKS)

**Question 14** (2 MARKS)

Describe how the hippocampus and cerebral cortex interact in the storage of long-term memory.

**Question 15** (1 MARK)

Describe the role of the cerebellum in memory.

### Key science skills questions

#### Question 16 (9 MARKS)

Dr Garzolini wanted to investigate the duration of short-term memory. Twenty participants were selected to take part in the study based on their response to an online advertisement. After giving consent, participants were assigned to an experimental or control condition. This was done through an online name generator. Both conditions listened to a recording which listed 20 nonsense two-syllable items, one per second. Both conditions experienced a 30 second delay after the recording before being asked to recall and write down as many nonsense items as possible. During the 30 second delay, the control condition were able to rehearse the nonsense items, while the experimental condition were asked to count down aloud from 100. Participants were given a score out of 20 to mark their performance.

- a Write a possible hypothesis for Dr Garzolini's investigation. (3 MARKS)
- b Name the allocation procedure used in this scenario and state an advantage of using this procedure. (2 MARKS)
- c Identify the experiment's independent variable (IV) and dependent variable (DV) and operationalise each. (4 MARKS)



# 07

UNIT 3 AOS 2, CHAPTER 7

## Reliability of memory

### 7A Brain trauma and neurodegenerative disease

- the effects of brain trauma on areas of the brain associated with memory and neurodegenerative diseases, including brain surgery, anterograde amnesia and Alzheimer's disease

### 7C Memory retrieval

- methods to retrieve information from memory or demonstrate the existence of information in memory, including recall, recognition, relearning and reconstruction

### 7B Factors affecting memory

- the factors influencing a person's ability and inability to remember information, including context and state dependent cues, maintenance and elaborative rehearsal and serial position effect

### 7D Reconstruction in Loftus' research

- the reconstruction of memories as evidence for the fallibility of memory, with reference to Loftus' research into the effect of leading questions on eye-witness testimonies

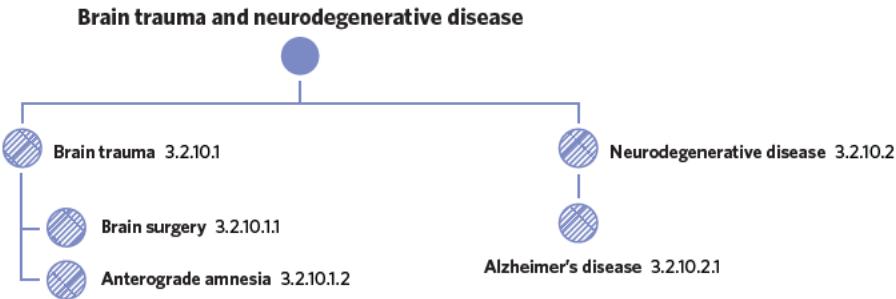


# 7A BRAIN TRAUMA AND NEURODEGENERATIVE DISEASE

In this chapter, you will be learning about the reliability of memory. This includes learning about impairments that can occur to your memory due to different kinds of brain trauma or neurodegenerative disease.

7A. Brain trauma and neurodegenerative disease	7B. Factors affecting memory	7C. Memory retrieval	7D. Reconstruction in Loftus' research
<b>Study design dot point</b>			
<ul style="list-style-type: none"> <li>the effects of brain trauma on areas of the brain associated with memory and neurodegenerative diseases, including brain surgery, anterograde amnesia and Alzheimer's disease</li> </ul>			
<b>Key knowledge units</b>			
Brain surgery (Brain trauma)			3.2.10.1.1
Anterograde amnesia (Brain trauma)			3.2.10.1.2
Alzheimer's disease (Neurodegenerative disease)			3.2.10.2.1

**In this lesson, you will be learning about brain trauma**, including the effects of **brain surgery** on different regions of the brain and **anterograde amnesia**. You will also be learning about neurodegenerative diseases, as demonstrated through **Alzheimer's disease**.



## Brain trauma 3.2.10.1

### OVERVIEW

Brain trauma occurs when an external force (as demonstrated by brain surgery) or internal cause produces damage to the brain. When brain trauma occurs to the hippocampus, it can result in a condition called anterograde amnesia.

### THEORY DETAILS

**Brain trauma** refers to any form of damage or injury to the brain. This may be caused by an external force (such as a blow to the head; known as traumatic brain injury), or an internal cause. Because brain surgery involves physical changes to an individual's brain that are outside their control, this surgery is an example of brain trauma.

### Brain surgery 3.2.10.1.1

When a particular region of the brain is operated on due to some kind of abnormality, such as a tumour, it can often cause long-term damage. As a result, the individual who underwent surgery may experience impaired functioning within the region operated on, including difficulty processing or retrieving different types of memory. This can disrupt the interactions between specific regions of the brain, and ultimately impair the storage of long-term memories. As highlighted in table 1, the potential effects of brain surgery differ depending on the region of the brain targeted.

**Brain trauma** any form of damage or injury to the brain

**Brain surgery** the treatment of brain injury or disease with the use of medical instruments

**Table 1** The effect of surgery on the different structures of the brain

Brain structure	Potential effect of surgery on memory
Cerebral cortex	Issues with the storage of explicit memories.
Amygdala	Issues with the encoding of emotional memories.
Cerebellum	Issues with the encoding of some types of implicit memories and storage of procedural memories.
Hippocampus	Issues with the encoding and consolidation of explicit memories.

**lesson link** The type of memory that each region of the brain is responsible for processing was covered in lesson 6B: *Memory and the brain*.

### Anterograde amnesia 3.2.10.1.2

Brain trauma sustained to the hippocampus can result in **anterograde amnesia**, a condition in which new explicit memories cannot be consolidated. This results in the individual being unable to remember events that occur after the trauma is experienced.

For example, if someone experienced damage to their hippocampus playing a sports match and were taken to hospital, they would not remember events after the accident if they had anterograde amnesia, such as being driven to the hospital or who their doctors were. If no damage had been sustained to their cerebral cortex, however, they would still remember events in their life leading up to the sports match, as this is where explicit long-term memories are stored.

**Anterograde amnesia** a condition where new explicit memories cannot be effectively consolidated after trauma to the hippocampus



Lesson 6A: *Atkinson-Shiffrin model of memory* provides an important insight into why people with anterograde amnesia are still capable of certain skills despite their memory impairments. This is because it is still possible to hold information in short-term memory, even though they are unable to consolidate the short-term memory to long-term memory. As a result, an individual with anterograde amnesia is still able to hold information in their short-term memory for the 18-30 second duration.

### Neurodegenerative disease 3.2.10.2

#### OVERVIEW

A neurodegenerative disease is a disease that involves the progressive loss of neurons in the brain. An example of a neurodegenerative disease is Alzheimer's disease.

**Neurodegenerative disease** a disease characterised by the progressive loss of neurons in the brain

#### THEORY DETAILS

A **neurodegenerative disease** refers to any disease that involves the progressive loss of neurons in the brain. **Alzheimer's disease** is an example of a neurodegenerative disease, where the loss of neurons in the brain causes issues with cognitive functioning, as evident through declining memory capabilities. In this sense, a neurodegenerative disease may be thought of as a form of brain trauma with an internal cause. In this sense, a neurodegenerative disease may be thought of as a form of brain trauma with an internal cause.

**Alzheimer's disease** a neurodegenerative disease that involves the progressive loss of neurons in the brain and is characterised by memory decline

#### Alzheimer's disease 3.2.10.2.1

The loss of neurons in the brain that occurs due to Alzheimer's disease occurs particularly in the hippocampus. Consequently, the person with Alzheimer's disease experiences anterograde amnesia, and is unable to consolidate new long-term memories.

**lesson link** In lesson 2E: *Chronic nervous system changes due to neurotransmitter dysfunction* you learned about Parkinson's disease, which is also a neurodegenerative disease.

Alzheimer's disease is a neurodegenerative disease, indicating a progressive loss of neurons in the brain. For patients with Alzheimer's, neuron death begins in the hippocampus and then moves outwards to the cerebral cortex. Damage to and loss of neurons in the cerebral cortex consequently disrupts the long-term storage of past explicit memories and the processing of new short-term memories. This accounts for other symptoms associated with Alzheimer's disease, such as being unable to recognise the faces of family, experiencing personality changes and a gradual loss of identity.

At the later stages of Alzheimer's disease, the brain can be observed as having significantly reduced in size due to a loss of brain matter, represented by the progressive loss of neurons. This is evident in figure 1, where the result of the gradual death of neurons in the brain is depicted.

As damage spreads to other brain regions of a patient with Alzheimer's, associated symptoms correspond to the structures of the brain that suffer damage. Along with characteristic memory impairment, other symptoms of Alzheimer's disease include:

- A decrease in cognitive functions, such as the ability to plan, problem-solve, think logically, and organise
- Changes in mood and emotion
- Becoming confused and disoriented
- Difficulty with language

There are specific biological causes of Alzheimer's disease that result in its development and progression. The biological causes of Alzheimer's disease include the presence of:

- **Amyloid plaques:** Fragments of the protein beta-amyloid accumulate into insoluble plaques around the neurons, inhibiting communication between neurons.
- **Neurofibrillary tangles:** The protein tau accumulates into insoluble tangles within neurons, inhibiting the transport of essential substances throughout the neuron and eventually killing it entirely.

#### **Useful tip**

To remember the difference between amyloid plaques and neurofibrillary tangles, it could be helpful to think about how amyloid plaques develop between neurons, whereas neurofibrillary tangles develop within neurons.

#### **Want to know more?**

You may have heard the terms 'Alzheimer's disease' and 'dementia' sometimes being used interchangeably. Dementia is the broad umbrella term for illnesses characterised by a decline in cognitive ability that interrupts daily life. Alzheimer's disease is the most common type of dementia, and is characterised by the specific neurological markers of plaques and tangles.

However, these neurological markers cannot be seen, and therefore a diagnosis cannot be conclusive. A conclusive diagnosis of Alzheimer's can only be made through an autopsy when the plaques and tangles can be identified. As such, some doctors and psychologists will diagnose a patient based on the symptoms they present, and use the broad term of dementia instead.

#### **Want to know more?**

There is no known cure for Alzheimer's disease, rather, medication can slow down its progression and manage some of its symptoms. Due to the loss of neurons, people with Alzheimer's disease have greatly reduced levels of the neurotransmitter acetylcholine. To counter this, certain medications, such as cholinesterase inhibitors like donepezil, aim to prevent the breakdown of acetylcholine in the brain.

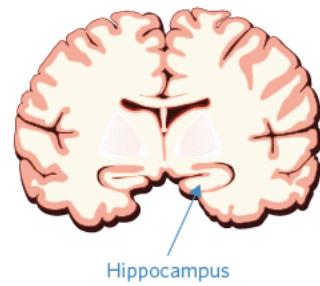
## **Theory summary**

In this lesson, you have learned about brain trauma and neurodegenerative disease. Specifically, you learned about brain surgery as an example of brain trauma and how brain trauma to the hippocampus results in anterograde amnesia. You also learned about Alzheimer's disease as a specific example of neurodegenerative disease. You should now understand the impact on memory that results from surgery in different regions of the brain, the effect of anterograde amnesia on memory processes, as well as the different stages and biological causes of Alzheimer's disease.

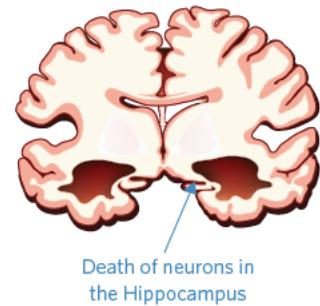
**Amyloid plaques** fragments of the protein beta-amyloid that accumulate into insoluble plaques that inhibit communication between neurons

**Neurofibrillary tangles** an accumulation of the protein tau that forms insoluble tangles within neurons, which then inhibit the transport of essential substances throughout the neuron, eventually killing the neuron entirely

#### **Healthy brain**



#### **Alzheimer's disease**



Images: Designua/Shutterstock.com

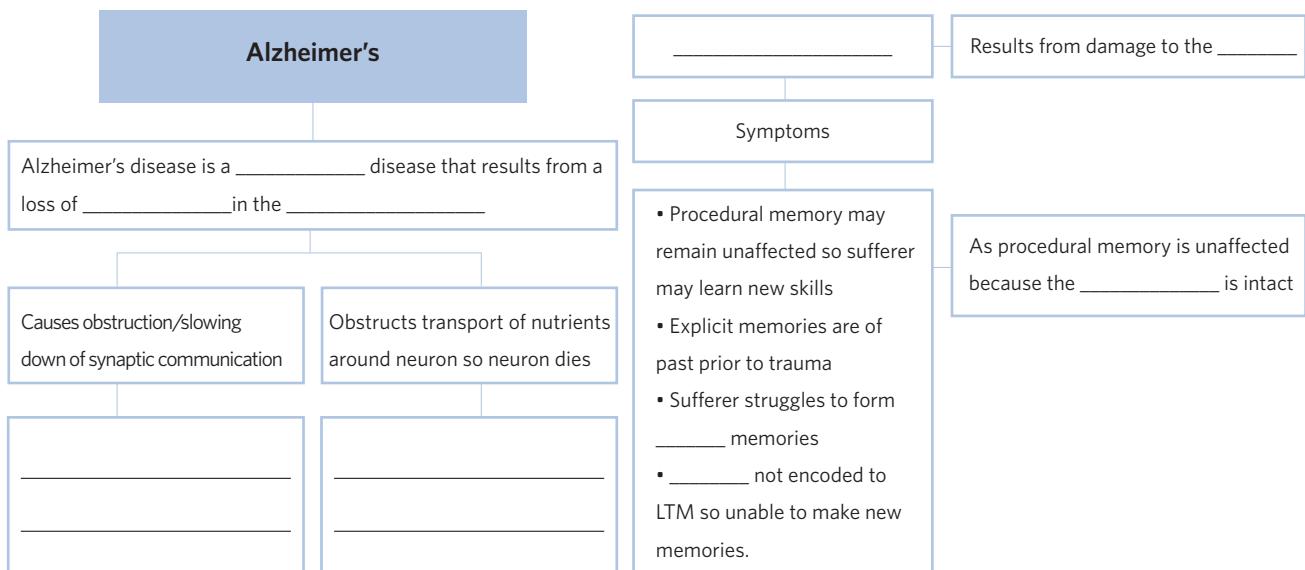
**Figure 1** Comparison of a healthy brain and the brain of someone with Alzheimer's disease

## **7A Activities**

- 1** Complete this table by identifying the two examples of brain trauma and providing a description of each.

Brain trauma	Description

- 2** Complete this mind map by filling in the blanks in the spaces provided.



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## 7A QUESTIONS

## Theory review questions

## Question 1

Match the key term from the lesson to the corresponding definition.

- Brain trauma
  - Brain surgery
  - Anterograde amnesia
  - Neurodegenerative disease
  - Alzheimer's disease

a A neurodegenerative disease that involves the progressive loss of neurons and memory capabilities \_\_\_\_\_

b Any damage sustained to a region or structure of the brain \_\_\_\_\_

c A condition where new explicit memories cannot be consolidated after damage is sustained to the hippocampus \_\_\_\_\_

d A disease characterised by the progressive loss of neurons in the brain \_\_\_\_\_

e The use of medical instruments to treat brain injury or disease \_\_\_\_\_

## **Exam-style questions**

## **Remember and understand**

**Question 2** (1 MARK)

Damage to the amygdala impairs the

- A recall of long-term memories.
  - B consolidation of emotionally arousing memories.
  - C consolidation of new short-term memories.
  - D recall of existing explicit memories.

**Question 3** (1 MARK)

The area of the brain that is associated with memory that is most likely to be affected by Alzheimer's disease is the

- A substantia nigra.
- B hippocampus.
- C cerebellum.
- D amygdala.

Adapted from VCAA 2017 exam MCQ5

**Question 4** (1 MARK)

Alzheimer's disease is

- A a neurodegenerative disease that everyone will eventually experience.
- B a neurodegenerative disease characterised by progressive memory loss.
- C an example of brain trauma caused by surgery to the hippocampus.
- D an example of brain trauma caused by anterograde amnesia.

**Question 5** (2 MARKS)

Describe anterograde amnesia.

**Question 6** (2 MARKS)

Describe two neurological differences from normal neural functioning that characterise Alzheimer's disease.

**Apply and analyse****Use the following information for questions 7 and 8.**

Michael got hit by a car riding to work and sustained serious brain trauma. Although he regained consciousness shortly afterwards, Michael is now unable to remember any events that have happened since the accident. However, Michael can still remember events that occurred before the crash.

**Question 7** (1 MARK)

Michael is experiencing

- A Alzheimer's disease.
- B difficulty retrieving past explicit memories.
- C anterograde amnesia.
- D difficulty retrieving past implicit memories.

**Question 8** (1 MARK)

A task that Michael should still be able to do is

- A remember his bike route from home to work.
- B learn new information at work.
- C remember the names of new people that he meets.
- D recite the details of a conversation that he had an hour ago.

Adapted from VCAA 2017 sample exam MCQ31

**Question 9** (2 MARKS)

Kalvin has recently had surgery on his cerebellum following a car accident.

Is it likely that Kalvin can ride his bike following the surgery? Justify your response.

**Question 10** (2 MARKS)

Felix is a 65-year-old man who has never had any issues with his memory. Felix's family became concerned when he started having difficulty remembering new information. Although Felix was able to recall memories from the past, he would often forget what had just been said to him, and would ask his family members the same question repeatedly. Felix's family took him to a doctor, who conducted an MRI and found that his brain had reduced in mass and that degeneration had occurred mostly in the hippocampus region of the brain.

Identify if a doctor would suspect that Felix may have Alzheimer's disease. Justify your response.

**Questions from multiple lessons****Question 11** (1 MARK)

Jarrad recently hit his head playing football. While he could respond to questions at the time, he could not consolidate the memories of these conversations and therefore could not remember any events occurring after the injury.

Jarrad's inability to remember events occurring after the injury demonstrates how new information cannot reach

- A sensory memory.
- B short-term memory.
- C long-term memory.
- D echoic memory.

**Question 12** (1 MARK)

After a serious driving accident, doctors discovered that Ashley had anterograde amnesia. As a result, Ashley could not remember any events after her accident, such as the names of the doctors in the hospital.

Identify the memory store that Ashely's new explicit memories cannot reach.

**Key science skills****Question 13** (1 MARK)

Jacob suffered a serious head injury while playing rugby on the weekend. When Jacob went to the hospital he was asked by the doctor to take part in a case study so that they could learn more about the effects of his injury on his brain function.

In this situation, a case study would be useful because

- A case studies can always be generalised to the population.
- B it would result in only quantitative data.
- C case studies can provide ideas for further research into brain injury.
- D a case study uses only non-invasive techniques to study the brain.

Adapted from VCAA 2014 exam MCQ29

**Question 14** (5 MARKS)

Dr Pierre is interested in studying the effectiveness of a particular medicine in increasing the volume of the hippocampus. In order to test this, Dr Pierre recruited elderly patients at the hospital where he worked and allocated them into one of two groups. One group was asked to take the medication while the other group took no medication. An MRI was conducted before and after the experiment to determine the level of growth in participants' hippocampal volume. It was found that after six weeks the group taking the medication experienced a small increase in volume, while the other group experienced a significant decrease during this period.

- a Identify the sampling technique used by Dr Pierre. (1 MARK)
- b Dr Pierre was unable to generalise the results from this investigation to people with Alzheimer's disease. Why? (1 MARK)

Adapted from VCAA 2018 exam SAQ4b

- c Explain why the results to Dr Pierre's experiment may be of interest to researchers investigating Alzheimer's disease. (3 MARKS)

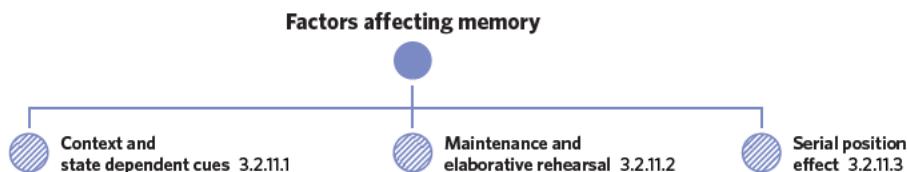
Adapted from VCAA 2018 exam SAQ4c

# 7B FACTORS AFFECTING MEMORY

So far in this chapter, you have learned about brain trauma and neurodegenerative disease. Now, you will further your understanding of the reliability of memory by looking at the different factors that affect memory. This involves exploring different types of cues that can be used to retrieve long-term memories, methods of rehearsing information and the psychological concept of the serial position effect.

7A. Brain trauma and neurodegenerative disease	7B. Factors affecting memory	7C. Memory retrieval	7D. Reconstruction in Loftus' research
<b>Study design dot point</b>			
• the factors influencing a person's ability and inability to remember information, including context and state dependent cues, maintenance and elaborative rehearsal and serial position effect			
<b>Key knowledge units</b>			
Context and state dependent cues			3.2.11.1
Maintenance and elaborative rehearsal			3.2.11.2
Serial position effect			3.2.11.3

In this lesson, you will be learning about factors affecting memory. This includes **context and state dependent cues**, **maintenance and elaborative rehearsal** and the **serial position effect**.



## Context and state dependent cues 3.2.11.1

### OVERVIEW

A retrieval cue is a stimulus that helps bring forward information from long-term memory. Context dependent cues relate to the physical environment where a memory was formed, whereas state dependent cues refer to aspects of an individual's psychological and physiological experience at the time of memory formation.

### THEORY DETAILS

A retrieval cue is any stimulus that helps an individual access information from long-term memory and bring it into conscious awareness.



In lesson **6A: Atkinson-Shiffrin model of memory** you learned about the different memory stores, including sensory, short-term and long-term memory. Using this model, you can understand a retrieval cue as a way of helping information transfer from long-term memory back to short-term memory, bringing it into an individual's conscious awareness.

**Context dependent cues** are aspects of the physical environment where a memory is recalled that match the environment where the memory was originally formed and encoded. When an individual returns to the physical environment where the memory was formed, it acts as a prompt for accessing that memory.

For example, if an actor in a play learned their lines on set, then returning to the set would act as a prompt for the actor to remember their lines.

**State dependent cues** are aspects of an individual's psychological or physiological state when a memory was formed. Returning to the same psychological or physiological state acts as a retrieval cue for accessing the memory that was formed in that state.

**Retrieval cue** stimuli that act as a prompt to access information from long-term memory

**Context dependent cues** stimuli in the physical environment where a memory is recalled that act as a prompt to retrieve memories formed in that environment

**State dependent cues** aspects of an individual's psychological and physiological experience at the time a memory was formed that later act as a prompt to retrieve that memory

For example, if you watched an action film that made you experience the psychological state of excitement, accompanied by physiological changes such as having an increased heart rate, then you are more likely to remember details of that film when you return to that state.

#### **Useful tip**

Context dependent cues demonstrate that it is helpful to study in the same physical environment that you will be in for a test or exam. When sitting the test or exam, this therefore means that the location you are in may aid the retrieval of the information that you studied.

## **Maintenance and elaborative rehearsal** 3.2.11.2

### **OVERVIEW**

One factor which influences memory is rehearsal, including maintenance and elaborative rehearsal.

### **THEORY DETAILS**

**Maintenance rehearsal** involves repeating information over and over again. By doing this, information is kept in short-term memory for as long as possible. Maintenance rehearsal works on the principle of extending the duration of short-term memory. By continuously repeating information, it is possible to remember it for the full duration of short-term memory. For example, if someone listed their phone number, by repeating the digits over and over again you could remember it for around 30 seconds, giving you enough time to type it into your phone. Maintenance rehearsal can often also allow for new information to be transferred into long-term memory.

**Elaborative rehearsal** involves repeating and linking new information to previously learned information that is already in the long-term memory store. By linking this new information to previously-stored information, it enables this new information itself to reach the long-term memory store. The likelihood of new information being transferred to long-term memory is increased if it is being linked to meaningful information which is significant to the individual. For example, you could remember the name of a new co-worker by relating their name to somebody else you know, such as a family member or celebrity. This strengthens the encoding of the new information of the co-worker's name, allowing for a lasting long-term memory to be formed.

**Maintenance rehearsal** repeating new information over and over again to functionally enhance the duration of short-term memory and transfer information to long-term memory

**Elaborative rehearsal** encoding new information by meaningfully linking it to information already stored in long-term memory to enhance its storage and later retrieval



In lesson **4A: Long-term potentiation and long-term depression** you looked at how learning and memory have a neural basis, where the formation of memory involves the repeated firing of neurons within neural pathways (long-term potentiation). This helps to demonstrate the biological aspect of elaborative rehearsal. Elaborative rehearsal does not rely on making new neural connections, but rather linking to already established ones.

#### **Useful tip**

Maintenance rehearsal includes common study techniques used by students, such as rote learning. As discussed, these techniques are helpful in keeping information in short-term memory, but not necessarily in transferring information to long-term memory where it can be retrieved later during a test or exam. This demonstrates how elaborative rehearsal is a more effective study method for ensuring that content reaches long-term memory.

## **Serial position effect** 3.2.11.3

### **OVERVIEW**

The serial position effect is a psychological phenomenon which involves the extent of correct recall of information relative to the order in which it was presented to someone. Within the serial position effect there is the primacy effect, which refers to enhanced recall of information presented first, and the recency effect, which refers to enhanced recall of information presented last.

## THEORY DETAILS

The **serial position effect** is a psychological concept that links the effectiveness of memory recall to its position when it was presented within a list of items. The serial position effect requires information from a list to be presented in a specific order, and for recall to occur after all pieces of information have been presented. When this occurs, the items towards the start and end of the list typically experience the greatest recall. By contrast, information presented in the middle of a list is the most likely to be forgotten.

The **primacy effect** refers to the enhanced recall of information that is presented at the beginning of a list. This information is the most likely to be rehearsed and therefore is most likely to be transferred into long-term memory. As a result, this information is stored and available for retrieval when it needs to be recalled.

The **recency effect** refers to the enhanced recall of information that is presented at the end of a list. This information is likely to still be in the short-term memory store by the time the information is retrieved, therefore meaning that it is still in conscious awareness and can be recalled correctly. The recency effect is typically stronger than the primacy effect.

As highlighted in figure 1, the serial position effect can be graphed with the percentage of recall on the y-axis and position of information in the list on the x-axis. This demonstrates how items at the beginning and end of a list experience the highest percentage of recall.

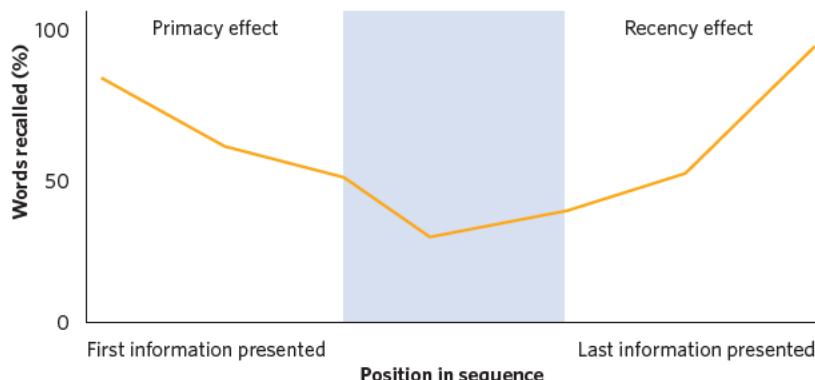


Figure 1 Serial position effect graph

**Serial position effect** a tendency for free recall to be superior for items at the end and beginning of a list compared to items in the middle

**Primacy effect** enhanced recall of information presented at the beginning of a list due to this information being rehearsed and transferred into long-term memory

**Recency effect** enhanced recall of information presented at the end of a list due to this information remaining in short-term memory

 **Memory device** To remember what the serial position effect looks like visually when it is presented as a graph, you can think of it as being 'U' shaped.



In lesson 7C: **Memory retrieval** you will learn about different ways of retrieving memory. The serial position effect relies on free recall, where information is retrieved in any order and without the use of a prompt. If serial recall is used, which is where recall occurs in the order that information was learned, only the primacy effect occurs. This occurs because participants would need to recall as many items as possible from the list in order from the beginning. By the time they reach the end of the list, the last items will no longer be within the 18-30 second duration of short-term memory.

### Want to know more?

When there is a delay between the presentation of words in a list and when recall takes place, the recency effect is no longer evident. This is because the information presented at the end of the list no longer remains in short-term memory given its 18-30 second duration. This is evident in figure 2.

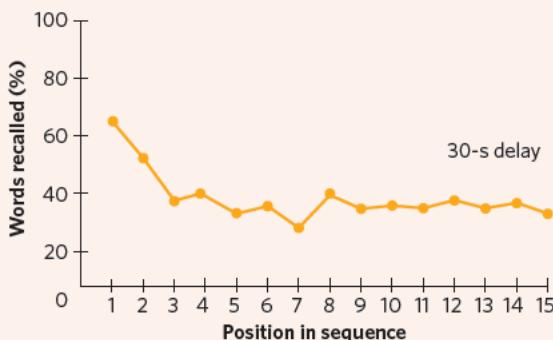


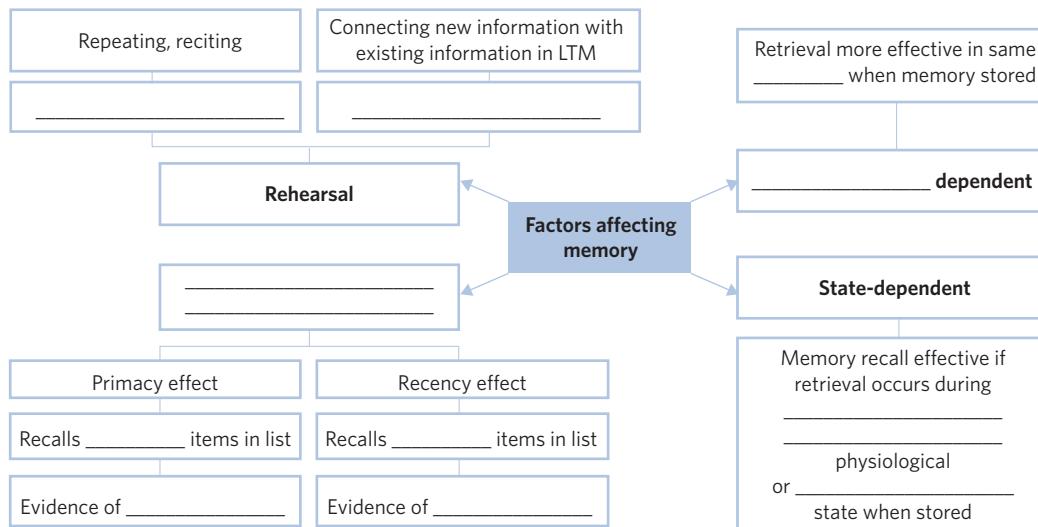
Figure 2 Serial position effect with delayed recall

## Theory summary

In this lesson, you have learned about the different factors affecting memories. Specifically, you have learned about context and state dependent cues as examples of retrieval cues, maintenance and elaborative rehearsal as examples of rehearsal and the psychological concept of the serial position effect, including the primacy and recency effect. You should now have an understanding of each of these concepts and be able to describe how they affect memory storage and retrieval.

## 7B Activities

- 1 Complete this mind map by filling in the blanks in the spaces provided.



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## 7B QUESTIONS

### Theory review questions

#### Question 1

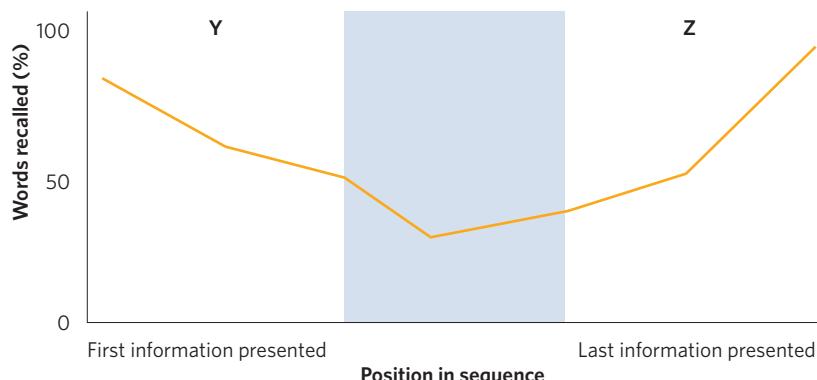
Match the key terms from the lesson to the corresponding definition.

- |                         |                         |                          |                  |
|-------------------------|-------------------------|--------------------------|------------------|
| • Retrieval cue         | • State dependent cue   | • Elaborative rehearsal  | • Primacy effect |
| • Context dependent cue | • Maintenance rehearsal | • Serial position effect | • Recency effect |
- a Repeating information over and over again to functionally enhance the duration of short-term memory and transfer information to long-term memory \_\_\_\_\_
- b Stimuli that helps recall information from long-term memory \_\_\_\_\_
- c A psychological phenomenon that explains why the effectiveness of recall is associated with the order that information is presented to someone \_\_\_\_\_
- d Stimuli in the physical context or environment where a memory is recalled that matches stimuli where it was formed \_\_\_\_\_
- e Enhanced recall of information presented first within a list \_\_\_\_\_
- f Aspects of an individual's psychological or physiological environment during recall that correspond to when the memory was first formed and enhance the retrieval of this memory \_\_\_\_\_
- g Enhanced recall of information presented last within a list \_\_\_\_\_
- h Repeating new information while linking it to previously learned memories to enable their transfer into long-term memory \_\_\_\_\_

**Question 2**

Which of the following options correctly matches the blanks?

	Y	Z
A	Recency effect	Primacy effect
B	Primacy effect	Recency effect
C	Serial position effect	Primacy effect
D	Serial position effect	Recency effect

**Exam-style questions***Remember and understand***Question 3** (1 MARK)

The serial position effect proposes that the

- A recall of items towards the beginning and middle of the list are the highest.
- B recall of items towards the beginning and end of the list are the highest.
- C recall of items in the middle of the list is higher than the recency and primacy effects.
- D recall is dependent on the type of information provided.

Adapted from VCAA 2016 exam MCQ15

**Question 4** (1 MARK)

Repeating information over and over again to keep it in short-term memory for as long as possible is referred to as

- A context dependent cues.
- B state dependent cues.
- C elaborative rehearsal.
- D maintenance rehearsal.

**Question 5** (1 MARK)

Identify a difference between maintenance and elaborative rehearsal.

**Question 6** (4 MARKS)

With the use of examples, describe the difference between context and state dependent cues.

*Apply and analyse***Question 7** (1 MARK)

Joseph is planning a surprise birthday party for his best friend. While he is waiting for his friend, he is incredibly excited and can feel his heart rate increasing. This reminds Joseph of when he was equally excited to surprise his mother for her birthday a year ago.

What factor has influenced Joseph's ability to remember surprising his mother for her birthday?

- A content dependent cues
- B state dependent cues
- C maintenance rehearsal
- D elaborative rehearsal

**Question 8** (1 MARK)

Brahim is at the supermarket when he realises that he forgot the shopping list. He calls up his partner who reads him the list groceries, which has around 20 items that he needs to purchase. Straight after the call, Brahim writes down all of the shopping items that he can remember.

Which shopping items is Brahim most likely to remember?

- A all of the items
- B the first items read to him
- C the last items read to him
- D the first and last items read to him

**Question 9** (3 MARKS)

Donovan is preparing for his boat licence test. When studying at home, Donovan was always relaxed and in a good mood. During the test, the palm of his hands became sweaty and his heart started racing. At the beginning of the test, Donovan could not remember any of the information that he studied at home.

Explain how the absence of state dependent cues could have led to Donovan forgetting the information for his boat licence test.

*Adapted from VCAA 2017 sample exam SAQ4b*

**Question 10** (3 MARKS)

Raheem is studying economics at university. This week at university, they are covering information that he learned about during high school. Although his lecturer explained it slightly differently, he was able to make connections to what the lecturer said and what he already remembered.

Describe how Raheem used elaborative rehearsal.

**Questions from multiple lessons****Use the following information for questions 11 and 12.**

Geun was preparing for his school play. When he was learning his lines during rehearsals he was always incredibly relaxed and had a slow heart rate. However, when he performed, his heart rate was incredibly fast and his palms were sweating. Geun struggled to remember his lines for the school play in this state.

**Question 11** (1 MARK)

During Geun's performance, which division of the nervous system was dominant?

- A sympathetic nervous system
- B parasympathetic nervous system
- C somatic nervous system
- D the spinal cord

**Question 12** (1 MARK)

Geun struggled to remember his lines during the performance due to the absence of

- A context dependent cues.
- B maintenance rehearsal.
- C elaborative rehearsal.
- D state dependent cues.

**Question 13** (5 MARKS)

Irene's revision strategy for tests usually consists of reading definitions over and over again in an attempt to memorise them. Irene used to find this strategy effective, but as she has transitioned into year 12 does not find that it is enough to deal with the increased tests and information that she needs to learn. Irene now tries to make links between the new information that she is learning and what she already knows. Using this technique, Irene's grades have improved dramatically.

- a Identify the type of rehearsal that Irene uses now that she is in year 12. (1 MARK)
- b Identify if Irene's strategy for preparing for tests in year 12 demonstrates context-specific effectiveness. Justify your response. (2 MARKS)
- c Describe how Irene demonstrated coping flexibility. (2 MARKS)

**Key science skills****Question 14** (9 MARKS)

Ms Kean wanted to demonstrate to her class the concept of the serial position effect. In order to do this, she set up an experiment with two trials. In the first trial, she read a list of 20 words to her class and then had them immediately try and write down as many as they could remember. In the second trial, she read a different list of 20 words to the class but then made them wait 30 seconds before writing down all the words that they could remember. In the first trial, her class had the highest recall for words at the beginning and end of the list, whereas in the second trial her class had the highest recall only for the words at the start of the list.

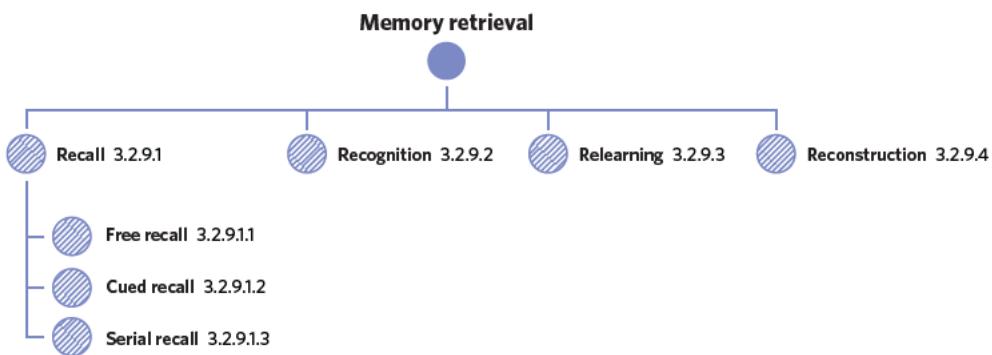
- a State the independent variable in Ms Kean's experiment. (1 MARK)
- b Identify the experimental research design that Ms Kean used. Justify your response. (2 MARKS)
- c Explain why recall of words at the beginning of the list was not impacted in the second trial. (2 MARKS)
- d Explain why the class demonstrated both the primacy and recency effect in the first trial. (4 MARKS)

# 7C MEMORY RETRIEVAL

So far in this chapter, you have learned about the impact of brain trauma and neurodegenerative disease on memory, and about the different factors affecting memory. Now, you will learn about the different ways that you can retrieve information from memory.

7A. Brain trauma and neurodegenerative disease	7B. Factors affecting memory	7C. Memory retrieval	7D. Reconstruction in Loftus' research
<b>Study design dot point</b>			
▪ methods to retrieve information from memory or demonstrate the existence of information in memory, including recall, recognition, relearning and reconstruction			
<b>Key knowledge units</b>			
Free recall (Recall)			3.2.9.1.1
Cued recall (Recall)			3.2.9.1.2
Serial recall (Recall)			3.2.9.1.3
Recognition			3.2.9.2
Relearning			3.2.9.3
Reconstruction			3.2.9.4

In this lesson, you will be learning about methods to retrieve information from memory or demonstrate the existence of information in memory. This involves learning about **recall**, **recognition**, **relearning** and **reconstruction**.



## Recall 3.2.9.1

### OVERVIEW

Recall is a method of retrieving information from memory. There are three types of recall: free recall, cued recall and serial recall.

### THEORY DETAILS

Recall refers to the process of retrieving previously learned information from long-term memory. This involves transferring information from long-term memory into short-term memory where it is recalled into your conscious awareness to be used as required. There are three different ways that information from memory can be recalled: through **free recall**, **cued recall** or **serial recall**. These three types of recall are compared in table 1.

**Recall** a method of retrieving information from memory

**Free recall** retrieving information from memory in any order without the use of a prompt

**Cued recall** retrieving information from memory with the use of a prompt

**Serial recall** retrieving information from memory in the order in which it was first encoded



**Table 1** Comparison between free, cued and serial recall

Type of recall	Description	Example of recalling the previously learned names of Australian Prime Ministers
<b>Free recall</b> 3.2.9.1.1	Retrieving information from long-term memory without any retrieval cue and in any order.	Being asked to recall as many Australian Prime Ministers as you can, in no particular order.
<b>Cued recall</b> 3.2.9.1.2	Retrieving information from long-term memory with the use of a retrieval cue. Having a cue to aid retrieval means that cued recall is more sensitive (effective at retrieving information from memory) than free recall.	Being asked who the prime minister of Australia was from 2015–2018 whose first name began with ‘M’.
<b>Serial recall</b> 3.2.9.1.3	Retrieving information from long-term memory in a specific order.	Being asked to list all the Prime Ministers of Australia correctly in order from the first to the most recent.

## Recognition 3.2.9.2

### OVERVIEW

Recognition is a method of retrieving information from memory that involves identifying originally learned information amongst a series of options.

### THEORY DETAILS

Do you prefer answering multiple choice questions rather than extended response questions? Multiple choice questions are an example of **recognition**, where you identify original information from your memory amongst a group of options.

The presence of the correct information acts as a cue to retrieve information from your long-term memory. For this reason, recognition is considered to be a more sensitive method of retrieval than recall.

## Relearning 3.2.9.3

### OVERVIEW

Relearning is a way of demonstrating the existence of information in memory. When relearning information that was already learned in the past, it typically takes a shorter period of time and fewer trials, demonstrating that some of this information is still held in long-term memory.

### THEORY DETAILS

**Relearning** refers to learning information that has been previously learned at an earlier time. The process of relearning demonstrates the existence of information in memory. This is because when learning information again, it typically takes a shorter period of time, demonstrating that some of that information was retained in long-term memory.

For example, imagine that you learned the piano during primary school but stopped at the start of high school because you did not have enough time to continue lessons. Then, a few years later, you decided to learn the piano again. Although you would not immediately be at the same skill level you were at when you stopped learning at the end of primary school, it would take significantly less time and fewer trials to reach this level once more than it did for initial learning. This is because of the principle of relearning. The time saved when learning the piano for a second time demonstrates the existence of previously-encoded information about playing the piano in long-term memory.

In terms of sensitivity, relearning is the most sensitive retrieval method. Relearning a task is the most effective way of retrieving information from long-term memory as it ensures that the entire task is covered and has the opportunity to be recalled. However, testing what you already know by relearning a task can be time-consuming and therefore not always possible.

**Recognition** identifying information from memory amongst a list of alternatives

**Relearning** learning information another time after having already learned this information in the past

### Want to know more?

There is a way to calculate how much time was saved during the process of relearning and therefore, how much information was already present in long-term memory. This is referred to as a savings score, which represents the amount of time that was saved when information is relearned. The formula for calculating a savings score is:

$$\text{Time taken to learn definitions the first time} - \text{time taken the second time} \times 100$$

Time taken the first time

## Reconstruction 3.2.9.4

### OVERVIEW

When you reproduce information stored in memory and piece it together to create a representation of the past, you are using reconstruction.

### THEORY DETAILS

When retrieving information from long-term memory, you are not replaying every aspect of an event in its entirety, but rather reconstructing your memory of that event. **Reconstruction** refers to this process of combining different pieces of information from memory in an attempt to create a comprehensive recollection of an event in its original order or form.

For example, reconstruction can occur during a memory test that involves the presentation of 20 different flash cards with different animals on them in a particular order. If a person then came and shuffled these flash cards and asked you to put them in the original order again, you would be reconstructing your original memory of the cards. This is because you would be using the information from your memory of the cards in an attempt to reproduce the photos in their original order.

In a broader sense, imagine that your friend was asking you about another friend's party that you both went to years ago. You remember aspects of the party, such as the venue it was held at and that you were wearing a scary costume, but not everything that happened that night. When retrieving the memory of the party for your friend, you reproduce the different pieces of information available from long-term memory (such as who hosted the party, where it was held and that you were wearing a scary costume) to reconstruct a coherent memory of the event.

### Theory summary

In this lesson, you have learned about the different types of memory retrieval. Specifically, you have learned about recall, recognition, relearning and reconstruction. You should now be able to describe each of these methods and explain how they allow for the retrieval of information from memory or demonstrate the existence of information in memory.

## 7C Activities

- Fill in the following table by providing a description and an example of the different retrieval methods.

Retrieval method	Description	Example
<b>Recall:</b>		
• Free recall		
• Cued recall		
• Serial recall		
<b>Recognition</b>		
<b>Relearning</b>		
<b>Reconstruction</b>		

**Reconstruction** the process of reproducing and piecing together information from memory in an attempt to form a coherent representation of a past event or stimuli



Sensory memory is the only type of memory that is completely representative of reality. The process of encoding memory into long-term memory for storage means that it becomes only a neural representation of reality. For a refresher on the process of encoding and the different memory stores, head to **lesson 6A: Atkinson-Shiffrin model of memory**.



The reconstruction of memory will be further explored in lesson **7D: Reconstruction in Loftus' research**, where you will examine the significance of reconstructive nature of memory in the context of eye-witness testimony and the fallibility of memory. In this context, new information can be introduced through leading questions that can disrupt the reconstruction process of an event to include potentially incorrect or misleading details.



# 7C QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |               |                 |               |                  |
|---------------|-----------------|---------------|------------------|
| • Recall      | • Cued recall   | • Recognition | • Reconstruction |
| • Free recall | • Serial recall | • Relearning  |                  |
- a Retrieving information from memory in any order and without the use of a prompt \_\_\_\_\_
- b Identifying information from memory within a group of items \_\_\_\_\_
- c Combining information from memory with other available information to form a more complete memory of an event \_\_\_\_\_
- d The broad term used to describe the overall process of retrieving information from memory \_\_\_\_\_
- e Retrieving information from memory with the use of a prompt \_\_\_\_\_
- f Learning information that was learned previously again to demonstrate the existence of information from memory \_\_\_\_\_
- g Retrieving information from memory in a specific order \_\_\_\_\_

### Question 2

Which of the following options correctly matches the blanks?

Method	Description
Free recall	W
X	- Retrieving information from memory with the use of a prompt
Serial recall	- Retrieving information from memory in the order that it was learned
Recognition	Y
Z	- Combining information from memory with other available information to create the most complete memory possible

	W	X	Y	Z
A	Identifying information from memory within a group of other items	Reconstruction	Retrieving information from memory in no order and without a prompt	Cued recall
B	Identifying information from memory within a group of other items	Cued recall	Retrieving information from memory in no order and without a prompt	Reconstruction
C	Retrieving information from memory in no order and without a prompt	Cued recall	Identifying information from memory within a group of other items	Reconstruction
D	Retrieving information from memory in no order and without a prompt	Reconstruction	Identifying information from memory within a group of other items	Cued recall

## Exam-style questions

### Remember and understand

#### Question 3 (1 MARK)

Which type of recall involves retrieving information with the use of a prompt?

- A free recall
- B cued recall
- C recognition
- D reconstruction

**Question 4** (1 MARK)

Free recall involves

- A retrieving information in a particular order, whereas serial recall does not.
- B retrieving information in no particular order, whereas serial recall involves retrieving information in a specific order.
- C retrieving information with assistance from a cue, whereas serial recall does not.
- D retrieving information with assistance from a cue, whereas cued recall does not.

**Question 5** (2 MARKS)

Describe how relearning demonstrates the existence of information in memory.

**Question 6** (2 MARKS)

Explain how recognition is used to retrieve information from memory.

**Apply and analyse****Question 7** (1 MARK)

Chan is devastated because he lost his phone and has no idea where it is. He tells his friend at school, who suggests that he writes down everything that he has done in the order that it occurred since he last saw it.

This method of retrieval is known as

- A free recall.
- B recognition.
- C serial recall.
- D cued recall.

*Adapted from VCAA 2018 exam MCQ40*

**Question 8** (1 MARK)

On the first day of school, Mr Brinc gave his history class a picture of all the important historical figures that would be covered in his subject and asked them to write down who they were. At the end of the year, Mr Brinc asked his students to write down every one of these figures without including a picture of them.

The tests on the first day and the last day of the were, respectively

- A recall and recognition.
- B relearning and recall.
- C free recall and cued recall.
- D cued recall and free recall.

*Adapted from VCAA 2017 exam MCQ7*

**Question 9** (1 MARK)

Brandon's sister was asking Brandon about a time when they went to their grandparents' house when they were children. Brandon remembered going to their grandparents house, but not what the event was for. However, when his sister mentioned how she remembered being sick afterwards, Brandon remembered that it was for Easter and that they both ate too much chocolate.

What method did Brandon use to complete the memory of going to his grandparents' house?

- A rehearsal
- B recognition
- C free recall
- D reconstruction



**Question 10** (6 MARKS)

Before teaching her psychology class about the divisions of the nervous system, Ms Nam wanted to know what her class already knew about this concept. She gave her class a list of possible names for the divisions of the nervous system and asked them to circle which ones were correct. When she finished teaching this unit, she gave her class a different test that required them to write down all of the different divisions of the nervous system in any order and to describe their function.

- Identify the memory retrieval method used by Ms Nam before teaching the unit on the divisions of the nervous system. Justify your response. (2 MARKS)
- Identify when Ms Nam used free recall. Justify your response. (2 MARKS)
- With the use of an example, explain how Ms Nam could have used cued recall to test her class' knowledge. (2 MARKS)

**Questions from multiple lessons****Use the following information for questions 11 and 12.**

Magnus used to learn the double bass as a child. When he first started learning the double bass, he found it difficult to read music. However, with much practice, Magnus became skilled at interpreting music and being able to play songs on his double bass. He stopped learning to play the double bass during high school because he was too busy. When Magnus picked it up again after high school, he found that it did not take nearly as much practice and time to learn how to read music and play songs.

**Question 11** (1 MARK)

In terms of neural plasticity, Magnus' increased accuracy as he practiced as a child was likely a result of

- maintenance rehearsals.
- elaborative rehearsal.
- long-term potentiation.
- long-term depression.

*Adapted from VCAA 2018 exam MCQ9*

**Question 12** (1 MARK)

The decreased time that it took Magnus to read music and play songs after high school demonstrates

- relearning.
- recognition.
- free recall.
- serial recall.

**Question 13** (4 MARKS)

Wanda was preparing for her psychology assessment with her teacher. Wanda struggled answering short-answer questions. To encourage Wanda to practice answering short-answer questions, her teacher would give her a chocolate bar every time she answered this type of question. Wanda now regularly hands in more short-answer questions to her teacher.

- Identify the retrieval method that Wanda uses when completing short-answer questions. (1 MARK)
- Using the language of operant conditioning, explain why Wanda now completes and hands in more short-answer questions. (3 MARKS)

**Key science skills****Question 14** (4 MARKS)

Dr Berntsen is studying the time that is saved when relearning musical instruments. Dr Berntsen sampled participants who had signed up for piano lessons at the teaching company 'Piano Power'. Dr Berntsen recorded the time it took participants to learn basic songs and then had them stop learning the piano entirely. Six months later, Dr Berntsen had the same participants relearn the basic songs and recorded how long it took them to learn to play them the second time around.

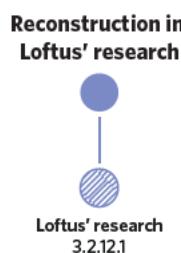
- What type of data is Dr Berntsen collecting when he records the time that it takes participants to learn the songs? Justify your response. (2 MARKS)
- Identify and operationalise the dependent variable in Dr Berntsen's experiment. (2 MARKS)

# 7D RECONSTRUCTION IN LOFTUS' RESEARCH

So far in this chapter, you have learned about brain trauma and neurodegenerative disease, factors affecting memory and memory retrieval. To further your understanding of the reliability of memory, you will now learn about the significance of memory reconstruction in the context of eye-witness testimony.

7A. Brain trauma and neurodegenerative disease	7B. Factors affecting memory	7C. Memory retrieval	7D. Reconstruction in Loftus' research
<b>Study design dot point</b>			
<ul style="list-style-type: none"> <li>the reconstruction of memories as evidence for the fallibility of memory, with reference to Loftus' research into the effect of leading questions on eye-witness testimonies</li> </ul>			
<b>Key knowledge units</b> <hr/> Loftus' research <span style="float: right;">3.2.12.1</span>			

In this lesson, you will be learning about Loftus' research, regarding memory reconstruction as evidence for the fallibility of memory. This includes examining how the use of leading questions can impact eye-witness testimonies through manipulating the reconstruction process of memory.



## Loftus' research 3.2.12.1

### OVERVIEW

American psychologist Elizabeth Loftus researched the effect that leading questions have on the reconstruction of eyewitness testimonies. Loftus' research provided groundbreaking evidence for the fallibility of memory.

### THEORY DETAILS

Psychologist Elizabeth Loftus investigated the effect of leading questions on the validity of **eye-witness testimony**, which is an account given about the details of an event that has been observed. She believed that **leading questions**, which contain information that is misleading or suggests a desired response, could impact the reliability of eye-witness testimony.

### The research

Loftus and Palmer (1974) aimed to test the effect of leading questions on eye-witness testimonies. To do this, they showed participants videos of a car crash and interviewed them afterwards. In this interview, they asked participants the leading question, 'About how fast were the cars going when they \_\_\_\_\_ each other?'. Within this question, they inserted different verbs implying different speeds. The different verbs included: smashed, collided, bumped, hit and contacted. These verbs represented leading information within the question as each implied a particular speed of the car. The different verbs used in the question was therefore the independent variable of the experiment. The dependent variable was the participants' reported speed of the cars in the crash videos.

**Eye-witness testimony** an account given by an individual of an event they have directly observed

**Leading questions** questions that contain information that imply or prompt a certain response



### The findings

The results of this experiment demonstrated that the wording of the question affected the way participants remembered the speed of the cars in the car crash videos. As demonstrated in table 1, participants who were asked how fast the cars were going when they ‘smashed’ reported that the cars were travelling faster than those who were asked how fast the cars were going when they ‘contacted’.

**Table 1** Speed estimates for the verbs used in Loftus’ research (Loftus & Palmer, 1974)

Verb	Mean speed estimate (MPH)
Smashed	40.5
Collided	39.3
Bumped	38.1
Hit	34.0
Contacted	31.8

The findings of Loftus’ experiment demonstrate that memory is fallible (prone to error) due to the process of memory reconstruction. Participants reconstructed their memory of the car crash by adding new information (i.e. the speed of the crash implied by the verb used in the leading question) with what was available in long-term memory about the video. This demonstrates how eye-witness memory is particularly susceptible to being reconstructed (updated/reconsolidated) during retrieval to include false information that may be introduced during questioning, especially if the questions include leading information.

Source: Adapted from 2017 VCE Psychology examination report p.4

#### Want to know more? –

Loftus also conducted a second experiment that suggested leading questions do not just affect memory reconstruction directly after they are asked, but have an enduring effect on long-term memory. 150 participants were shown a video of a car crash, where 50 were asked ‘about how fast were the cars going when they *smashed* into each other?’, another 50 asked ‘about how fast were the cars going when they *hit* each other?’ and the remaining 50 were not asked about vehicle speed. One week later, all participants were asked if they saw any broken glass in the video of the car crash. There was no broken glass in the video, but as demonstrated in table 2, participants who had the verb ‘smashed’ used in their question were significantly more likely to report seeing broken glass than those who had the verb ‘hit’ used. This demonstrates that leading questions can influence the re-encoding of long-term memory, providing further evidence for the fallibility of memory and the limitations of eye-witness testimony as reliable evidence in court.

**Table 2** Response to being asked if there was broken glass according to verb condition (Loftus & Palmer, 1974)

Response	Verb condition		
	Smashed	Hit	Control
YES	16	7	6
NO	34	43	44

### Theory summary

In this lesson, you have learned about memory reconstruction in the context of Loftus’ research. You should now have an understanding of how the reconstruction of memories is evidence for the fallibility of memory and be able to demonstrate this with reference to Loftus’ research into the effect of leading questions on eye-witness testimonies.

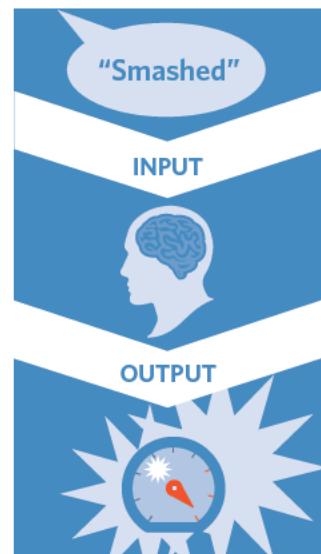


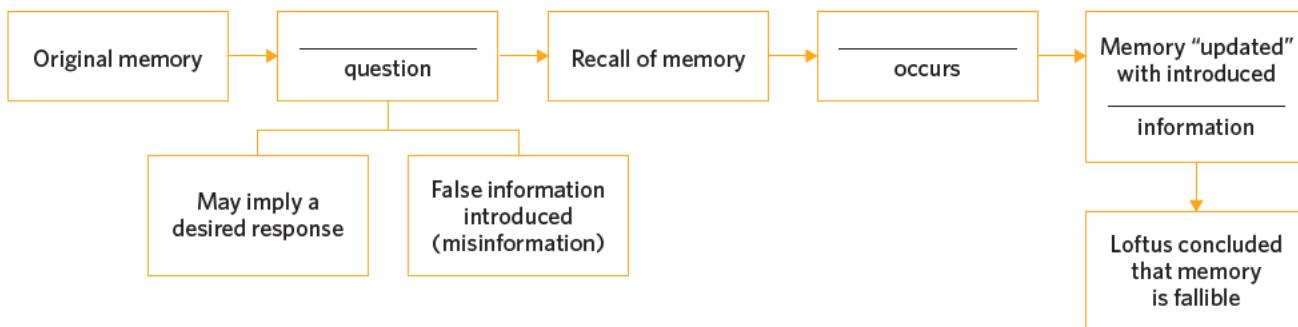
Image: valterZ/Shutterstock.com

**Figure 1** You can think of leading questions being the ‘input’ that impacts the reconstruction of memory (the ‘output’).

**lesson link** Loftus’ research confirms how memories are reconstructions of real events. If you need a refresher on memory reconstruction, head to lesson **7C: Memory retrieval**.

## 7D Activities

Fill in the blanks to complete this flow-chart of reconstruction in Loftus' research.



*Reproduced from Edrolo and M.Adem, 2017.*

## 7D QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- Leading question      • Eye-witness testimony
- a An individual's statement of the details of an event that they saw \_\_\_\_\_
- b Questions that contain misleading information or are phrased in such a way that suggests the desired response \_\_\_\_\_

### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

Research by Loftus on the effect of leading questions on eye-witness testimonies has found that

- A eye-witness testimonies are reconstructions of events that can be manipulated by information that is given after the event.
- B eye-witness testimonies are reconstructions of events and are therefore always accurate.
- C eye-witness testimonies are not reconstructed and are therefore highly reliable as evidence in court.
- D eye-witness testimonies are not reconstructed and are therefore not reliable evidence in court.

*Adapted from VCAA 2017 sample exam MCQ33*

#### Question 3 (2 MARKS)

Describe how leading questions can affect memory reconstruction during eye-witness testimonies.

### Apply and analyse

#### Question 4 (1 MARK)

Zoya was walking to school when she saw a student's wallet being stolen from their pocket. Zoya went to the police and was shown a series of photographs of potential suspects.

In this scenario, which of the following is an example of a leading question?

- A What street were you on when you saw the wallet being stolen?
- B What clothing was worn by the person who stole the wallet?
- C How tall was the young man who stole the wallet?
- D What time was the wallet stolen?

*Adapted from VCAA 2016 exam MCQ24*



**Question 5** (3 MARKS)

Ashkan was at a house party when two masked intruders came in and asked everyone to hand over their wallets. After this event, Ashkan was asked questions by news reporters, including 'how old were the boys who robbed you?' and 'what weapons did they use to interrogate you?' When interviewed later by the police to give an official eye-witness testimony, Ashkan reported that the robbers were young men and armed.

In terms of Loftus' research, why would defence lawyers question the reliability of the description that Ashkan gave to police?

*Adapted from VCAA 2017 exam SAQ2*

**Questions from multiple lessons****Question 6** (1 MARK)

Indah was recently asked a series of questions in court after having witnessed a robbery in a cafe. When talking in front of court Indah could feel her heart rate increasing significantly.

Which division of Indah's nervous system is responsible for increasing Indah's heart rate when talking in front of the court?

- A** parasympathetic
- B** sympathetic
- C** somatic
- D** central

**Question 7** (6 MARKS)

Kai was at home when a group of intruders broke into his house and stole many of his belongings. As soon as the intruders left, Kai called the police to explain what had happened. Kai was taken out of his house to a police station to be interviewed. Before his interview, a series of journalists asked Kai questions, such as 'what type of mask did the intruders use?' Kai then reported to the police that the intruders were wearing masks.

- a** Identify if the accuracy of Kai's description could be questioned. Justify your response. (3 MARKS)
- b** Describe how context dependent cues could have been used to increase the reliability of Kai's eye-witness testimony. (3 MARKS)

**Key science skills****Use the following information for questions 8-11.**

Following the work of Elizabeth Loftus, Dr Halabi conducted an experiment to investigate the effect of leading questions on the ability to accurately identify a robber from a photo. Dr Halabi conducted their experiment in two stages:

**Stage 1:**

45 university students were randomly allocated into either group A or B. Both groups were shown a video where a robber broke into a convenience store. The angle of the video clearly shows that the robber was not wearing any headwear. Both groups were then asked a critical question after having watched the video. For group A, the critical question was 'do you recall what the robber was wearing?' For group B, the critical question was 'do you recall seeing the robber wearing the cap?'

**Stage 2:**

After a day, participants returned and were asked to provide a description of the robber's appearance and Dr Halabi noted whether participants recalled the robber wearing a cap.

**Question 8** (1 MARK)

What was the independent variable in Dr Halabi's experiment?

- A** whether or not participants went to university
- B** whether or not participants recalled the robber wearing a cap
- C** participants' description of the robber's appearance
- D** the use of leading or non-leading questions

*Adapted from VCAA 2018 exam MCQ44*

**Question 9** (1 MARK)

The experimental research design that Dr Halabi used during stage 1 was

- A matched participants.
- B independent groups.
- C repeated measures.
- D longitudinal.

*Adapted from VCAA 2018 exam MCQ45*

**Question 10** (1 MARK)

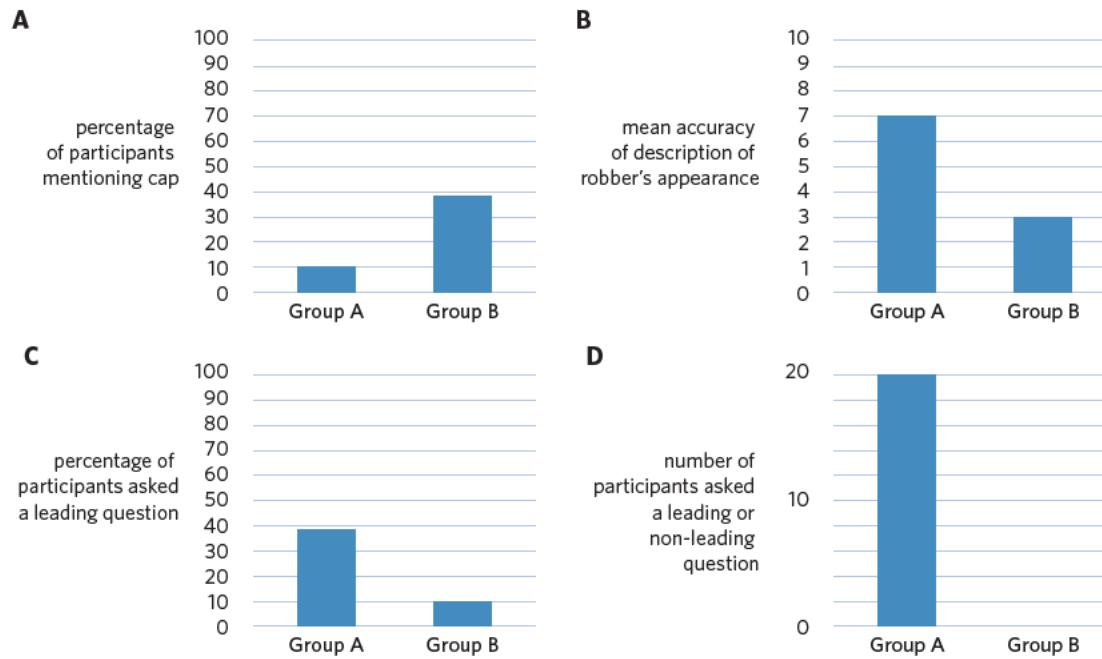
In the written report for the experiment, Dr Halabi stated that their results confirmed Loftus' findings that eye-witness testimonies are often fallible because

- A memory retrieval is a reconstructive process and can be updated with false information.
- B when eye-witnesses retrieve their memory outside of where it occurred they cannot use context dependent cues.
- C eye-witness testimony is subjective.
- D eye-witnesses often lie.

*Adapted from VCAA 2018 exam MCQ49*

**Question 11** (1 MARK)

Which of the following graphs is most appropriately labelled and best predicts the results for stage 2 of Dr Halabi's experiment?



*Adapted from VCAA 2018 exam MCQ46*

**Question 12** (2 MARKS)

Dr Franco designed an experiment to further explore the impact of leading questions on the reconstruction of memory. Dr Franco set up an experiment under the same conditions as Loftus and found that their results matched Loftus' results from the original experiment.

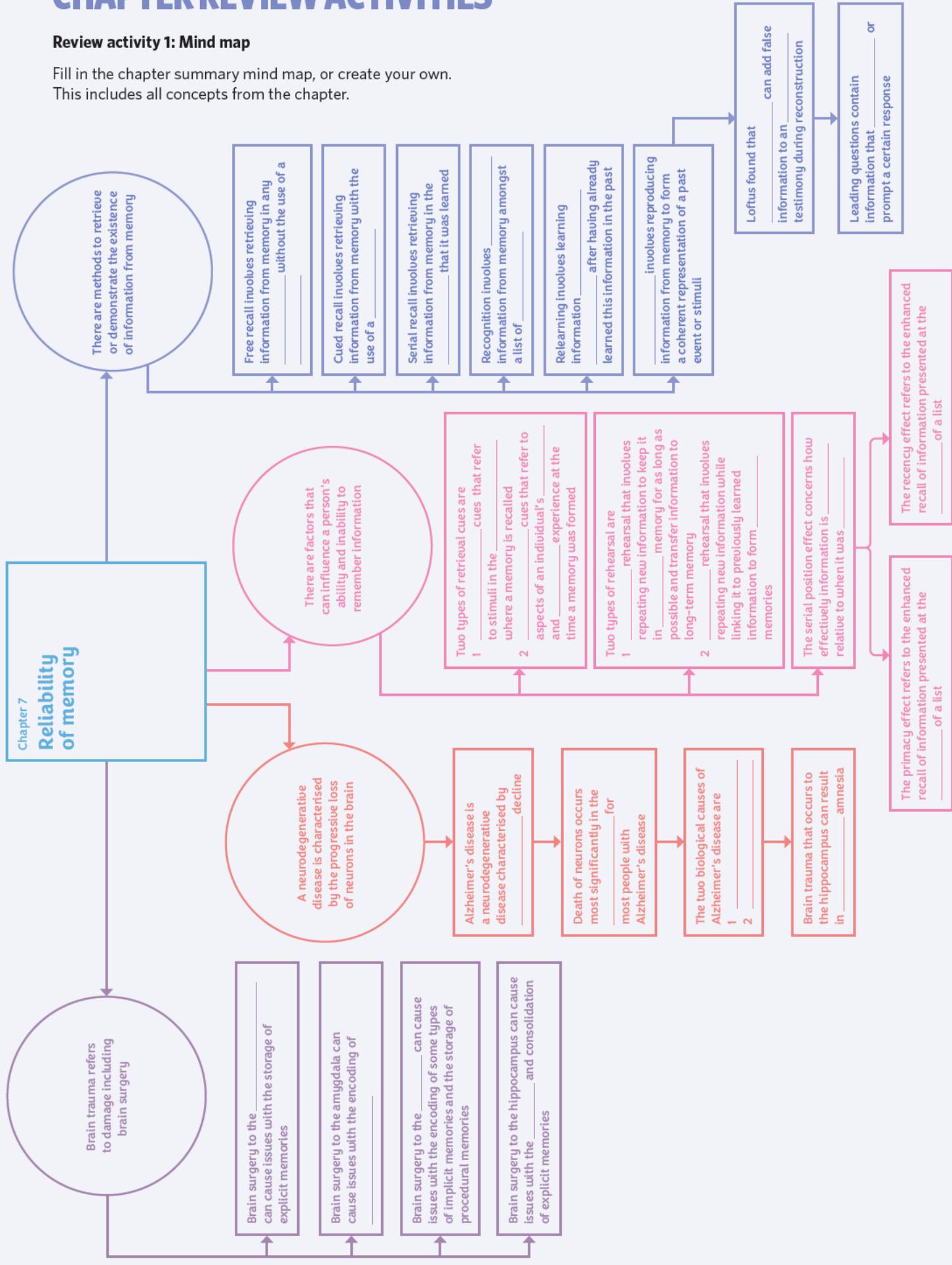
Identify if Dr Franco's experiment demonstrated the reliability of Loftus' experiment. Justify your response.



# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

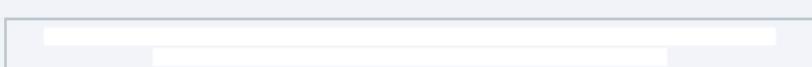
Fill in the chapter summary mind map, or create your own.  
This includes all concepts from the chapter.



**Review activity 2: Definition bank**

Fill in the table with your own notes.

Key terminology	Your own definition
Brain trauma	
Brain surgery	
Anterograde amnesia	
Neurodegenerative disease	
Alzheimer's disease	
Amyloid plaques	
Neurofibrillary tangles	
Retrieval cue	
Context dependent cues	
State dependent cues	
Maintenance rehearsal	
Elaborative rehearsal	



Key terminology	Your own definition
Serial position effect	
Primacy effect	
Recency effect	
Recall	
Free recall	
Cued recall	
Serial recall	
Recognition	
Relearning	
Reconstruction	
Leading questions	
Eye-witness testimony	

**Review activity 3: Notes from Ted Talk video**

Go to the TedTalks website ([Ted.com](http://Ted.com)) and find the video called *Elizabeth Loftus: How reliable is your memory?* by Elizabeth Loftus. (TED, 2013)

Take notes on what is said about the following concepts.

Memory reconstruction

---

---

---

Eye-witness testimony

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---

Leading questions

---

---

---

## CHAPTER TEST

### Multiple choice questions

**Use the following information for questions 1 and 2.**

Bobby has been doing practice psychology exams as a form of revision. Bobby is concerned because he always seems to perform better on the multiple choice section in comparison to the short answer and extended response sections.

**Question 1** (1 MARK)

The multiple choice section of the exam uses

- A serial recall.
- B relearning.
- C recognition.
- D cued recall.

**Question 2** (1 MARK)

It is likely that Bobby performs better on the multiple choice section because

- A recognition has a higher sensitivity as a method of retrieving information than recall.
- B recall has a higher sensitivity as a method of retrieving information than recognition.
- C it allows bobby to use relearning.
- D it allows him to use state dependent cues.

**Question 3** (1 MARK)

Catherine was in the living room when she started craving toast. However, when Catherine went to the kitchen to make herself toast she forgot what she was there for. When Catherine went back to the living room, she suddenly remembered why she went to the kitchen.

What factor influenced Catherine's ability to remember why she went to the kitchen?

- A maintenance rehearsal
- B state dependent cues
- C elaborative rehearsal
- D context dependent cues



***Use the following information for questions 4 and 5.***

Rosie's grandmother Evelyn has been experiencing symptoms of Alzheimer's disease for the past year. One symptom that stood out to Rosie was that she could not remember any new information that was told to her.

**Question 4** (1 MARK)

Which region of Evelyn's brain would likely experience the greatest loss of neurons, given her symptoms?

- A cerebellum
- B hippocampus
- C cerebral cortex
- D amygdala

**Question 5** (1 MARK)

Evelyn's inability to remember any new information demonstrates

- A that she has had brain surgery.
- B Alzheimer's disease.
- C memory reconstruction.
- D anterograde amnesia.

***Use the following information for questions 6 and 7.***

A few years ago Beatrice was with her friends at a party when a rat ran across the floor. Beatrice was terrified and ran out of the room with her heart beating quickly as her friends laughed at her for her overreaction. Beatrice's friends remembered this event and brought it up with her, but told her that her reaction was not that extreme to make sure that she didn't feel bad. Beatrice remembered the event her friends were referring to without the aspects of her overreaction.

**Question 6** (1 MARK)

Beatrice's different recollection of the event at the party demonstrates

- A the effect of leading questions on eye-witness testimonies.
- B the reconstructive nature of memory.
- C the serial position effect.
- D anterograde amnesia.

**Question 7** (1 MARK)

Beatrice was at her friends house when a cockroach ran across the ground. Beatrice could feel her heart beating quickly and suddenly remembered that she did run out of the room at the party due to the rat.

Beatrice remembering that she did run out of the room at the party demonstrates

- A context dependent cues.
- B state dependent cues.
- C elaborative rehearsal.
- D maintenance rehearsal.

**Question 8** (1 MARK)

The serial position effect proposes that

- A information presented at the start of a list will be the most recalled.
- B information presented at the start and middle of a list will be the most recalled.
- C information presented at the start and end of a list will be the most recalled.
- D information presented at the middle of a list will be the most recalled.

**Question 9** (1 MARK)

Research by Loftus has found that

- A exposure to leading questions has no impact on the accuracy of an eye-witness' testimony.
- B eye-witness memories are never reconstructed and are always accurate.
- C eye-witness memories are reconstructions of events that can be manipulated and are, therefore, highly reliable evidence in court.
- D eye-witness memories are reconstructions of events that can be manipulated and aren't always reliable as evidence in court.

Adapted from VCAA 2017 sample exam MCQ33

**Question 10** (1 MARK)

Brain surgery to the amygdala can cause issues

- A consolidating emotionally arousing memories.
- B storing explicit memories.
- C consolidating implicit memories.
- D remembering anything after the surgery took place.

**Short answer questions****Question 11** (2 MARKS)

Describe a difference between context and state dependent cues.

**Question 12** (3 MARKS)

Gerda was on the street when she saw two masked people break into a convenience store. Gerda was questioned about the incident by a newspaper reporter, who asked questions such as 'how old were the boys who robbed the store?' and 'what type of weapons did they have?' When interviewed later by the police, Gerda described the robbers as young males who were armed.

In terms of Loftus' research, explain why the reliability of the description given by Gerda could be questioned.

Adapted from VCAA 2017 exam SAQ2

**Question 13** (4 MARKS)

With the use of examples, describe maintenance and elaborative rehearsal.

**Question 14** (3 MARKS)

In terms of methods of retrieval, explain why students are more likely to score better on multiple choice questions than on short answer questions.

Adapted from VCAA 2013 exam SAQ8

**Question 15** (3 MARKS)

Stere is a highschool psychology teacher. When teaching her class about memory, Stere decided to run a small experiment where she read out a list of 20 words and then asked students to recall as many as possible straight after reading the final word.

Referring to the serial position effect and memory stores, describe the likely results of Stere's experiment.



**Key science skills questions****Question 16** (5 MARKS)

Camilo is planning his VCE Psychology practical investigation on the effectiveness of context dependent cues. He is thinking about using an independent groups design, where one group of students are asked to memorise 20 words outside and then recall them in this same environment. The other group will be asked to memorise the words outside, but then be asked to recall them in a classroom.

- a Identify and operationalise the independent variable of Camilo' planned experiment. (2 MARKS)
- b Predict the results of Camilo's proposed practical investigation, using relevant psychological concepts to justify your response. (3 MARKS)

*Adapted from 2017 sample exam SAQ7eii*

**Extended response****Question 17** (10 MARKS)

Vedad is a 75-year-old grandfather. Recently, Vedad's family have been concerned by his inability to remember any new information. Vedad's family took him to a doctor, who reported to the family that he suspected Vedad was in the early stages of Alzheimer's disease.

As Vedad's doctor, provide an outline of Alzheimer's disease, including its neurological differences from normal neural functioning, and describe how damage to the brain regions involved will impact Vedad's memory. In addition, analyse how the following concepts could be used to increase Vedad's ability to remember information for his daily life:

- Context and state dependent cues
- Maintenance and elaborative rehearsal



UNIT

# 4

# How is wellbeing developed and maintained?

Consciousness and mental health are two of many psychological constructs that can be explored by studying the relationship between the mind, brain and behaviour. In this unit students examine the nature of consciousness and how changes in levels of consciousness can affect mental processes and behaviour. They consider the role of sleep and the impact that sleep disturbances may have on a person's functioning. Students explore the concept of a mental health continuum and apply a biopsychosocial approach, as a scientific model, to analyse mental health and disorder. They use specific phobia to illustrate how the development and management of a mental disorder can be considered

as an interaction between biological, psychological and social factors. Students examine the contribution that classical and contemporary research has made to the understanding of consciousness, including sleep, and the development of an individual's mental functioning and wellbeing.





# UNIT 4

# AOS1

## How do levels of consciousness affect mental processes and behaviour?

**Differences in levels of awareness of sensations, thoughts and surroundings influence individuals' interactions with their environment and with other people. In this area of study students focus on states of consciousness and the relationship between consciousness and thoughts, feelings and behaviours. They explore the different ways in which consciousness can be studied from physiological and psychological perspectives and how states of consciousness can be altered. Students consider the nature and importance of sleep and apply biological, psychological and social factors to analyse the effects of sleep disturbances on psychological functioning, including mood, cognition and behaviour.**

### Outcome 1

On completion of this unit the student should be able to explain consciousness as a continuum, compare theories about the purpose and nature of sleep, and elaborate on the effects of sleep disruption on a person's functioning.





# 08

UNIT 4 AOS 1, CHAPTER 8

## Nature of consciousness

### 8A States of consciousness

- consciousness as a psychological construct that varies along a continuum, broadly categorised into normal waking consciousness and altered states of consciousness (naturally occurring and induced)

### 8C Measuring consciousness

- the measurement of physiological responses to indicate different states of consciousness, including electroencephalograph (EEG), electromyograph (EMG), electro-oculograph (EOG) and other techniques to investigate consciousness (measurement of speed and accuracy on cognitive tasks, subjective reporting of consciousness, including sleep diaries, and video monitoring)

### 8B Features of states of consciousness

- changes in a person's psychological state due to levels of awareness, controlled and automatic processes, content limitations, perceptual and cognitive distortions, emotional awareness, self-control and time orientation

### 8D Alertness, brain wave patterns and drug-induced ASCs

- changes in levels of alertness as indicated by brain wave patterns (beta, alpha, theta, delta) due to drug-induced altered states of consciousness (stimulants and depressants)

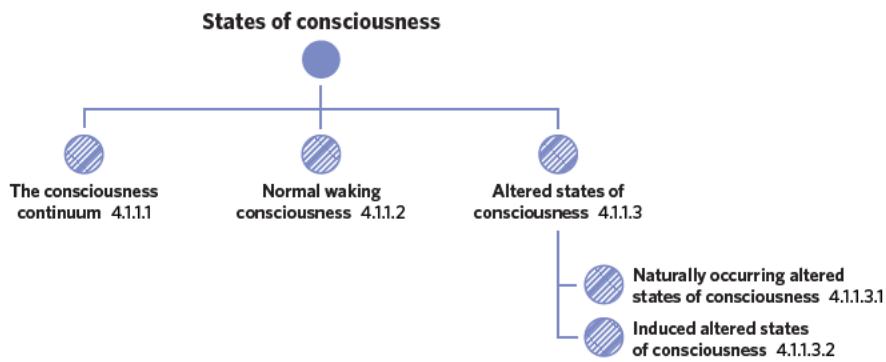


# 8A STATES OF CONSCIOUSNESS

What is consciousness? How do we know what state of consciousness someone is in? What are the characteristics of these different states? How do we use physiological measures to infer different states of consciousness? These are ideas that will be discussed in this chapter. In this introductory lesson, you will start exploring ideas about consciousness and learn why consciousness is understood as a psychological construct.

8A. States of consciousness	8B. Features of states of consciousness	8C. Measuring consciousness	8D. Alertness, brain wave patterns and drug-induced ASCs								
<b>Study design dot point</b>											
<ul style="list-style-type: none"> <li>consciousness as a psychological construct that varies along a continuum, broadly categorised into normal waking consciousness and altered state of consciousness (naturally occurring and induced)</li> </ul>											
<b>Key knowledge units</b>											
<table> <tr> <td>The consciousness continuum</td> <td>4.1.1</td> </tr> <tr> <td>Normal waking consciousness</td> <td>4.1.1.2</td> </tr> <tr> <td>Naturally occurring altered states of consciousness (Altered states of consciousness)</td> <td>4.1.1.3.1</td> </tr> <tr> <td>Induced altered states of consciousness (Altered states of consciousness)</td> <td>4.1.1.3.2</td> </tr> </table>				The consciousness continuum	4.1.1	Normal waking consciousness	4.1.1.2	Naturally occurring altered states of consciousness (Altered states of consciousness)	4.1.1.3.1	Induced altered states of consciousness (Altered states of consciousness)	4.1.1.3.2
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Normal waking consciousness	4.1.1.2										
Naturally occurring altered states of consciousness (Altered states of consciousness)	4.1.1.3.1										
Induced altered states of consciousness (Altered states of consciousness)	4.1.1.3.2										

In this lesson, you will be learning about **consciousness**, and how consciousness varies along a continuum. You will learn about the two broad categories of consciousness: **normal waking consciousness** and **altered states of consciousness**.



## The consciousness continuum 4.1.1.1

### OVERVIEW

Consciousness is a psychological construct that is understood as a continuum consistency of points relating to normal waking consciousness from different altered states of consciousness.

### THEORY DETAILS

Psychologists often study things that are not always easily observable or measured.

A **psychological construct** is an agreed upon description of a psychological phenomena – that is, a psychological idea or concept that isn't directly observable. These agreed-upon understandings and descriptions help psychologists to communicate about things that we can't directly see. Examples of psychological constructs include: anxiety, fear, intelligence, and self-esteem.

The psychological construct we will be focussing on in this chapter is consciousness.

**Psychological construct**  
an agreed upon description and understanding of psychological phenomena which cannot be overtly measured or observed

Consciousness has been central to debates in philosophy for thousands of years. Philosophers examined questions such as 'what does it mean to be aware?', 'how do I know that I am alive?', 'how do I know that I am myself?'. In the last few decades, the development in technology has allowed scientists to examine these questions from another perspective by looking at the brain, in order to further explore these questions of consciousness.

There is still no consensus among scientists on exactly what consciousness is. In psychology we understand **consciousness** as our awareness of the external environment and our internal world.

- The external environment consists of things like sounds that we hear, things we see, other people around us.
- Our internal stimuli includes our inner thoughts (cognition), emotions, concentration, mood and internal sensations, such as hunger, thirst and pain.

Our awareness shifts throughout the day, from internal to external, from more to less aware. These differing levels of awareness are characterised by psychologists as the **consciousness continuum**. Along the consciousness continuum, we have high levels of awareness on one end; such as when you are focussing your attention on a SAC. On the other end of the continuum is a lack of awareness; such as when a person is in a vegetative state, they have no consciousness and hence no awareness. Other states of consciousness that fall along the continuum of varying levels of awareness include sleeping, meditation, daydreaming or being in a coma. Figure 1 illustrates an example of different states of consciousness along a continuum.

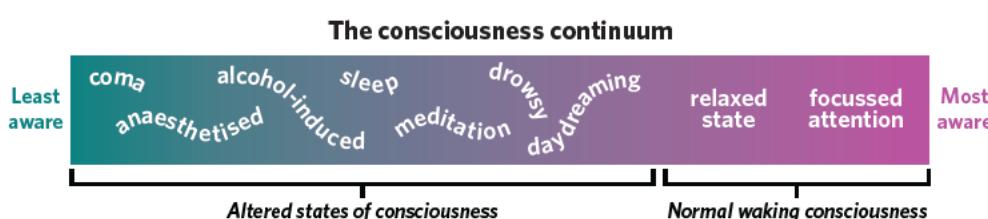


Figure 1 The consciousness continuum ranges from least aware states of consciousness to most aware states of consciousness.

## Normal waking consciousness 4.1.1.2

### OVERVIEW

Normal waking consciousness is the state of consciousness most people spend the majority of their time in. It is characterised by the ability to be aware of both internal and external stimuli.

**Normal waking consciousness (NWC)** the state of being awake and aware of internal and external stimuli

### THEORY DETAILS

On one end of the consciousness continuum is normal waking consciousness, the state of consciousness that most people are in for the majority of their day. **Normal waking consciousness (NWC)** is characterised by the ability to be aware of our internal and external stimuli, and the ability to voluntarily direct our awareness and attention. During NWC, people are able to regulate their emotions, control their actions and thoughts, have an accurate sense of time and are able to accurately perceive internal and external stimuli.

### Example:

As you are reading this text, you are likely experiencing normal waking consciousness. You are able to take in information from external stimuli, such as seeing the words on this page, hearing the sounds around you, and feeling the clothes on your skin. You are also aware of your internal world, such as your current mood, the thoughts going through your mind and your memories from this morning. You are able to switch your attention between these and you are in control of what you pay attention to.

## Altered states of consciousness 4.1.1.3

### OVERVIEW

Altered states of consciousness is a broad term that covers any state of consciousness that differs from normal waking consciousness.

**Consciousness** the awareness of internal and external stimuli

**Consciousness continuum** a progression of states of consciousness ranging from least aware to most aware



## THEORY DETAILS

**Altered states of consciousness (ASC)** are defined in contrast to normal waking consciousness. They are often a temporary change in state of consciousness and can be broadly categorised into naturally occurring ASCs or induced ASCs.

In any ASC, there may be perceptual or cognitive distortions, changes in self-control, emotional regulation, and time-orientation. They are typically marked by decreased levels of awareness.

These features of states of consciousness will be explored further in the next lesson: 8B.

### Naturally occurring altered states of consciousness 4.1.1.3.1

**Naturally occurring altered states of consciousness** are those that occur without intervention, that is, they occur in an expected and natural way.

Examples of naturally occurring ASCs include:

- Daydreaming
- Drowsiness
- Sleep

In each of the above examples, the levels of awareness to external stimuli is decreased as compared to NWC.

### Induced altered states of consciousness 4.1.1.3.2

**Induced altered states of consciousness** are those that occur due to purposeful action or aid, that is they have been intentionally brought about.

Other than naturally occurring ASCs, people can also experience altered states of consciousness that are induced. Induced ASCs can occur for a variety of reasons, including medical (such as an induced coma or being under anaesthetic), spiritual (meditation), or because people are seeking the experience of these altered states (such as drug and alcohol consumption).

Examples of induced altered states of consciousness include:

- Alcohol-induced
- Meditation
- Psycho-active drugs
- Induced coma
- Hypnosis

#### Want to know more?

Meditation is an induced altered state of consciousness in which an individual chooses to decrease their awareness of external stimuli and increase their awareness to internal stimuli.

Research has shown that there are many benefits of meditation, including stress reduction, increased immunity, improved focus, better sleep quality, and improved general happiness and well-being.

If you are interested in trying meditation for yourself, **Smiling Mind** is a free, not-for-profit app that you can download to listen to guided meditations.



**Altered states of consciousness (ASC)** a state of consciousness that is characterised by different levels of awareness as compared to normal waking consciousness

**Naturally occurring altered states of consciousness** a type of altered state of consciousness that occurs without intervention

**Induced altered states of consciousness** a type of altered state of consciousness that occurs due to a purposeful action or aid

#### Useful tip

ASCs are defined in comparison to NWC. When distinguishing whether someone is in an ASC or not, make sure to refer to their levels of awareness in relation to NWC.

## Theory summary

In this lesson, you have learned about consciousness as a psychological construct, as well as understanding that consciousness is understood as a continuum of awareness. You should be able to give a description of what consciousness is and be able to distinguish between NWC and ASC, as well as whether the ASC is induced or naturally occurring.

In the next lesson, you will learn about the features of states of consciousness and how to use these characteristics to infer what state of consciousness an individual is experiencing.

## 8A Activities

- 1 For one minute, write down everything that comes to mind: your stream of thought, your emotions, what you can see, hear and feel; anything that you pay attention to. This is an example of what is going through your stream of consciousness.
- 2 Read through each of the following scenarios and determine whether the person is experiencing NWC or an ASC.
  - a Ben is feeling really sick and has a high fever. He is struggling to stay awake and is seeing hallucinations of bugs crawling all over him. His mum is worried and is sitting next to him trying to calm him down, but he can't hear or see her clearly.
  - b Eamon is writing an essay for her English class. She is so focussed on her essay that she doesn't hear her dad calling her for dinner.
  - c Feven is currently under hypnosis in her psychologists' office. She is working with her psychologist using hypnotherapy to quit smoking.

## 8A QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                               |                                   |
|-------------------------------|-----------------------------------|
| • Consciousness               | • Psychological construct         |
| • Naturally occurring ASC     | • Altered states of consciousness |
| • Induced ASC                 | • Consciousness continuum         |
| • Normal waking consciousness |                                   |
- a An agreed-upon definition and understanding of unobservable phenomena within the field of psychology \_\_\_\_\_  
 b The broad term used to categorise states of consciousness that are temporary and differ from normal waking consciousness; they are typically marked by decreased levels of awareness \_\_\_\_\_  
 c A type of ASC that occurs with purposeful intervention or aid \_\_\_\_\_  
 d The awareness of both stimuli from your internal world and the external world \_\_\_\_\_  
 e The state of being awake and aware; the state of consciousness people typically spend the majority of their day in \_\_\_\_\_  
 f A progression of different states of consciousness that ranges from least aware to most aware \_\_\_\_\_  
 g A type of ASC that occurs without intervention \_\_\_\_\_

#### Question 2

Put the following states of consciousness from least aware to most aware on the consciousness continuum below.

- |                      |                               |
|----------------------|-------------------------------|
| a Alcohol-induced    | e Dreaming                    |
| b Vegetative state   | f Daydreaming                 |
| c Hypnotised         | g Normal waking consciousness |
| d Focussed attention | h Meditation                  |

Least aware

Most aware



**Exam-style questions*****Remember and understand*****Question 3** (1 MARK)

Which of the following is an example of an induced altered state of consciousness?

- A sleep
- B daydreaming
- C meditation
- D focussed attention

**Question 4** (1 MARK)

Which of the following is not an example of an induced altered state of consciousness?

- A under the influence of alcohol
- B dreaming
- C anaesthetised
- D meditation

**Question 5** (1 MARK)

Which of the following sequences best illustrates the consciousness continuum from most aware to least aware?

- A asleep → daydreaming → under anesthesia → focussing on a crossword puzzle
- B daydreaming → focussing on a crossword puzzle → under anesthesia → asleep
- C focussing on a crossword puzzle → daydreaming → under anesthesia → asleep
- D focussing on a crossword puzzle → daydreaming → asleep → under anesthesia

***Apply and analyse*****Question 6** (1 MARK)

Jason is concentrating on his driving test. His level of consciousness is best described as

- A normal waking consciousness.
- B an induced state of normal waking consciousness.
- C a naturally occurring altered state of consciousness.
- D an induced altered state of consciousness.

**Question 7** (1 MARK)

Uisce, Andrew and Jaimee were learning about meditation in their psychology class. Their teacher played a guided meditation for them to follow along with.

Uisce practiced the meditation, but Andrew was distracted by notifications on his phone and was responding to a text he had received, and Jaimee was daydreaming about winning his next soccer game.

Which of the following identifies the state of consciousness being experienced by Uisce, Andrew and Jaimee?

	Uisce	Andrew	Jaimee
A	normal waking consciousness	induced altered state of consciousness	naturally occurring altered state of consciousness
B	induced altered state of consciousness	normal waking consciousness	naturally occurring altered state of consciousness
C	naturally occurring altered state of consciousness	normal waking consciousness	induced altered state of consciousness
D	naturally occurring normal waking consciousness	induced altered state of consciousness	naturally occurring altered state of consciousness

**Question 8** (2 MARKS)

Kaitlyn and Michael were at a party. Kaitlyn was drinking alcohol and Michael was drinking soda water because he was the designated driver for the night. Identify the state of consciousness that Kaitlyn and Michael are experiencing.

Kaitlyn \_\_\_\_\_

Michael \_\_\_\_\_

**Question 9** (2 MARKS)

Rachel is sitting in her psychology class and listening to her teacher whilst taking notes on her laptop. In the corner of her eye she sees other students leaving their classes for lunch and then realises that she is hungry as she hadn't had breakfast that morning.

What state of consciousness is Rachel likely experiencing? Justify your response.

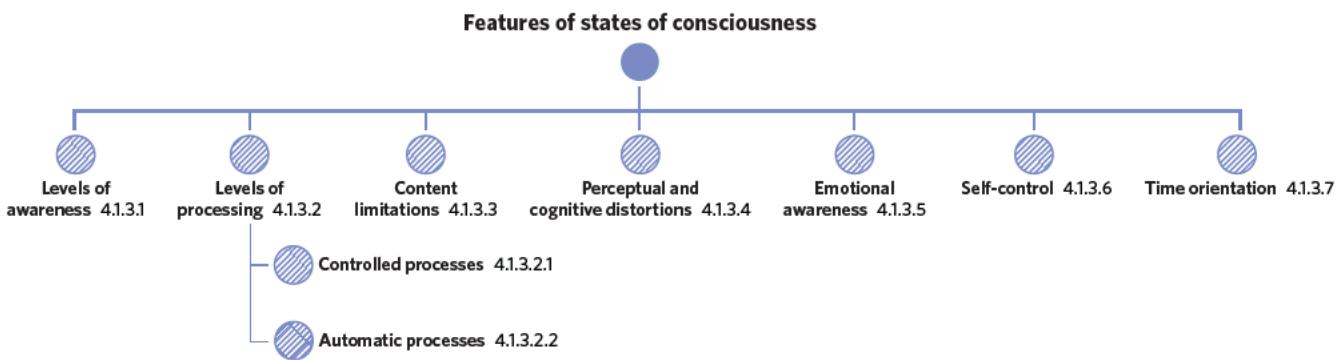


# 8B FEATURES OF STATES OF CONSCIOUSNESS

Earlier in this chapter, you learned about consciousness, including the difference between normal waking consciousness (NWC) and altered states of consciousness (ASC). You learned that consciousness can be understood in terms of levels of awareness. In this lesson, you will examine other features you can use to distinguish between different states of consciousness; changes to these features alter a person's psychological state.

8A. States of consciousness	8B. Features of states of consciousness	8C. Measuring consciousness	8D. Alertness, brain wave patterns and drug-induced ASCs																
<b>Study design dot point</b>																			
<ul style="list-style-type: none"> <li>changes in a person's psychological state due to levels of awareness, controlled and automatic processes, content limitations, perceptual and cognitive distortions, emotional awareness, self-control and time orientation</li> </ul>																			
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<table> <tr> <td>Levels of awareness</td> <td>4.1.3.1</td> </tr> <tr> <td>Controlled processes (levels of processing)</td> <td>4.1.3.2</td> </tr> <tr> <td>Automatic processes (levels of processing)</td> <td>4.1.3.2.2</td> </tr> <tr> <td>Content limitations</td> <td>4.1.3.3</td> </tr> <tr> <td>Perceptual and cognitive distortions</td> <td>4.1.3.4</td> </tr> <tr> <td>Emotional awareness</td> <td>4.1.3.5</td> </tr> <tr> <td>Self-control</td> <td>4.1.3.6</td> </tr> <tr> <td>Time orientation</td> <td>4.1.3.7</td> </tr> </table>				Levels of awareness	4.1.3.1	Controlled processes (levels of processing)	4.1.3.2	Automatic processes (levels of processing)	4.1.3.2.2	Content limitations	4.1.3.3	Perceptual and cognitive distortions	4.1.3.4	Emotional awareness	4.1.3.5	Self-control	4.1.3.6	Time orientation	4.1.3.7
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Emotional awareness	4.1.3.5																		
Self-control	4.1.3.6																		
Time orientation	4.1.3.7																		

In this lesson, you will be learning about some of the key features of states of consciousness and how they can indicate a person's psychological state. These may be used to distinguish between NWC and ASCs and also between various kinds of ASCs.



## Levels of awareness 4.1.3.1

### OVERVIEW

One feature to distinguish between psychological states is the level of awareness an individual possesses. Awareness refers to how conscious and alert someone is to both internal and external stimuli.

### THEORY DETAILS

Awareness can vary on a spectrum from total awareness to no awareness. This is shown in figure 1, also seen in lesson 8A. As you learned in the previous lesson, in NWC people have fairly high levels of awareness, allowing them to observe what is going on around them as well as things happening in their own mind and body. In ASCs, awareness tends to be lowered or focussed on certain stimuli, whether it be internal or external. For example, in the altered state of daydreaming, an individual may be less aware of external stimuli, but totally absorbed by the internal stimuli of their thoughts.

**Levels of awareness** the degree to which an individual is conscious of stimuli

In contrast, in an alcohol-induced ASC a person might have lower levels of awareness in general, causing them to be less aware of both their surroundings and inner thoughts.

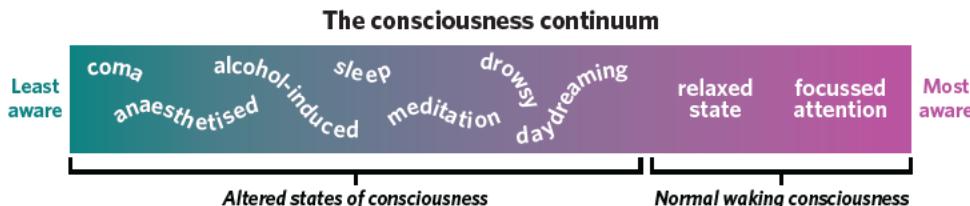


Figure 1 The consciousness continuum which represents the spectrum of consciousness in terms of awareness (least to most aware)

## Levels of processing 4.1.3.2

### OVERVIEW

Levels of processing refer to how much focus and concentration is required to complete a task or understand information. In this sense, 'processing' refers to the nature of mental operations. There are two types of processes: controlled and automatic processes.

### THEORY DETAILS

#### Automatic processes 4.1.3.2.1

Automatic processes are a type of task that require low levels of mental processing. They require little mental effort and conscious control. Automatic processes may be completed at the same time as other tasks, like listening to the radio while taking a shower.

Automatic tasks don't require full concentration, either because of learned experience and repetition or because of the simplicity of the task. A task may start out as a controlled process and become automatic with practice. For example, playing the chords to a song on the guitar may need full attention to begin with, but once learned, it becomes almost second-nature.

#### Controlled processes 4.1.3.2.2

On the other hand, controlled processes are a type of task that require high levels of mental processing. In other words, they require conscious focus and concentration, and can only be completed one at a time. This higher level of mental effort is required when tasks are particularly complex like playing a difficult piece of music on guitar; or, when they are unfamiliar and being learned such as learning to drive a car.

In NWC, people are able to perform both automatic and controlled processes. In ASCs, both types of tasks are possible, but the concentration and mental effort required to complete either may be increased. As such, a task that is normally an automatic process may become a controlled process when a person is experiencing an ASC. For example, walking home from the train station might usually be an automatic process for someone, but when they are in an alcohol-induced ASC this might require much more mental effort, and instead becomes a controlled process task.



Figure 2 Playing the guitar starts as a controlled process but can then become an automatic process.

**Automatic processes** tasks that require low levels of mental processing

**Controlled processes** tasks that require high levels of mental processing

### Useful tip

When commenting on levels of processing, you should specify which type of task/s are possible given the psychological state, using the key terminology controlled and automatic processes.

## Content limitations 4.1.3.3

### OVERVIEW

Content refers to the information an individual is consciously aware of. Content limitations refer to constraints a person exerts over the information in their own mind.

### THEORY DETAILS

In NWC, the 'content' of a person's thoughts is generally organised, logical and restricted. Individuals are able to exert some level of control over what enters their thoughts, blocking out what is irrelevant or potentially disruptive. Essentially, people are able to 'limit' their 'content' in NWC, and are able to choose what to focus on and what not to focus on; this is referred to as content limitations.

In contrast, various ASCs may make these limitations more difficult. For example, in a drug-induced ASC people may have illogical, disorganised thoughts. They may also be unable to suppress or control some thoughts that they normally could. Daydreaming is another ASC in which a person's content is also less limited than in NWC.

**Content limitations** a restraint placed on the thoughts that are occurring in a person's mind



During daydreams, content is almost entirely internally focussed, while the person remains unreceptive to external stimuli often without meaning to or realising. Figure 3 is an artistic representation of a brain exerting content limitations compared to a brain in which the content is more unlimited.

#### **Useful tip**

When a person's content is different to that in NWC, it can be described as content limitations being reduced or at times even becoming unlimited.

### **Perceptual and cognitive distortions** 4.1.3.4

#### **OVERVIEW**

Perceptual and cognitive distortions refer to atypical, or abnormal, variation in the way an individual interprets and processes sensory stimuli and thoughts.

#### **THEORY DETAILS**

Perception is the process of interpreting information received via the senses. Cognition involves understanding and processing information. It includes the ways in which people think, interpret and problem solve. These processes are used in combination by individuals to make sense of the world around them. In NWC, people's perceptions and cognition are generally an accurate reflection of reality.

Perceptual and cognitive distortions involve something being different or abnormal to the way a person understands or views things in NWC. ASCs generally exaggerate, dull or completely vary the way perceptions and thoughts occur in NWC. Distortions can vary from something insignificant like being unable to remember something one usually would, to having intense hallucinations that completely distort an individual's ordinary sense of reality.

In an alcohol-induced ASC for example, an individual's visual perception may be altered as they 'see double' or have blurred vision. This is an example of perceptual distortion. In a marijuana-induced ASC, an individual might find things much more amusing than in NWC as they think about things in a different way; this is an example of a cognitive distortion.

Some examples of perceptual and cognitive distortions include:

- Time distortions
- Illogical or irrational thoughts
- Reduced spatial awareness
- Reduced ability to problem solve and reason
- Hallucinations
- Distortions within particular senses e.g. sense of smell, vision or hearing
- Changes to pain thresholds
- Memory difficulties

#### **Useful tip**

You should be aware of some types of perceptual and cognitive distortions such as visual or auditory hallucinations and having a distorted sense of time. When asked to comment on them, state whether or not perceptual and cognitive distortions are present and, if relevant, specify which kinds. Keep in mind that you can call something either a perceptual or cognitive distortion if you know it's a specific kind of distortion, or just mention the whole label if you are not sure.



**Figure 3** An artistic representation of the difference between a brain with content limitations, in which thought is organised and logical; compared to one with more unlimited content, in which content is disorganised and illogical

**Perceptual and cognitive distortions** atypical (abnormal) variation in the way an individual interprets and processes stimuli

## Emotional awareness 4.1.3.5

### OVERVIEW

Emotional awareness refers to the level of understanding and control people have over their feelings, as well as the ability to accurately perceive the emotions of others.

### THEORY DETAILS

In both NWC and ASCs, events or thoughts can make it difficult to control your emotions. Generally though, being in ASC makes awareness of your emotional state and control of it more difficult, producing reactions that are unexpected, heightened or dulled for the individual relative to the situation.

In some drug-induced ASCs for example, people may become highly emotional and receptive to things they would usually ignore, and also become more willing to discuss them with other people. It may also become more difficult to accurately perceive the emotions of others, such as not being able to read the facial expressions of another person to understand that they are getting angry.

**Emotional awareness** the understanding and control people have over their feelings, as well as the ability to accurately perceive the emotions of others

#### *Useful tip*

There are a range of ways you can discuss emotional awareness. Some common ways to describe these levels include 'reduced emotional awareness', 'heightened emotions' and 'appropriate emotional responses'.

## Self-control 4.1.3.6

### OVERVIEW

Self-control refers to a person's ability to restrain or hold composure over their thoughts, feelings and actions.

**Self-control** a person's ability to restrain or hold composure over their thoughts, feelings and actions

### THEORY DETAILS

Unique experiences and environments all contribute to individuals' relative levels of self-control. Generally speaking, people have their highest levels of self-control during NWC. In ASCs, different components of self-control may be affected. For example, in alcohol-induced ASCs, a person's physical self-control may be decreased, observed in the inability to walk in a straight line. Of course other components of self-control can be affected, like the previously mentioned control of emotions and content of thoughts.

#### *Useful tip*

Generally when commenting on self-control, you might describe it as being 'reduced', 'limited', 'decreased' or 'adequate'. It might also sometimes be relevant to comment on which aspect/s of self-control are affected like behaviour, emotions and thoughts.

## Time orientation 4.1.3.7

### OVERVIEW

A person's time orientation refers to their perception of how much or how little time has elapsed, and the ability to situate events in the past, present or future. Abnormal time orientation may be considered a perceptual and cognitive distortion.

### THEORY DETAILS

The time orientation of an individual may be accurate or distorted. Often distortions are due to being in an ASC. Various drug-induced ASCs, for example, may make time feel like it has either slowed down completely, or as though it's rushing by. Time orientation may also vary in NWC depending on how stimulated a person is, with lack of stimulation generally correlating to a slower passing of time.

**Time orientation** the perception of how much or how little time has elapsed, and the ability to situate things in the past, present or future



**Useful tip**

Describing time orientation usually involves commenting on whether it is accurate or distorted. For example, phrases like 'distorted sense of time' or 'inaccurate time orientation' may be useful. To remember the role of time orientation, think of the phrase 'time flies when you're having fun'. This is just one example of how different states of consciousness can change one's perception of time, in this case a state of high stimulation.

**Theory summary**

Although you do not have to memorise how the features of states of consciousness appear in specific ASCs, it is useful to use the example of alcohol-induced ASCs to consider how they might change in various ASCs. Table 1 summarises the difference between NWC and alcohol-induced ASCs. It is important to know that these features are generalised, and each feature would vary depending on the level of alcohol consumption and the individual.

**Table 1** Summary of how the features of states of consciousness differ in an alcohol-induced ASC, as compared to NWC

Feature of states of consciousness	Normal waking consciousness	Alcohol-induced ASC
Levels of awareness	Awareness of both internal and external stimuli	Decreased levels of awareness
Levels of processing	Both controlled and automatic processes are possible	More mistakes on automatic processes and greater difficulty with controlled processes
Content limitations	Content is able to be limited	Content limitations likely to be reduced
Perceptual and cognitive distortions	Perception and cognition is an accurate representation of reality	Perception and cognition may be inaccurate
Emotional awareness	Emotional reactions are generally appropriate to the event or situation	Emotions may be dulled or heightened; individuals may be more open to discussing their emotions or they might display inappropriate emotional reactions to the situation
Self-control	Control exerted over thoughts, feelings and actions	Reduced levels of self-control
Time orientation	Time orientation mostly an accurate reflection of time passing in reality	Time may feel as though it's going faster or slower than in reality

**Useful tip**

It is important to know that you cannot memorise how each feature of consciousness will be necessarily affected by an ASC, as they are too varied and subjective depending on the factors of a given situation, the type of ASC and the individual. For example, people's own baseline state of NWC is varied, and so the starting point from which diversions of consciousness are made must also be considered. When answering questions about these features, be sure to consider all information given in the scenario, and discuss the features of the ASC in comparison to NWC.

In this lesson, you have learned about some of the different features of states of consciousness and how they may alter between different psychological states. It is important that you are familiar with the meaning, and are able to discuss all the features including: levels of awareness, levels of processing, content limitations, perceptual and cognitive distortions, emotional awareness, self-control and time orientation. You should be able to describe how all of these may appear in various ASCs compared to NWC, and apply them to scenarios.



One way of remembering the features of states of consciousness is with the word: **ACCEPTS**, where each letter stands for a feature:

- A**wareness
- C**ontent limitations
- C**ontrolled and automatic processes
- E**motional awareness
- P**erceptual and cognitive distortions
- T**ime orientation
- S**elf control

## 8B Activities

- 1 For each of the following scenarios identify the state of consciousness the individual is in and the characteristic/s that is/are being displayed. Justify your response.
- Sarah went out for her 21st birthday. At around 1am, Sarah shifted from being extremely happy to extremely sad, which was uncharacteristic for her. She wasn't able to control her emotions; she began crying when she spilt some of her drink, when something like this would not usually faze her.
  - Dara was sitting in her mathematics class when she began daydreaming about what it might feel like to fly. When she refocussed on her maths problems she realised she couldn't remember what her teacher had set for homework.
  - Sam was focussing on his Legal Studies exam. Although he was very nervous about doing poorly, he blocked these thoughts out and concentrated on finishing his exam.
  - Jarrod was very tipsy at a party. Although he is usually very responsible, Jarrod ran through a fire and sustained burns to his feet and legs.
  - Warren was holidaying in the French countryside. When exploring, he would often marvel at the rich colours of the landscape.
  - Shyamala woke up from a dream thinking that she had slept for hours and was late for work. When she looked at her alarm clock, she realised that she had only been asleep for two hours.

*Reproduced from Edrolo and A.Muller, 2017.*

- 2 Fill in the table provided with reference to controlled and automatic processes.

Process	Automatic process	Controlled process
Speed of processing		
Level of attention required		
Degree of difficulty of task		
Ability to undertake other tasks at the same time		
Example		

*Reproduced from Edrolo and A.Muller, 2017.*

## 8B QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- levels of awareness
  - controlled processes
  - automatic processes
  - content limitations
  - perceptual and cognitive distortions
  - emotional awareness
  - self-control time orientation
- A person's ability to restrain or hold composure over their thoughts, feelings and actions \_\_\_\_\_
  - The degree to which an individual is conscious of stimuli \_\_\_\_\_
  - A type of task that requires high levels of mental processing \_\_\_\_\_
  - Atypical variation in the way an individual's senses and thoughts interpret and process stimuli \_\_\_\_\_
  - The level of understanding and control a person has of their own feelings \_\_\_\_\_
  - A control on the information that is going on in a person's own mind \_\_\_\_\_
  - A type of task that requires low levels of mental processing \_\_\_\_\_
  - The perception of how much or how little time has elapsed, and the ability to situate things in the past, present or future \_\_\_\_\_



**Question 2**

Fill in the blanks with the missing key term.

- Lower
- Higher
- Levels of processing
- Automatic processes
- Controlled processes

\_\_\_\_\_ refer to how much focus and concentration is required to understand information or complete a task. \_\_\_\_\_ require \_\_\_\_\_ levels of concentration and mental effort, and may be completed alongside other tasks. On the other hand, \_\_\_\_\_ require \_\_\_\_\_ levels of concentration and mental effort, only being able to be completed one at a time.

**Exam-style questions*****Remember and understand*****Question 3** (1 MARK)

Which of the following is most likely to use automatic processing?

- A reading a book
- B listening to music
- C baking a cake
- D reading your school timetable for the first time

**Question 4** (1 MARK)

In an altered state of consciousness, a person will most likely experience

- A increased content limitations, in which they have less control of their thoughts.
- B decreased content limitations, in which they have greater control of their thoughts.
- C increased content limitations, in which they have greater control of their thoughts.
- D decreased content limitations, in which they have less control of their thoughts.

**Question 5** (2 MARKS)

Describe how changes to a person's time orientation and self-control may differ in an altered state of consciousness as compared to normal waking consciousness.

***Apply and analyse*****Question 6** (1 MARK)

Lucinda broke her arm and was rushed to the hospital. When she arrived, she was given a drug in the form of gas to relieve her pain in a hospital room. As she breathed it in, she saw her surroundings change to a deep white cave and the bed beneath her disappear. She also began to feel extremely anxious beyond her control. Lucinda's surroundings changing and her uncontrollable anxiety are respectively evidence of

- A perceptual and cognitive distortions, increased content limitations.
- B increased content limitations, decreased emotional awareness.
- C perceptual and cognitive distortions, decreased emotional awareness.
- D decreased self-control, decreased levels of awareness.

**Question 7** (1 MARK)

Muhammad was swimming in a pool and hit his head at the end of the lane. When his friend was talking to him after, he noticed that Muhammad was talking much more openly about his feelings than usual. Muhammad could be considered to be in an altered state of consciousness because he

- A seemed to be limiting the content of his thoughts and speech less than usual.
- B knew how long it had been since he began swimming.
- C was able to get out of the pool without falling over.
- D had reduced automatic processes compared to controlled processes.

**Question 8** (2 MARKS)

Karen was sick with a fever and as a result entered an altered state of consciousness. She reported that she was having intense visual hallucinations. Provide one other example of a perceptual or cognitive distortion that Karen might also be experiencing.

*Adapted from Edrolo and A.Muller, 2017*

**Question 9** (4 MARKS)

Using an example, identify two differences between controlled and automatic processing.

**Question 10** (4 MARKS)

Logithan was studying for an upcoming mathematics exam when he felt his concentration deteriorating. Logithan needed to keep studying to be able to revise all of the content that was going to be on the exam, so he got up and made himself a coffee. Soon after, he felt awake enough to keep studying.

- a In terms of processing, describe the difference between Logithan studying and Logithan making himself a coffee. (2 MARKS)
- b Identify and describe one change to Logithan's psychological state that may have occurred after he drank the coffee. (2 MARKS)

**Questions from multiple lessons****Use the following information for questions 11 and 12.**

Callum was playing football when he got a big knock to the head. He fell unconscious and an ambulance was called. When the paramedics arrived, Callum woke up. The paramedics asked him some questions and told Callum they were going to take him to the closest hospital. Ten minutes later, as they were on the road, Callum became very confused and angry, and asked the paramedics where he was being taken. They identified that he was in an altered state of consciousness.

**Question 11** (1 MARK)

Which of the following identifies the likely change to Callum's psychological state when he was in an altered state of consciousness?

- A greater difficulty performing two controlled processes at once
- B greater self-control
- C decreased emotional awareness
- D increased content limitations

*Adapted from VCAA 2018 Exam MCQ23*

**Question 12** (1 MARK)

Callum asking where he was being taken is evidence of

- A anterograde amnesia, caused by trauma to his cerebral cortex
- B anterograde amnesia, caused by trauma to his hippocampi
- C anterograde amnesia, caused by trauma to his cerebellum
- D anterograde amnesia, caused by trauma to his amygdala

**Question 13** (4 MARKS)

Tina is visiting her brother's new apartment for the first time. She has had a few glasses of wine, and is in an altered state of consciousness. Her brother is trying to teach her how to use his coffee machine, showing her how it works by making himself a coffee. When Tina tries to make a coffee after the demonstration, she is unable to replicate her brother's actions.

Identify two likely changes to Tina's psychological state while she is in an altered state of consciousness and describe how they may have affected the success of her observational learning.



***Key science skills*****Question 14** (4 MARKS)

A researcher wanted to investigate the relationship between induced altered states of consciousness and content limitations. She did this by asking her participants personal questions when they were in normal waking consciousness (condition 1). A few days later, she caught up with the same participants over a drink at a bar to induce an altered state of consciousness (condition 2) and asked them personal questions again. A qualitative measure of the depth and openness of responses was used. Participants were also asked at the end of the experiment if they felt a difference in their openness, what they would attribute it to. Many participants reported feeling more comfortable with the researcher the second time round due to the amount of time they'd spent together and the setting of the bar.

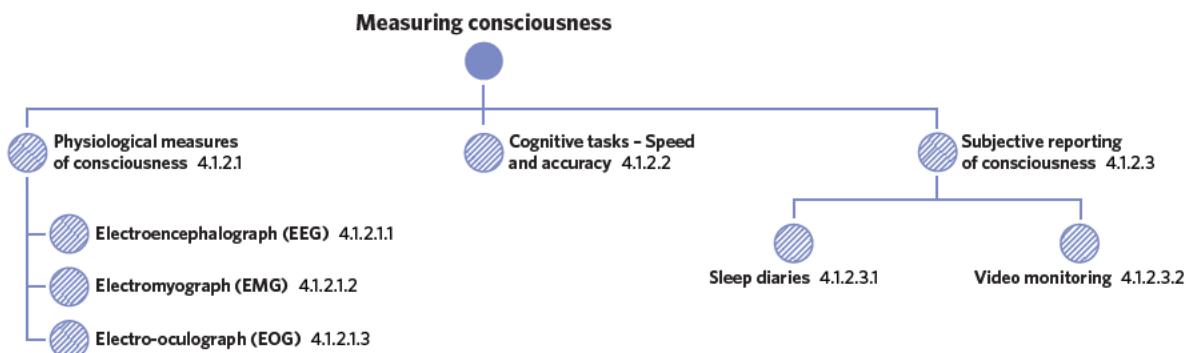
- a What was the experimental design used in this study? (1 MARK)
- b Was there a confounding variable in this study? Justify your response. (3 MARKS)

# 8C MEASURING CONSCIOUSNESS

So far in this chapter, you have learned about the consciousness continuum and how states of consciousness may be distinguished according to different psychological features. In this lesson, you will focus on the measurement of consciousness.

8A. States of consciousness	8B. Features of states of consciousness	8C. Measuring consciousness	8D. Alertness, brain wave patterns and drug-induced ASCs												
<b>Study design dot point</b>															
<ul style="list-style-type: none"> <li>the measurement of physiological responses to indicate different states of consciousness, including electroencephalograph (EEG), electromyograph (EMG), electro-oculograph (EOG) and other techniques to investigate consciousness (measurement of speed and accuracy on cognitive tasks, subjective reporting of consciousness, including sleep diaries, and video monitoring)</li> </ul>															
<b>Key knowledge units</b>															
<table> <tr> <td>Electroencephalograph (EEG) (Physiological measures of consciousness)</td> <td>4.1.2.1.1</td> </tr> <tr> <td>Electromyograph (EMG) (Physiological measures of consciousness)</td> <td>4.1.2.1.2</td> </tr> <tr> <td>Electro-oculograph (EOG) (Physiological measures of consciousness)</td> <td>4.1.2.1.3</td> </tr> <tr> <td>Cognitive tasks – Speed and accuracy</td> <td>4.1.2.2</td> </tr> <tr> <td>Sleep diaries (Subjective reporting of consciousness)</td> <td>4.1.2.3.1</td> </tr> <tr> <td>Video monitoring (Subjective reporting of consciousness)</td> <td>4.1.2.3.2</td> </tr> </table>				Electroencephalograph (EEG) (Physiological measures of consciousness)	4.1.2.1.1	Electromyograph (EMG) (Physiological measures of consciousness)	4.1.2.1.2	Electro-oculograph (EOG) (Physiological measures of consciousness)	4.1.2.1.3	Cognitive tasks – Speed and accuracy	4.1.2.2	Sleep diaries (Subjective reporting of consciousness)	4.1.2.3.1	Video monitoring (Subjective reporting of consciousness)	4.1.2.3.2
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Electro-oculograph (EOG) (Physiological measures of consciousness)	4.1.2.1.3														
Cognitive tasks – Speed and accuracy	4.1.2.2														
Sleep diaries (Subjective reporting of consciousness)	4.1.2.3.1														
Video monitoring (Subjective reporting of consciousness)	4.1.2.3.2														

In this lesson, you will be learning about tools psychologists use to make assessments about individuals' consciousness. These include measures of physiological responses, as well as some psychological and behavioural measures of consciousness that obtain both subjective and objective data.



## Physiological measures of consciousness 4.1.2.1

### OVERVIEW

One way psychologists may determine individuals' consciousness is through the measurement of their physiological responses. There are three different physiological measures you should be familiar with, which will be examined: EEGs, EMGs and EOGs.

**Electroencephalograph (EEG)** a device that detects, amplifies and records the electrical activity of the brain

### THEORY DETAILS

The three main devices that psychologists use to determine a person's state of consciousness are: EEG, EMG and EOG. These three physiological measures all work by taking a reading of some aspect of an individual's physiology via the electrical activity it produces. This reading comes from detecting, amplifying and then recording this electrical activity. The reading is then used by a psychologist to make a judgement about consciousness.

### Electroencephalograph (EEG) 4.1.2.1.1

An electroencephalograph (EEG) is a device that detects, amplifies and records the electrical activity of the brain. The electrical activity comes from the communication of neurons in the brain. This activity is represented in the form of brain wave patterns.



Figure 1 A diagram of a person connected to an EEG, with brain waves displayed on the screen it is connected to.



These can be used to make a judgement about the state of consciousness a person might be in, as different kinds of brain wave patterns correlate to different states of consciousness. In order to take these readings, a medical professional or researcher attaches electrodes to the outside of a person's head. This process can be seen in figure 1.

### Electromyograph (EMG) 4.1.2.1.2

An **electromyograph (EMG)** is a device that detects, amplifies and records the electrical activity of the body's muscles. By attaching electrodes to the skin above the muscles under investigation, the movement and tension of muscles are recorded. This is shown in figure 2. This can indicate different levels of consciousness. For example, little to no activity in the body's muscles might be indicative of reduced awareness, such as when a person is sleeping or in a relaxed state. In contrast, high tension or movement may indicate an alert state.

**lesson link** In the next lesson **8D: Alertness, brain wave patterns and drug-induced ASCs**, you will learn more about some of the different kinds of brain wave patterns, how to read them and what they might indicate about someone's state of consciousness.

**Electromyograph (EMG)** a device that detects, amplifies and records the electrical activity of the body's muscles

#### Useful tip

You do not have to be able to read an EMG reading. When commenting on the expected EMG reading in a given scenario, comment on the level of activity; e.g. low activity, high activity.

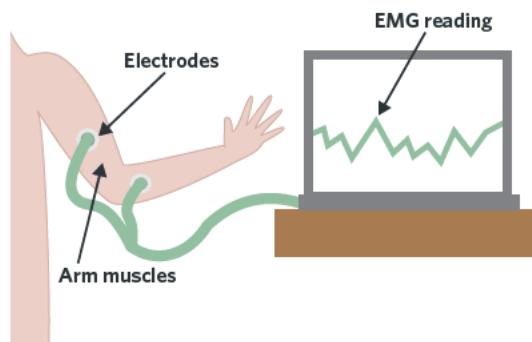


Figure 2 A diagram of an EMG connected to a person's arm muscles via electrodes, producing an EMG reading on the screen.

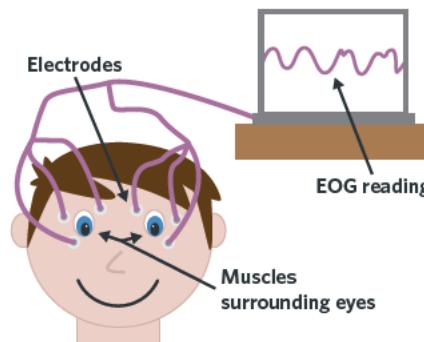


Figure 3 A diagram of an EOG, with electrodes attached to the muscles surrounding the eyes. The reading is on the screen to the right.

### Electro-occulograph (EOG) 4.1.2.1.3

An **electro-occulograph (EOG)** is a device that detects, amplifies and records the electrical activity of the muscles that move the eyes. The movement of these muscles therefore reflects the movement of the eyes, taken from electrodes attached to the skin above these muscles. This is shown in figure 3. This is useful for measuring consciousness, as little to no activity of these muscles would likely indicate low levels of awareness, as a person doesn't move their eyes much when relaxed or in most stages of sleep. As with the EMG, when commenting on the expected EOG readings in a given scenario, state the expected levels of activity, such as low activity or high activity.

**Electro-occulograph (EOG)** a device that detects, amplifies and records the electrical activity of the muscles surrounding the eyes

#### Useful tip

Many students lose marks by simply stating that the EOG detects, amplifies and records electrical activity of the eyes. In order to gain full marks, it is essential that you state 'muscles surrounding the eyes'.



**lesson link** In chapter 9, you will learn about the two different kinds of sleep (REM and NREM). These are distinguished by eye movement, and so the EOG is of great importance to differentiating between them.

#### Memory device

When describing the role of each physiological measure, you must state that it detects, amplifies and records electrical activity, and specify where the electrical activity comes from. In order to remember this, use the acronym DARE (detect, amplify, record electrical activity of...) in your responses.

**Useful tip**

In order to best remember the difference between the three physiological measures, think of the letter in the middle of each initialism for what it measures. For EMGs, you can remember the 'M' for 'muscles' (the body's muscles). For EOGs you can remember 'O' for ocular, which means relating to the eyes. EEGs unfortunately are more difficult to make this quick connection, but it is the remaining measure so you can remember that it measures activity of the brain.

## Cognitive tasks - Speed and accuracy 4.1.2.2

### OVERVIEW

Aside from these physiological measures, psychologists also use psychological measures to determine a person's state of consciousness. A common psychological measure is of a person's speed and accuracy on cognitive tasks.

### THEORY DETAILS

There are a variety of tests a psychologist can get a person to perform to gauge their state of consciousness. A **cognitive task** is a form of testing that measures some aspect/s of a person's thought processes. Most commonly, these tasks test a person's cognitive speed and accuracy. **Speed** refers to how quickly a person responds to a stimulus. In testing, a person's reaction time might be taken as a measure of their cognitive speed. On the other hand, cognitive **accuracy** comes from precision in completing a task, generally measured by the number of errors a person makes. The combination of these measures can inform a psychologist about a person's consciousness. If, for example, a person is in an altered state of consciousness, they might have reduced speed and accuracy.

An example of a speed and accuracy test might require people to unjumble words as quickly as possible to reveal their correct spelling. Other types of tests may get participants to select the 'odd one out' of a group of alternatives as quickly as possible. Another common test of accuracy requires people to notice patterns, choosing the best picture or shape out of alternatives to complete them.

## Subjective reporting of consciousness 4.1.2.3

### OVERVIEW

Subjective reporting is another source of data from which psychologists can make judgements about states of consciousness. You should be familiar with two kinds: sleep diaries and video monitoring.

### THEORY DETAILS

**Subjective reporting** of consciousness involves obtaining data directly from the individual under investigation. Because it often involves methods of self-report and self-observation, it can be considered biased and should generally be used in combination with more objective measures.

#### Sleep diaries 4.1.2.3.1

One common method of subjective reporting is the use of **sleep diaries**. These are a kind of record containing self-reported qualitative descriptions from the individual about their sleeping periods, including an estimated time spent sleeping and judgements they might have about the quality and nature of their sleep. This information is recorded over a period of time, most commonly a few weeks. This informs psychologists about the naturally occurring altered state of consciousness sleep, and its effect on various aspects of the individual's life. This subjective method is somewhat problematic, as individuals may not be able to determine the exact time they fell asleep or be able to remember the quality of their sleep upon waking.

**Cognitive tasks** a form of assessment that measures some aspect/s of a person's thought processes

**Speed** the rate at which a person responds to a stimulus in a task

**Accuracy** the precision with which a person completes a task



In lesson **1G: Data organisation and interpretation** you learned about how the mean can be used as a way of analysing data. The mean is used to determine the results of speed and accuracy on these cognitive tasks, providing the average speed/percentage of correct responses.

**Subjective reporting** a method of data collection involving accounts directly from the individual about some aspect of their behaviour, biology or psychology

**Sleep diaries** a record from an individual containing qualitative descriptions of the amount and nature of their sleep over a certain period of time



### Video monitoring 4.1.2.3.2

**Video monitoring** is another method under subjective reporting of consciousness that provides behavioural data about sleep. Video monitoring involves the use of camera and audio technologies to record an individual as they sleep. This provides data specific to the individual to track their sleeping and waking periods, their movements and activities when sleeping and the sounds they make in this period. This is particularly useful for monitoring those with sleeping disorders. Video monitoring can also be used in conjunction with physiological measures to give validity to a phenomenon. For example, a spike in an EMG recording would correspond to bodily movement in the bed, which is validated with video monitoring.

**Video monitoring** a type of data collection involving video and sound recordings of an individual in their sleeping period



It is important to be able to relate the different measures of consciousness to their different classifications of data collection, which is explored in lesson **1F: Collection of data**. While some of these measures provide objective data (the three physiological measures, cognitive tasks), others provide subjective data (video monitoring and sleep diaries). Further, some provide researchers with quantitative data (the physiological measures, the results of cognitive tasks), while others more qualitative (description of occurrences in video monitoring can be qualitative, as well as the content of sleep diaries). This kind of information has been tested alongside measures of consciousness on past exams.



The measures of consciousness in this lesson relate directly to the research methods notion of validity and reliability in lesson **1H: Evaluation of research**. In order to have valid and reliable readings of consciousness, a combination of several kinds of data is best. For example, a psychologist reading data from an EOG showing high activity might infer that a person is alert and aware. However, high EOG activity can indicate a stage of sleep. Combining other consciousness measures like video monitoring would then be necessary to have a reliable and valid measure.

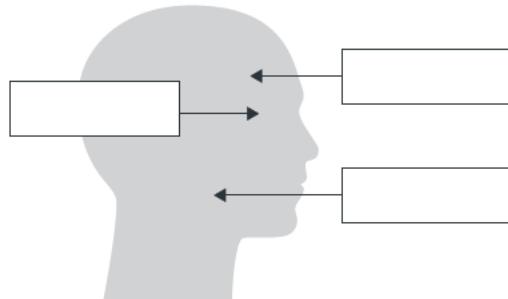
## Theory summary

In this lesson, you have learned about some of the different tools to measure consciousness. You should be familiar with three physiological measures, namely the EEG, EMG and EOG; and, how they operate to take readings. You also learned about how cognitive tasks of speed and accuracy can give a psychologist an indication of someone's consciousness. You should be able to explain the difference between speed and accuracy, and how they might be measured. Finally, you learned about two subjective measures of consciousness: sleep diaries and video monitoring. You should be able to explain the kind of data they record, and what they can be used for. In general, you should be able to link these measures of consciousness to concepts in research methods; they are relevant to types of data (qualitative, quantitative, objective and subjective) and notions of validity and reliability.

## 8C Activities

1 For the diagram provided

- a fill in the labels to identify where the electrodes of an EEG, EOG and EMG would be placed.
- b outline how each of these devices measure consciousness.



Adapted from Edrolo and A.Muller, 2017.

# 8C QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |                   |                        |                    |
|-------------------|------------------------|--------------------|
| • EEG             | • EOG                  | • EMG              |
| • Cognitive tasks | • Speed                | • Accuracy         |
| • Sleep diaries   | • Subjective reporting | • Video monitoring |
- a The rate at which a person responds to a stimulus in a task \_\_\_\_\_
- b A method of data collection involving accounts directly from the individual about some aspect of their behaviour, biology or psychology \_\_\_\_\_
- c A device that detects, amplifies and records the electrical activity of the brain \_\_\_\_\_
- d A form of testing that measures some aspect/s of a person's thought processes \_\_\_\_\_
- e A type of data collection involving video and sound recordings of an individual in their sleeping period \_\_\_\_\_
- f A device that detects, amplifies and records the electrical activity of the body's muscles \_\_\_\_\_
- g A device that detects, amplifies and records the electrical activity of the muscles surrounding the eyes \_\_\_\_\_
- h A record from an individual containing qualitative descriptions of the amount and nature of their sleep over a certain period of time \_\_\_\_\_
- i The precision with which a person completes a task \_\_\_\_\_

### Question 2

Complete the following table categorising the measures of consciousness. Some cells may be left blank.

- |        |  |
|--------|--|
| • EMGs | • Cognitive tasks - speed and accuracy |
| • EOGs | • Video monitoring                     |

	Objective data	Subjective data
Physiological data	EEGs	
Behavioural and psychological data		Sleep diaries

## Exam-style questions

### Remember and understand

#### Question 3 (1 MARK)

An EOG works by

- A detecting, amplifying and recording electrical activity of the eyes.
- B detecting, amplifying and recording electrical activity of the brain.
- C detecting, amplifying and recording electrical activity of the muscles.
- D detecting, amplifying and recording electrical activity of the muscles surrounding the eyes.

#### Question 4 (2 MARKS)

Name one physiological measure of consciousness and describe how it is used.

### Apply and analyse

#### Use the following information for questions 5 and 6.

Noam is having major difficulties sleeping at night, and so he visited a sleep laboratory where a specialist took tests to measure his consciousness. These included the use of an EOG and video monitoring.



**Question 5** (1 MARK)

These measures are respectively examples of

EOG	Video monitoring
A a psychological measure, recording eye muscle movement.	a psychological measure, recording observable movement and sound.
B a physiological measure, recording muscular movement of the body.	a behavioural measure, recording observable movement and sound.
C a physiological measure, recording eye muscle movement.	a behavioural measure, recording observable movement and sound.
D a physiological measure, recording eye muscle movement.	a psychological measure, recording observable movement and sound.

**Question 6** (1 MARK)

One other **subjective** measure the specialist could use with Noam would be

- A the use of a sleep diary.
- B the measurement of speed and accuracy on cognitive tasks.
- C the use of an EEG.
- D the use of an EMG.

**Question 7** (2 MARKS)

Chris has found it increasingly difficult to concentrate on his school work, being unable to stay focussed on one task for more than a few minutes at a time. After seeking advice from a psychiatrist, he was given a medication to trial to see if it would improve his concentration levels.

Outline one psychological measure the psychiatrist could use to test Chris's consciousness and concentration in response to the medication and how they could use it.

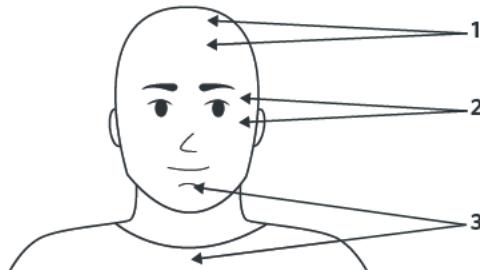
**Question 8** (2 MARKS)

Gian Luca was connected to an EOG and EMG, and showed relatively high activity on both the readings. From this data alone, what might a psychologist infer about Gian Luca's level of awareness?

**Question 9** (6 MARKS)

On the image name the piece of equipment that would be used to measure the physiological responses at points 1, 2 and 3 and describe how they take a measure of consciousness.

Adapted from VCAA 2018 exam MCQ24

**Questions from multiple lessons****Question 10** (5 MARKS)

Jessa's marks at school have rapidly begun to decline. Once the top of her maths class, Jessa has been struggling to learn new concepts and complete her homework with the ease she had before. Unsettled by the rate at which her skills seemed to be declining, Jessa's father took her to a psychologist for advice. The psychologist performed cognitive tests on Jessa, recording her speed and accuracy. The psychologist found that her speed and accuracy were much lower than expected. He then used an EEG to record Jessa's physiological responses, but found that they were normal.

- a Identify the role of an EEG and explain why Jessa's psychologist may have used one after seeing Jessa's results on the cognitive test. (2 MARKS)
- b Jessa's psychologist suggested that Jessa might be suffering from anterograde amnesia. Identify the brain structure involved most directly in anterograde amnesia and explain how anterograde amnesia might be responsible for Jessa's struggles in maths class. (3 MARKS)

**Question 11** (6 MARKS)

Rufus had been feeling out of sorts and so went to a medical professional for a general check up. The doctor ran a variety of tests to examine Rufus's psychological and physiological health. He began by using a rubber hammer to tap lightly below his knee. Rufus responded by immediately drawing back his leg. The doctor then ran another test, in which Rufus was required to hit the spacebar on a computer's keyboard every time he saw the name of a mammal flash upon the screen. The doctor recorded how quickly Rufus hit the spacebar, as well as the percentage of correct responses he made.

- a Name the type of response the doctor was testing when he tapped Rufus on the knee with the hammer. (1 MARK)
- b Referring to key nervous system structures, describe the physiological processes involved in Rufus immediately drawing his knee back. (3 MARKS)
- c What was being tested when Rufus was required to hit the spacebar every time he saw the name of a mammal? (2 MARKS)

**Key science skills****Question 12** (1 MARK)

Measurements of physiological responses and sleep diaries provide respectively

- A objective qualitative data, objective quantitative data.
- B subjective qualitative data, subjective qualitative data.
- C objective quantitative data, subjective qualitative data.
- D subjective quantitative data, objective qualitative data.

**Question 13** (2 MARKS)

Outline why an EEG reading is an example of objective quantitative data.

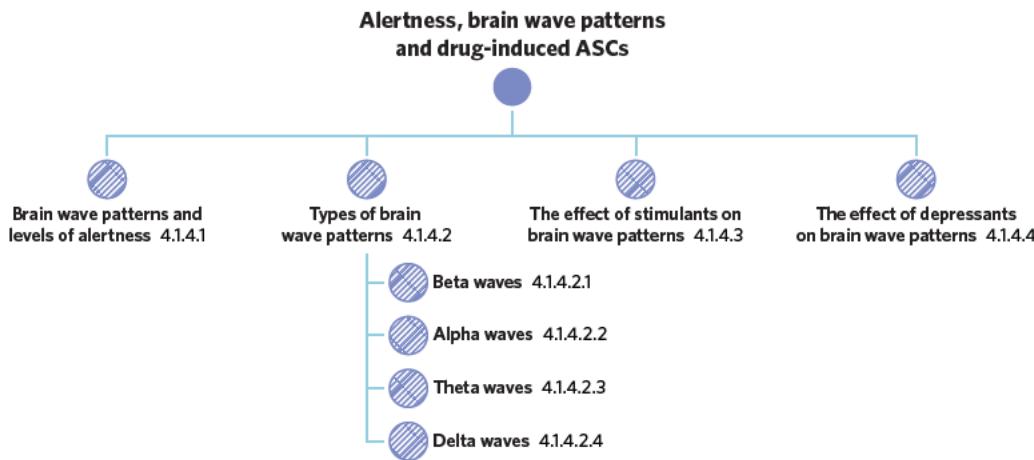


# 8D ALERTNESS, BRAIN WAVE PATTERNS AND DRUG-INDUCED ASCS

Throughout this chapter, you have learned about the nature of consciousness and how it varies. In this lesson, you will learn about how brain waves patterns from an EEG can be used to track consciousness. You will also cover how different types of drugs influence consciousness and its corresponding brain wave patterns.

8A. State of consciousness	8B. Features of states of consciousness	8C. Measuring consciousness	8D. Alertness, brain wave patterns and drug-induced ASCs
<b>Study design dot point</b>			
• changes in levels of alertness as indicated by brain wave patterns (beta, alpha, theta, delta) due to drug-induced altered states of consciousness (stimulants and depressants)			
<b>Key knowledge units</b>			
Brain wave patterns and levels of alertness 4.1.4.1			
Beta waves (Types of brain wave patterns) 4.1.4.2.1			
Alpha waves (Types of brain wave patterns) 4.1.4.2.2			
Theta waves (Types of brain wave patterns) 4.1.4.2.3			
Delta waves (Types of brain wave patterns) 4.1.4.2.4			
The effect of stimulants on brain wave patterns 4.1.4.3			
The effect of depressants on brain wave patterns 4.1.4.4			

In this lesson, you will be learning about concepts relating to **brain waves**, including the four types and how to read them. You will also cover how different brain waves reflect different levels of alertness. Specifically, you will study how drug-induced ASCs from both stimulants and depressants can change levels of alertness and therefore the brain waves produced.



## Brain wave patterns and levels of alertness 4.1.4.1

### OVERVIEW

Brain waves can be used as a physiological measure of consciousness. Importantly, brainwaves change with varying levels of alertness, meaning that a person's state of consciousness can be inferred by what is seen on an EEG.

### THEORY DETAILS

As you've learned in this chapter, one physiological measure of consciousness is taken with an EEG. EEGs detect, amplify and record electrical activity of the brain in the form of brain waves. **Brain waves** are a pattern of electrical activity in the brain caused by neurons communicating.

**Brain wave** a pattern of electrical current in the brain caused by neurons communicating, visually represented as a wave

Brain waves are visually represented as wavy lines. There are two things you need to look for when reading an EEG recording: frequency and amplitude. In figure 1 you will see both of these labelled on a brain wave.

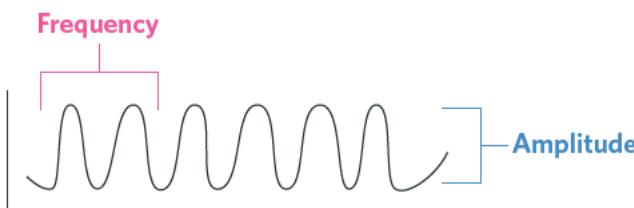
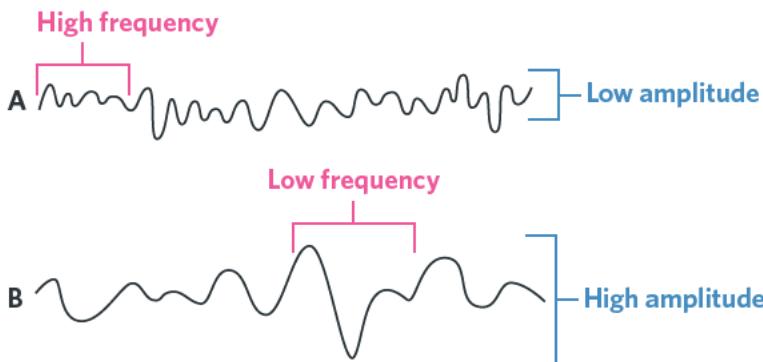


Figure 1 a labelled diagram showing the difference between amplitude and frequency on a brain wave

- **Frequency** refers to how many brain waves there are per second. Visually, you can see that it measures how close the waves are occurring together. The closer the waves are to each other, the higher the frequency.
- **Amplitude** refers to the intensity of the electric current in the brain. Visually, this is represented as the height of the peaks and dips in the waves. The higher the peak compared to the dip, the higher the amplitude.

In general, brain waves can be used to reflect levels of alertness in the brain. High frequency and low amplitude waves are usually indicative of high levels of alertness, while low frequency and high amplitude waves are indicative of lower levels of alertness. For example, when someone is alert and concentrating on study, they are likely to have higher frequency and lower amplitude waves than someone who is daydreaming and looking out the window. Figure 2 is a diagram comparing a brain wave of someone who is very alert to someone who is less alert.



**Brain wave A:** Person is fairly alert, with high frequency (close together) waves, and low amplitude (low wave peaks).

**Brain wave B:** Person has lower levels of alertness, with low frequency (far apart) waves, and high amplitude (high wave peaks).

Figure 2 Two brain waves comparing high and low level alertness

**Frequency** a measurement indicating how many brain waves there are per second, visually represented as how close the waves appear together

**Amplitude** a measurement indicating the intensity of an electric current in the brain, visually represented as the height of the wave peaks

#### Want to know more? —

When you look up brain wave patterns, you might find different measurements used to label the frequency and amplitude. Although not examinable, it might be useful to know when visually interpreting a brain wave that:

- Frequency is measured in Hertz (usually labelled Hz)
- Amplitude is measured in microvolts

#### Useful tip —

Even though this dot point states that you need to know brain waves in relation to the effect of drug-induced ASCs, you may also be tested more generally on how brain waves can reflect different levels of alertness and be asked to apply them to situations beyond that of a drug-induced ASC. You will not be expected to know the exact amplitude and frequency for any state of consciousness, but are expected to be able to give an indication of their levels e.g. high, low, increased or decreased.



To remember the difference between frequency and amplitude in relation to levels of alertness, think of *f* for frequency and *f* for fast. This is because frequency is about how fast (or slow) your brain waves are going. When you're most alert, your frequency is fastest, just like your reaction times to stimuli in your environment. Amplitude on the other hand is not about speed, but about how high or low the peaks and dips of waves are. The more alert you are, the lower these amplitude peaks are.



## Types of brain wave patterns 4.1.4.2

### OVERVIEW

You need to be familiar with four different types of brain waves and how they reflect different levels of alertness. These brain waves are beta, alpha, theta and delta waves.

### THEORY DETAILS

Table 1 outlines the characteristics of the four types of brain wave patterns you must be familiar with: beta, alpha, theta and delta brain waves.

**Table 1** Comparison of the four types of brain wave patterns

Beta waves 4.1.4.2.1	Alpha waves 4.1.4.2.2	Theta waves 4.1.4.2.3	Delta waves 4.1.4.2.4
<b>Comparative definition:</b> the highest frequency, lowest amplitude brain wave in the course, indicating very high levels of alertness	<b>Comparative definition:</b> the second highest frequency, second lowest amplitude brain wave in the course, indicating reduced alertness and wakefulness	<b>Comparative definition:</b> the second lowest frequency, second highest amplitude brain wave in the course, indicating low levels of alertness	<b>Comparative definition:</b> the lowest frequency, highest amplitude brain wave, indicating very low levels of alertness
			
<b>Examples:</b> during studying, reading, working	<b>Examples:</b> during reflecting, daydreaming, relaxing	<b>Examples:</b> sleeping, deep meditation	<b>Examples:</b> deep sleep, coma

**Beta waves** fast, small brain waves with high frequency and low amplitude, indicating high levels of alertness

**Alpha waves** medium sized brain waves with medium-high frequency and low-medium amplitude, indicating an alert but relaxed state

**Theta waves** medium sized brain waves with low-medium frequency and medium-high amplitude, indicating low levels of alertness

**Delta waves** slow and large brain waves with low frequency and high amplitude, indicating very low levels of alertness

 **Memory device** To remember the brain waves in order of what they indicate about levels of alertness, remember the acronym 'BAT-D'. Beta, alpha, theta and finally delta reflect their order from most alert to least alert.



**BAT-D**

### Useful tip

Often a person may not experience one clear brain wave pattern, but be in between them. Because in reality not just one clear brain wave is produced at all times, if you are not sure it helps to say the brain wave and 'like' e.g. 'alpha-like brain waves'.

## The effect of stimulants on brain wave patterns 4.1.4.3

### OVERVIEW

Stimulants are a type of drug that induce an ASC of heightened arousal and alertness compared to NWC. These changes are reflected in brain waves of the person experiencing the ASC.

### THEORY DETAILS

Stimulants are a type of drug that come in many forms. All stimulants have a physiological effect by increasing central nervous system activity, and a cognitive effect in that they increase alertness. People take stimulants for a variety of reasons, and they can come in both legal substances like caffeine, or illegal substances like party drugs. The effects of stimulants also vary greatly depending on the user and the form, amount and strength of the substance. Ultimately, stimulants have an energising effect on the brain and body.

In this topic, you must be able to describe the effect stimulants have on people's brain wave patterns. As you've learned, increased levels of alertness are reflected by higher frequency and lower amplitude brain waves. As such, when a person takes a stimulant compared to when they are in NWC, they will likely experience an increase in frequency and decrease in amplitude of the brain wave patterns. In other words, there will be an increase in beta waves and a decrease in alpha, theta and delta waves.

**Stimulants** a class of drugs that increase central nervous system and body activity, increasing levels of alertness compared to NWC

### Examples of stimulants:

- Caffeine such as in coffee and soft drinks
- Nicotine in tobacco
- Amphetamines such as those found in medicine for attention deficit hyperactivity disorder
- Methamphetamines such as recreational/party drugs like ecstasy

### The effect of depressants on brain wave patterns 4.1.4.4

#### OVERVIEW

Depressants are a type of drug that induce an ASC of decreased arousal and alertness compared to NWC. These changes are reflected in brain waves of the person experiencing the ASC.

#### THEORY DETAILS

Depressants also come in many forms. All depressants have a physiological effect by decreasing central nervous system activity, and a cognitive effect in that they decrease alertness. There are a variety of uses for and reasons why people use depressants. Like stimulants, they can come in both legal and illegal forms. Some depressants may have medical purposes such as pills to help those with sleeping difficulties. Other depressants like alcohol are used recreationally, often to induce relaxation and reduce one's inhibitions. As with stimulants, depressants' effects vary depending on the use and the form, amount and strength of the substance. Ultimately, they have a relaxing effect.

You must also be able to describe the effect of depressants on brain wave patterns. As depressants reduce awareness, there is a corresponding change to a person's frequency and amplitude in brain wave patterns. While frequency decreases, amplitude increases, meaning there is a decrease in beta waves and an increase in alpha, theta and delta waves.

A summary of the difference between the effects of stimulants and depressants on brain waves is detailed in figure 3.

#### Examples of depressants:

- Benzodiazepines like Xanax to reduce anxiety
- Opiates such as morphine to reduce pain
- Barbiturates to help with sleeping difficulties and anxiety
- Alcohol to promote relaxation and reduce inhibition

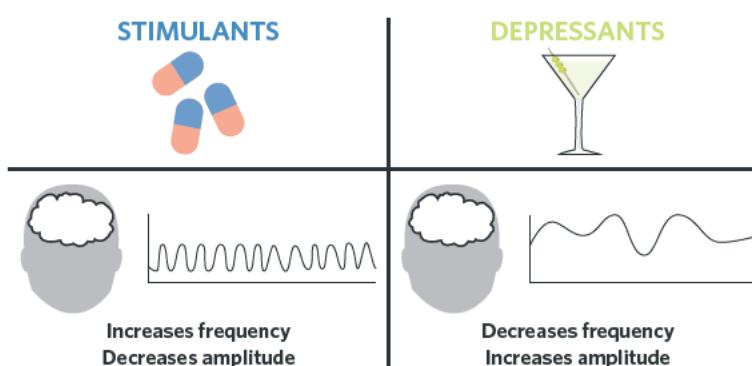


Figure 3 The effect of stimulants and depressants on brain waves

**lesson link** As noted, the effects of both stimulants and depressants may vary greatly depending on their form, amount and strength, as well as the person who is taking the substance. Aside from describing their effects in terms of changes to brain wave patterns, it may also be useful to draw on your knowledge from lesson 8B: *The features of states of consciousness*. Both stimulants and depressants can alter features such as cognitive and perceptual distortions, time orientation, emotional awareness and content limitations in different ways. As such, something both types of drugs have in common is that they produce ASCs which alter these features.

This lesson examines how stimulants and depressants affect levels of alertness; stimulants increase activity and therefore alertness, while depressants decrease it. This is consistent, whereas these drugs' effects on other features of states of consciousness like awareness, self control etc. may vary.

**Depressants** a class of drugs that reduce central nervous system and body activity, reducing levels of alertness compared to NWC

**lesson link** You will learn more about the role of the depressants benzodiazepines and how they can be used to reduce anxiety in lesson 13C: *Interventions for phobia*.

**lesson link** The effect of stimulants and depressants is relevant to lesson 2A: *Central and peripheral nervous systems* and lesson 2D:

**Neurotransmitters**. As you've learned in this lesson, stimulants and depressants cause changes to an individual's nervous systems. Stimulants increase activity of the central nervous system and stimulate the sympathetic responses. In contrast, depressants decrease the nervous system activity of the body. Both stimulants and depressants can have a variety of effects on neurotransmission, increasing, preventing or altering the way neurotransmitter is passed from neuron to neuron.



## Theory summary

In this lesson, you have learned about how brain waves can be used to measure different levels of alertness. Essentially, high frequency and low amplitude brain waves reflect higher levels of alertness, while the opposite reflects lower levels of alertness. Further, beta waves indicate the highest levels of alertness and delta indicate the lowest levels. You should now be able to comment on the general level of alertness each brain wave reflects, and describe their relative levels of frequency and amplitude. You should also be able to consider what kind of brain waves a person may be experiencing given a certain activity or state of consciousness. Finally in this lesson, you examined how stimulants and depressants affect levels of alertness and brain wave activity. You should be able to explain the effects either class of drug has on brain waves, including the name of the brain waves they induce and their impacts on frequency and amplitude levels.

## 8D Activities

**1** Read the following instructions I-IV, then comment on scenarios a-e

- I** Comment on the person's level of alertness (high, low, reduced, increased etc)
- II** Comment on whether there was likely an increase or decrease in their frequency (as compared to normal waking consciousness, or prior to the event in the scenario)
- III** Comment on whether there was likely an increase or decrease in their amplitude (as compared to normal waking consciousness, or prior to the event in the scenario)
- IV** If a drug was taken, identify whether it is more likely a stimulant or a depressant

### Scenarios

- a** Cara always had trouble getting to sleep. Her doctor recently prescribed her a medication drug to make her tired before bed, which she now takes. Tonight, she took her prescribed medication and began to feel tired and sleepy.
- b** Gus suffered from extreme social anxiety and has been on a prescribed anti-anxiety drug for 6 months now. When he takes it, he feels a lot calmer and less on edge.
- c** Jessa loves to drink Coca Cola because the drug in it, caffeine, makes her feel energised and awake. She drinks it every day for this reason, despite advice from her dentist.
- d** Vinny is studying intensely for a maths test. He is doing practice questions and checking his answers, and doing high-level calculations.
- e** Chris is procrastinating doing his homework. He lies on the couch, and begins scrolling through pictures on social media absentmindedly.

## 8D QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |               |               |               |
|---------------|---------------|---------------|
| • Brain waves | • Beta waves  | • Delta waves |
| • Frequency   | • Alpha waves | • Stimulants  |
| • Amplitude   | • Theta waves | • Depressants |
- a** The brain wave pattern showing the second most level of alertness, with medium-high frequency and low-medium amplitude. \_\_\_\_\_
  - b** A component of brain waves' visual representation showing how fast they are going. \_\_\_\_\_
  - c** The brain wave pattern showing the lowest level of alertness, with the lowest frequency and highest amplitude. \_\_\_\_\_
  - d** An electrical impulse in the brain visually represented by frequency and amplitude. \_\_\_\_\_
  - e** A type of drug that decreases activity in the body, reducing frequency and increasing amplitude of brain wave patterns. \_\_\_\_\_

- f The brain wave pattern showing the highest level of alertness, with the highest frequency and lowest amplitude. \_\_\_\_\_
- g The brain wave pattern showing the second lowest level of alertness, with low-medium frequency and medium-high amplitude. \_\_\_\_\_
- h A component of brain waves' visual representation showing the intensity of the brain's electrical activity \_\_\_\_\_
- i A type of drug that increases activity in the body, increasing frequency and decreasing amplitude of brain wave patterns. \_\_\_\_\_

**Question 2**

Fill in the following table with the words below about brain wave patterns:

- |               |               |           |
|---------------|---------------|-----------|
| • Theta       | • Lowest      | • Highest |
| • Medium-High | • Medium-High | • Beta    |

Brain wave name	Frequency	Amplitude	Image
	Highest	Lowest	
Alpha		Low-Medium	
	Low-Medium		
Delta			

**Question 3**

Fill in the following table with the words below about stimulants and depressants.

- |                   |             |              |
|-------------------|-------------|--------------|
| • Benzodiazepines | • Increases | • Depressant |
| • Stimulant       | • Decreases | • Increases  |

Drug classification	Effect on frequency	Effect on amplitude	Example/s	Effect on level of alertness
			Caffeine	
	Decreases	Increases		Decreases

**Exam-style questions***Remember and understand***Question 4** (1 MARK)

Benzodiazepines are considered to be a depressant. This means that the likely changes to a person's brain waves after they have consumed a benzodiazepine would be

- A increased amplitude, decreased frequency.
- B decreased amplitude, increased frequency.
- C increased amplitude, increased frequency.
- D decreased amplitude, decreased frequency.

**Question 5** (1 MARK)

Beta waves are different to theta waves as they demonstrate that a person is

- A more alert, with high-frequency, low-amplitude waves.
- B more alert, with low-frequency, high-amplitude waves.
- C less alert, with high-frequency, low-amplitude waves.
- D less alert, with low-frequency, high-amplitude waves.



**Question 6** (1 MARK)

Levels of alertness can be reflected by brain waves. From **most** alert to **least** alert, the brain waves that would be shown on an EEG are

- A** theta, alpha, delta, beta.
- B** delta, beta, alpha, theta.
- C** beta, alpha, theta, delta.
- D** alpha, theta, delta, beta.

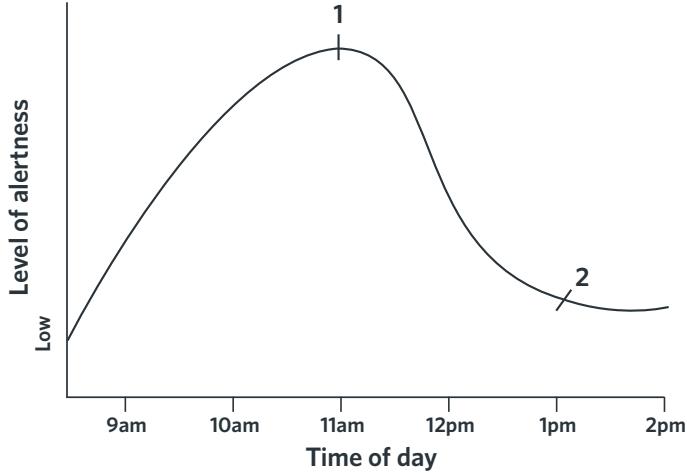
**Question 7** (2 MARKS)

In terms of the type and features of brain wave patterns, what might a person given a higher dose of a stimulant compared to a lower dose of a stimulant show?

**Apply and analyse****Question 8** (1 MARK)

The graph tracks someone's awareness during a morning in which they consumed caffeine. Caffeine is considered to be a stimulant.

Which of the following options correctly labels points 1 and 2 of the graph with their expected brain wave patterns?

**Point 1****Point 2**

<b>A</b>	Caffeine having greatest effect. Higher frequency, lower amplitude brain waves.	Caffeine wearing off. Lower frequency, higher amplitude brain waves.
<b>B</b>	Caffeine having greatest effect. Lower frequency, higher amplitude brain waves.	Caffeine wearing off. Higher frequency, lower amplitude brain waves.
<b>C</b>	Caffeine wearing off. Higher frequency, lower amplitude brain waves.	Caffeine having greatest effect. Lower frequency, higher amplitude brain waves.
<b>D</b>	Caffeine wearing off. Lower frequency, higher amplitude brain waves.	Caffeine having greatest effect. Higher frequency, lower amplitude brain waves.

**Question 9** (1 MARK)

Claire is a single mother of three children, and looks after her large house alone. She also works part time four days a week. Having so much on her plate, she finds it very hard to unwind at night and often finds that a glass of red wine helps her mind relax and become less alert to her stresses.

When Claire consumes wine to relax and becomes less alert, an EEG would show a brain wave pattern that has

- A** high-frequency, low-amplitude waves.
- B** high-frequency, high-amplitude waves.
- C** medium-high frequency, low-medium amplitude waves.
- D** low-frequency, low-amplitude waves.

**Question 10** (1 MARK)

Sita, Declan and Lee are at a wedding. Sita is on the dance floor and has had lots of soft drink, making her feel pumped and awake. Lee is chatting and having a conversation with a glass of water, while Declan is a bit tipsy and tired after consuming alcohol from the bar tab.

Which of the following options correctly identified each guest's likely state of consciousness?

	Sita	Declan	Lee
A	Drug-induced ASC (stimulant)	Drug-induced ASC (depressant)	Normal waking consciousness
B	Drug-induced ASC (depressant)	Drug-induced ASC (stimulant)	Normal waking consciousness
C	Normal waking consciousness	Drug-induced ASC (depressant)	Drug-induced ASC (stimulant)
D	Normal waking consciousness	Drug-induced ASC (stimulant)	Drug-induced ASC (depressant)

**Question 11** (2 MARKS)

Daydreaming is considered to decrease levels of alertness.

Identify the likely changes to someone's amplitude and frequency of brain wave patterns when they enter a state of daydreaming.

Amplitude: \_\_\_\_\_

Frequency: \_\_\_\_\_

**Question 12** (3 MARKS)

Joseph, Ryan and Michelle are at a bar for lunch. All three order a drink. Joseph orders a sparkling water, Ryan orders an iced coffee (a stimulant), and Michelle orders a glass of wine (a depressant). Describe the likely changes to each individual's brain wave patterns after consuming their drink.

Joseph: \_\_\_\_\_

Ryan: \_\_\_\_\_

Michelle: \_\_\_\_\_

**Questions from multiple lessons**

**Use the following information for questions 13 and 14.**

Tilly has a SAC coming up at school next week. After school one night she spent an hour studying hard, before unwinding with a cup of tea afterwards.

**Question 13** (1 MARK)

How might Tilly's brain wave frequency and amplitude change as she transitions from studying for the upcoming SAC to drinking a cup of tea afterwards?

	Frequency	Amplitude
A	decrease	decrease
B	increase	increase
C	decrease	increase
D	increase	decrease



**Question 14** (1 MARK)

The difference in brain wave patterns when studying for a SAC compared to drinking tea are because

- A studying for a SAC is an automatic process requiring greater mental effort, while drinking tea is a controlled process requiring less mental effort.
- B studying for a SAC is a controlled process requiring less mental effort, while drinking tea is an automatic process requiring greater mental effort.
- C studying for a SAC is an automatic process requiring less mental effort, while drinking tea is controlled process requiring greater mental effort.
- D studying for a SAC is a controlled process requiring greater mental effort, while drinking tea is an automatic process requiring less mental effort.

**Question 15** (1 MARK)

Identify one psychological similarity between a stimulant-induced altered state of consciousness and a depressant-induced altered state of consciousness.

**Question 16** (5 MARKS)

Aerobic exercise involves focussing on breathing and oxygen to the body. Research has shown that some aerobic exercises requiring deep and slow breathing, like yoga, increase relaxation and reduce physiological arousal.

- a Describe what an EEG might show when connected to someone performing yoga. (2 MARKS)
- b In terms of levels of alertness and nervous system functioning, explain why this kind of exercise might help to reduce stress. (3 MARKS)

**Question 17** (8 MARKS)

Tess and Ruben have a school formal coming up and just received a message from the school coordinator during lunch time that they may bring a date. Ruben, having already got a date in mind, was not at all fazed by this and continued to eat his lunch. Tess however, began to worry that she might not be able to find one in time and be judged for going alone. She immediately started compiling a list of people in her mind and organising her diary accordingly.

- a In terms of Lazarus and Folkman's Transactional Model of Stress and Coping, explain why Ruben and Tess may have evaluated their situation differently in terms of primary appraisal. (4 MARKS)
- b Comment on each student's likely brain wave patterns after receiving the message. Justify your response. (4 MARKS)

**Question 18** (8 MARKS)

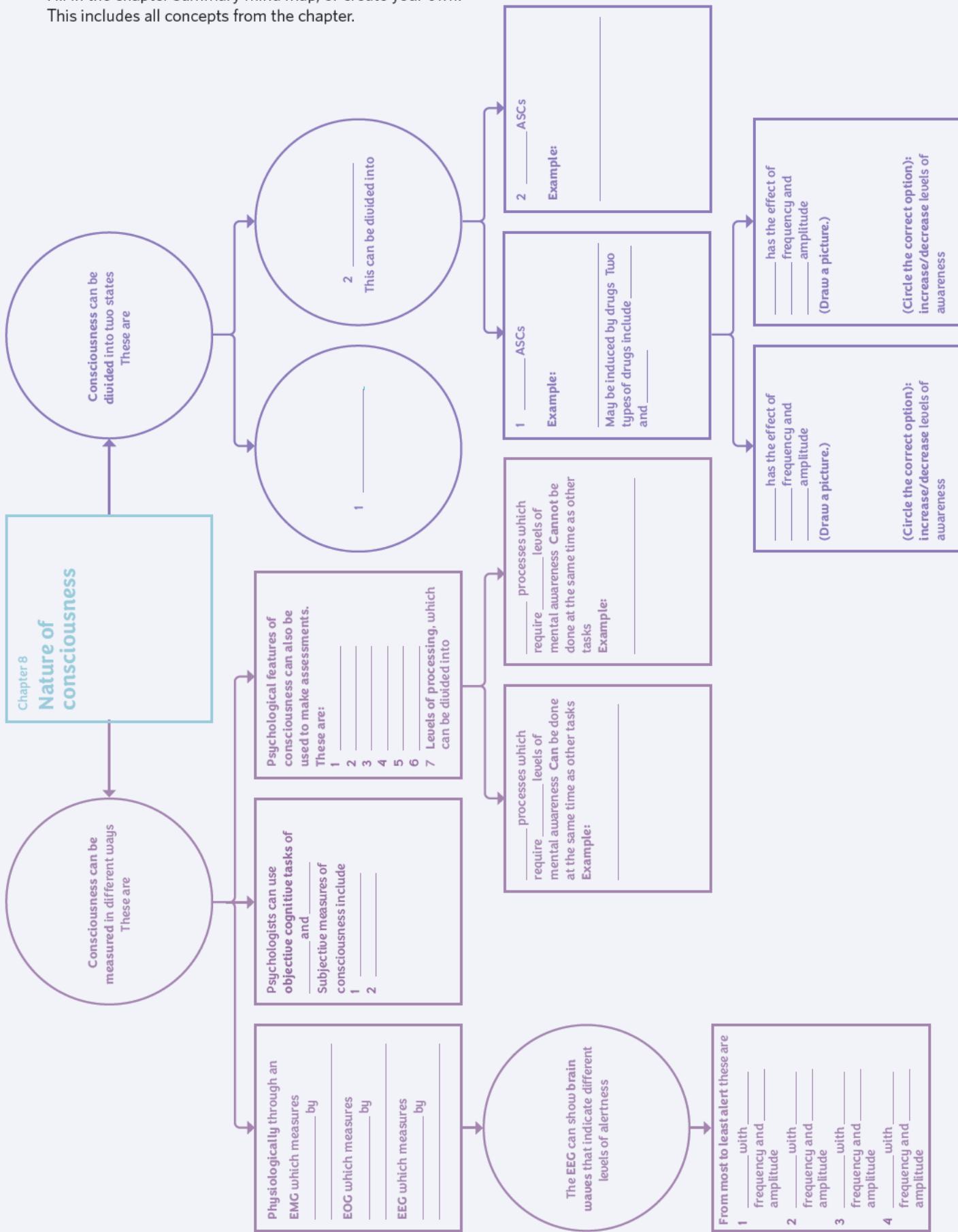
Ishmael is an actor and often practices his lines for plays in the shower.

- a In terms of processing and levels of awareness, describe what is involved in both the task of practicing lines and taking a shower. (4 MARKS)
- b Compared to when practicing in the shower, how might Ishmael's brain wave patterns change when he is actually performing on stage? Justify your response. (2 MARKS)
- c In terms of memory cues, why might it help Ishmael to picture himself in the shower when he is performing on stage? (2 MARKS)

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own.  
This includes all concepts from the chapter.

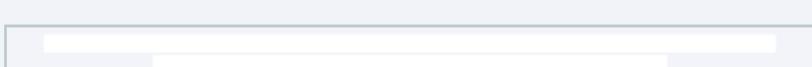


**Review activity 2: Example bank**

Fill in the table with your own notes. For a relevant example, you can draw upon instances in your life where this concept may be relevant.

Key terminology	Your own definition	Relevant example
The consciousness continuum		
Normal waking consciousness		
Altered states of consciousness		
Psychological construct		
Consciousness		
Naturally occurring ASCs		
Induced ASCs		
Awareness		
Levels of processing		
Controlled processes		
Automatic processes		
Content limitations		

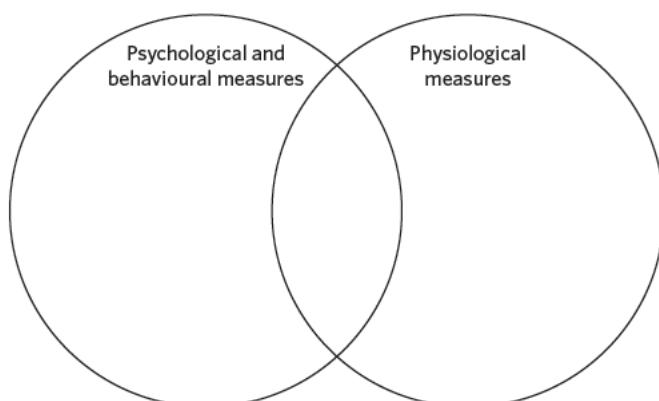
Key terminology	Your own definition	Relevant example
Perceptual and cognitive distortions		
Emotional awareness		
Self-control		
Time orientation		
EEG		
EMG		
EOG		
Cognitive tasks		
Subjective reporting on consciousness		
Sleep diaries		
Video monitoring		
Alertness		



Key terminology	Your own definition	Relevant example
Brain waves		
Frequency		
Amplitude		
Beta waves		
Alpha waves		
Theta waves		
Delta waves		
Stimulants		
Depressants		

### Review activity 3: Venn diagram

Fill in the venn diagram below, thinking of as many similarities between physiological and psychological/behavioural measures of consciousness as you can. Use as many key terms and concepts from the chapter as you can. This can include strengths and weaknesses of either kind too.



**Review activity 4: Mnemonic creation for nature of consciousness**

In this chapter, you learned the mnemonic acronym 'BAT-D' to remember the order of brain waves that reflect the highest to lowest levels of alertness. Try to come up with some of your own mnemonics for other concepts throughout the chapter. These can be acronyms, little stories/narratives to help you remember the order of things, rhymes and so on. A key concept that might work well with a mnemonic is:

- the measurement of physiological responses to indicate different states of consciousness, including electroencephalograph (EEG), electromyograph (EMG), electro-oculograph (EOG) and other techniques to investigate consciousness (measurement of speed and accuracy on cognitive tasks, subjective reporting of consciousness, including sleep diaries, and video monitoring)

## CHAPTER TEST

### Multiple choice questions

**Question 1** (1 MARK)

An EEG is

- a psychological measure of consciousness that measures brain waves.
- a psychological measure of consciousness that measures muscle movement and tension.
- a physiological measure of consciousness that measures brain waves.
- a physiological measure of consciousness that measures muscle movement and tension

**Question 2** (1 MARK)

Delta waves can be associated with

- high alertness.
- normal waking consciousness.
- an altered state of consciousness.
- focussed attention.

Adapted from VCAA 2018 exam MCQ26

**Question 3** (1 MARK)

A person performing a controlled process would most likely also be exhibiting

- delta waves.
- self-control.
- accurate time orientation.
- divided attention.

**Question 4** (1 MARK)

After a person takes a stimulant, what would the following physiological measures of consciousness show?

	EMG	EEG
A	Increased activity	A decrease in frequency and an increase in amplitude
B	Increased activity	An increase in frequency and a decrease in amplitude
C	Decreased activity	A decrease in frequency and an increase in amplitude
D	Decreased activity	An increase in frequency and a decrease in amplitude



**Use the following information for questions 5–9.**

In the past few months, Sean has been drinking a lot of alcohol after work each day as a means of dealing with the stress of his demanding boss. Alcohol is considered to be a depressant. His wife Julia has noticed Sean's inability to concentrate or complete tasks to his normal ability. He used to be able to recount the news and world affairs with her while he made dinner, but now he can't keep a conversation going at the same time as he cooks. Worried about the effects drinking has had, Julia asked Sean to see a psychologist.

**Question 5** (1 MARK)

When Sean drinks alcohol, what kind of state is he in?

- A A naturally occurring altered state of consciousness, in which his brain waves show decreased frequency and increased amplitude.
- B An induced altered state of consciousness, in which his brain waves show decreased frequency and increased amplitude.
- C A naturally occurring altered state of consciousness, in which his brain waves show increased frequency and decreased amplitude.
- D An induced altered state of consciousness, in which his brain waves show increased frequency and decreased amplitude.

**Question 6** (1 MARK)

Sean's inability to recount world affairs while he cooks is an example of

- A more difficulty performing two tasks at once.
- B reduced emotional awareness.
- C more difficulty performing two automatic processes.
- D reduced content limitations.

*Adapted from VCAA 2018 Exam MCQ23*

**Question 7** (1 MARK)

Julia's concern about the effects of drinking on Sean is an example of what type of stress?

- A major stress
- B life events
- C acculturative stress
- D daily pressures

**Question 8** (1 MARK)

Compared to her husband's brain wave patterns when induced with alcohol, Julia's brain waves when worrying would likely

- A have more theta waves, and less alpha, beta and delta.
- B have more delta, theta and alpha, and less beta.
- C have more beta, and less alpha, theta and delta.
- D have more beta, delta and theta, and less alpha.

**Question 9** (1 MARK)

Sean's choice of alcohol as a coping mechanism is an example of

- A approach coping.
- B avoidance coping.
- C exercise.
- D problem-focussed coping.

**Question 10** (1 MARK)

Learning a new mathematical formula and eating a sandwich are respectively

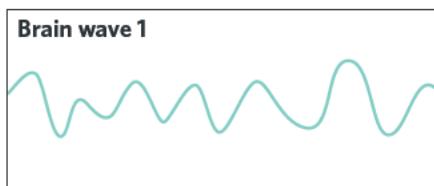
- A a controlled process requiring low levels of mental effort, an automatic process requiring high levels of mental effort.
- B a controlled process requiring high levels of mental effort, an automatic process requiring low levels of mental effort.
- C an automatic process requiring high levels of mental effort, a controlled process requiring low levels of mental effort.
- D an automatic process requiring low levels of mental effort, a controlled process requiring high levels of mental effort.

**Short answer questions****Question 11** (2 MARKS)

Describe the likely changes to a person's brain wave patterns as they transition from high levels of awareness to low levels of awareness.

**Question 12** (2 MARKS)

The diagram shows two different brain wave patterns. Which brain wave indicates the highest level of alertness? Comment on the features of each brain wave in your answer.

**Question 13** (4 MARKS)

Phoebe was driving a car to work along a busy road. She was concentrating on the road in front of her, when a car unexpectedly pulled out in front of her. Soon after, she felt as though there was a rush going through her body.

- a What would an EEG most likely read about Phoebe's physiological responses shortly after the car pulled out in front of her? (1 MARK)
- b In terms of Selye's General Adaptation Syndrome (GAS), what stage would Phoebe most likely be in shortly after the car pulled out in front of her? Justify your response. (2 MARKS)
- c In terms of the effects on brain wave patterns, what is the similarity between the effects of a stressor like that in Phoebe's situation, to that of the effects of a stimulant. (1 MARK)

**Question 14** (5 MARKS)

Yusef used to play guitar when he was a young teenager, and be able to play difficult songs without concentrating, as well as sing along at the same time. It has now been decades since he last played, and when picking up a guitar as an adult Yusef has to concentrate and look at his hands in order to be able to play the songs he used to.

- a In terms of levels of processing, describe the difference between Yusef playing guitar when he was a teenager to picking it up again as an adult. (2 MARKS)
- b In terms of neural plasticity, name the process responsible for Yusef's difficulty playing guitar as an adult and explain its role in the level of processing that Yusef needed to complete this task. (3 MARKS)

**Question 15** (6 MARKS)

Caffeine is a type of stimulant often consumed in coffee and soft drinks. Sometimes the effects of caffeine can become addictive, as people come to rely on it to make them feel awake and alert enough for their daily tasks and activities.

- a Identify likely changes to the amplitude and frequency of brain wave patterns expected in a person after they have consumed caffeine. (2 MARKS)
- b Using the three-phase model of operant conditioning, explain why the effects of caffeine might become addictive. (4 MARKS)



### Key science skills questions

#### Question 16 (1 MARK)

The difference between internal and external validity is that

- A internal validity refers to the subjective data collected being reliable, whereas external validity refers to the objective data collected being reliable.
- B internal validity means that the IV affected the DV, whereas external validity means the results can be generalised to other people, time and settings.
- C internal validity refers to whether the results can be applied to the population, whereas external validity refers to whether results can be applied to people wider than the population.
- D internal validity means that extraneous variables relating to participants were controlled for, whereas external validity means that extraneous variables beyond that of participants were controlled for.

#### Question 17 (9 MARKS)

Researchers conducted an investigation into states of consciousness after stimulant consumption with two groups of healthy 50-year-old women with no history of brain disease or trauma. The investigation was conducted in the morning by a research assistant who wasn't told the topic of research. The first group was administered a capsule containing a small amount of a legal stimulant. The second group was given a capsule containing only water.

The participants were not aware of which condition they were in. Soon after, each participants' brain wave patterns were measured.

- a Identify the likely prominent brain wave/s of each group. Justify your response. (4 MARKS)
- b Identify the purpose of having a research assistant who is not aware of the topic of research and explain its relevance in this investigation. (3 MARKS)
- c Identify an extraneous variable and explain how it may have affected results in this investigation. (2 MARKS)

### Extended response

#### Question 18 (10 MARKS)

Adem is a 16-year-old boy who plays competitively in his local-league football. One match, Adem got knocked by another player during a tackle, and fell unconscious on the field for one minute. When he woke, he was carried off the field to the first aid staff and his mother, who was very worried.

As the first-aid people on the sideline started to ice Adem's head, Adem's mother became more and more hysterical. In order to calm her down, a fellow club member began to tell her about all the ways you can check someone's consciousness and psychological state to make sure they are okay.

With reference to the situation, write a list of what that person may have told Adem's mum to console her. In your response, include as many ways as you can to investigate someone's psychological state and what they can reveal about Adem's consciousness. Also include the tests that doctors and nurses can run once Adem gets to hospital to investigate his state of consciousness and explain how they measure consciousness. Discuss any relevant theories and ideas of consciousness in your response, and be sure to explain to Adem's mother why a variety of tests are needed in order to investigate someone's consciousness.



# 09

UNIT 4 AOS 1, CHAPTER 9

## Importance of sleep

### 9A Sleep rhythms

- sleep as a regular and naturally occurring altered state of consciousness that follows a certain circadian rhythm and involves the ultradian rhythms of REM and NREM stages
- 1–4 sleep excluding corresponding brain wave patterns and physiological responses for each stage

### 9C Sleep across the lifespan

- the differences in sleep across the lifespan and how these can be explained with reference to the total amount of sleep and changes in a typical pattern of sleep (proportion of REM and NREM)

### 9B The purpose and function of sleep

- theories of the purpose and function of sleep (REM and NREM) including restoration theory and evolutionary (circadian) theory

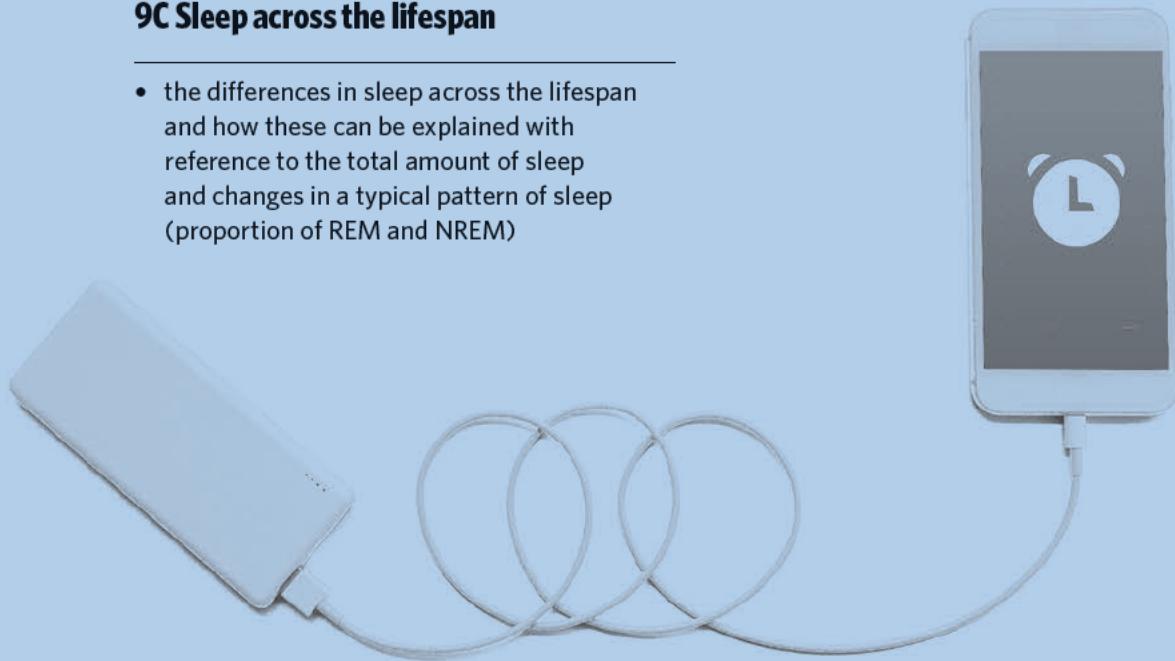


Image by inspire finder/Shutterstock.com

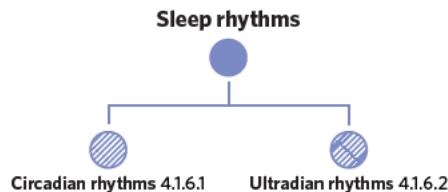


# 9A SLEEP RHYTHMS

In this chapter you will be learning about sleep, which is a regular and naturally-occurring altered state of consciousness that is considered to be reversible and involves a complete disengagement to external stimuli. Given that this is the first lesson in this chapter, it is necessary to define sleep and explain how there are different types of sleep and sleep cycles. This involves learning about the sleep rhythms (circadian and ultradian) and the concepts related to these.

9A. Sleep rhythms	9B. The purpose and function of sleep	9C. Sleep across the lifespan
<b>Study design dot point</b>		
<ul style="list-style-type: none"> <li>sleep as a regular and naturally occurring altered state of consciousness that follows a certain circadian rhythm and involves the ultradian rhythms of REM and NREM stages 1–4 sleep excluding corresponding brain wave patterns and physiological responses for each stage</li> </ul>		
<b>Key knowledge units</b>		
Circadian rhythms		4.1.6.1
Ultradian rhythms		4.1.6.2

In this lesson, you will be learning about **sleep rhythms**, specifically how sleep relates to the concepts of **circadian** and **ultradian rhythms**. This includes learning about the two different types of sleep: rapid eye movement (REM) sleep and non-rapid eye movement (NREM) sleep, and sleep cycles.



## Circadian rhythms 4.1.6.1

### OVERVIEW

Circadian rhythms are 24 hour cycles involving changes to physiological functioning or activity. The human sleep-wake cycle is an example of a circadian rhythm given that various biological changes repeat themselves daily as we transition from sleeping to being awake and alert.

### THEORY DETAIL

An important feature of circadian rhythms is that they occur in 24 hour cycles, repeating themselves across the course of a full day. During this time, various physiological changes occur, as exemplified by the sleep-wake cycle. **Sleep** is a regular and naturally-occurring altered state of consciousness that is considered to be reversible and involves a complete disengagement to external stimuli. The cycle of going from sleep to being awake within a 24 hour period is called the **sleep-wake cycle**; this is the primary circadian rhythm for humans.

Your body undergoes various physiological changes every day as you transition from time spent sleeping during the night to completing waking time activities, such as school or work, during the day. Environmental cues, such as light, play an important role in initiating physiological responses that moderate the human sleep-wake cycle. Given that the sleep-wake cycle is a daily cycle, occurring across a 24 hour period, it is therefore a prime example of a circadian rhythm.

**Sleep** a regular and naturally-occurring altered state of consciousness that involves disengagement with internal and external stimuli

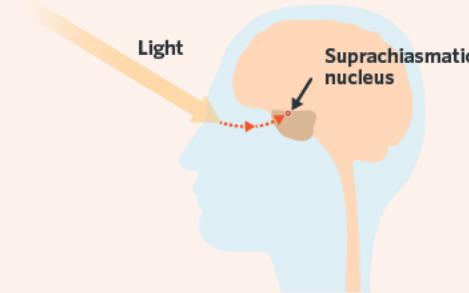
**Circadian rhythm** changes to our physiological function or activity that occur as part of a cycle that lasts around 24 hours

**Sleep-wake cycle** a daily cycle that is made up of time spent sleeping and time being awake and alert

**Want to know more?**

An area of the hypothalamus called the suprachiasmatic nucleus (SCN) receives sensory information regarding the amount of light that has been detected in the eyes.

Based on this information, the hypothalamus sends neuronal messages to the pineal gland to secrete either more or less melatonin into the bloodstream. Melatonin is a hormone that has sleep-inducing qualities. This process is what helps you feel tired when it is dark and stay awake during the day when you need to go to school or work. This level of detail is not necessary when responding to questions about the



sleep-wake cycle on the exam, but helps to illustrate the physiological changes that are involved and to have a deeper understanding of why it is classified as a circadian rhythm.



The process of melatonin being secreted based on light detection is further explored in lesson **10B: Circadian phase disorders**, where you will look at the natural sleep-wake cycle shift experienced by adolescents as an example of a circadian phase disorder.

## Ultradian rhythms 4.1.6.2

### OVERVIEW

Ultradian rhythms are cycles occurring within 24 hours and involve changes to physiological function or activity. A sleep cycle is an example of an ultradian rhythm given that it occurs for approximately 90 minutes and involves biological changes as you progress through distinct stages of sleep.

### THEORY DETAILS

Ultradian rhythms are cycles which occur within 24 hours that involve changes in physiological functioning or activity. A sleep cycle is a proportion of the full period of time that a person spends asleep, which is referred to as a sleep episode. One sleep cycle consists of stages of REM and NREM sleep and, depending on sleep duration, there are usually around five or six sleep cycles during one sleep episode. A sleep cycle is an example of an ultradian rhythm because they occur for a period of roughly 90 minutes, and involves various changes in physiological activity as the sleeper progresses through the different stages of sleep.

**REM sleep** refers to rapid eye movement sleep. Notable information about REM sleep includes:

- The sleeper is virtually paralysed during REM sleep, meaning that most muscle movement is not possible.
- Dreaming tends to occur during REM sleep.
- The sleeper frequently recalls dreams when woken during REM sleep.
- The amount of time spent in REM sleep increases as the sleep episode progresses, with the largest amount of REM in the sleep cycle occurring immediately before waking.
- REM sleep makes up approximately 20-25% of a sleep episode for most age groups.
- REM is a light stage of sleep; despite the muscle paralysis, the brain is active and sleepers can be woken fairly easily from this stage.

**Useful tip**

REM sleep is often referred to as paradoxical sleep. This is because the mind is incredibly active, despite the outward appearance of the body being still. This is not a term that is required when responding to questions, but may help you remember how REM sleep involves activity in the brain, but not the body.

**Ultradian rhythm** changes in physiological function or activity that arise as part of a cycle which occurs within 24 hours

**Sleep episode** the full duration of time spent asleep

**Sleep cycle** a proportion of a sleep episode in which the sleeper progresses through stages of REM and NREM sleep, lasting on average 90 minutes for humans

**REM (Rapid eye movement)**

**sleep** a type of sleep where the sleeper experiences rapid eye movement beneath closed eyelids



The proportion of REM and NREM sleep changes throughout the human lifespan. Therefore, it is important to understand that the proportions of REM and NREM sleep provided in this lesson are not consistent across your whole life. This will be explored in **9C: Sleep across the lifespan**.

More detail regarding the purpose of REM and NREM sleep will be covered in the following lesson **9B: The purpose of sleep**.



NREM sleep refers to non-rapid eye movement sleep. Notable information about NREM sleep includes:

- NREM sleep is subdivided into four different stages (NREM1, NREM2, NREM3, NREM4).
- Muscle movement is possible for the sleeper during NREM sleep.
- The sleeper does not frequently recall dreams when woken during NREM sleep.
- The amount of time spent in NREM sleep is highest during the first half of a sleep episode.
- NREM sleep makes up approximately 75–80% of a sleep episode.
- NREM1 and NREM2 are light sleep and the sleeper may not realise that they have been sleeping if woken during these stages.
- NREM3 and NREM4 are deep sleep and the sleeper is likely to feel drowsy and disoriented if woken during these stages.

**NREM (Non rapid eye movement) sleep** a type of sleep that is subdivided into four different stages, where the sleeper does not experience any rapid eye movement

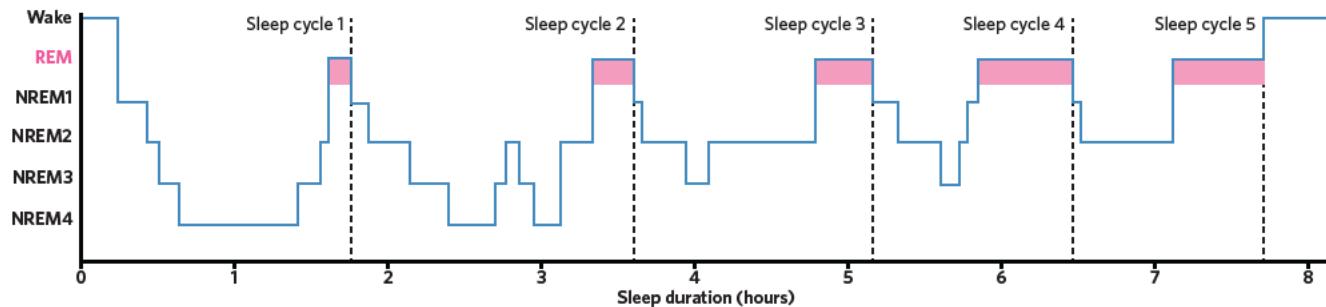


Figure 1 A typical hypnogram for an average adult sleep episode

The different stages of sleep and the corresponding sleep cycles are visualised using a hypnogram. A hypnogram is a sleep graph that tracks the proportion of time spent in each stage of sleep, including awakenings, throughout a sleep episode. Figure 1 shows an example of a hypnogram. When interpreting hypnograms, it is important to recognise that the stage of sleep is on the y-axis and the duration of the sleep episode is on the x-axis. The longer the line in the horizontal direction, the greater the duration spent in a particular stage of sleep. To determine what this particular stage of sleep is, align where the line is travelling in the horizontal direction with the vertical axis with the different stages of sleep.

#### Useful tip

Not all four stages of NREM sleep are necessarily experienced in a sleep cycle, and they may not be experienced in a chronological order.

## Theory summary

In this lesson, you have learned about circadian and ultradian rhythms, using the sleep-wake cycle as an example of a circadian rhythm and sleep cycles consisting of different stages of REM and NREM sleep as an example of an ultradian rhythm. As summarised in table 1, you should now be able to understand the distinctions between circadian and ultradian rhythms.

Table 1 Comparison of circadian and ultradian rhythms

Circadian rhythms	Ultradian rhythms
<ul style="list-style-type: none"> <li>• Changes in physiological function or activity that are part of a 24-hour cycle</li> <li>• For example, the sleep-wake cycle consisting of time spent sleeping and being awake and alert</li> </ul>	<ul style="list-style-type: none"> <li>• Changes in physiological function or activity that are part of a cycle that occur within 24 hours</li> <li>• For example, one sleep cycle consisting of distinct stages of REM and NREM sleep</li> </ul>

You should now also be able to compare REM and NREM sleep. A summary table outlining the key differences between these two types of sleep is also provided in table 2.

Table 2 Comparison of REM and NREM sleep

REM sleep	NREM sleep
<ul style="list-style-type: none"> <li>• Involves sudden onsets of rapid eye movement beneath closed eyelids</li> <li>• Sleep paralysis/no muscle movement possible</li> <li>• Constitutes approximately 20–25% of a sleep episode</li> <li>• Is not subdivided into any stages</li> <li>• Dreams are frequently recalled if woken during this stage</li> </ul>	<ul style="list-style-type: none"> <li>• Does not involve any rapid eye movement</li> <li>• Muscle movement is possible</li> <li>• Constitutes approximately 75–80% of a sleep episode</li> <li>• Is subdivided into four distinct stages</li> <li>• Dreams are not usually recalled if woken during this stage</li> </ul>

**lesson link** Hypnograms will be further explored in the upcoming lesson 9C: *Sleep across the lifespan*, where they are used to compare characteristics of sleep across different age groups throughout the human lifespan.

## 9A Activities

1 Use the terms below to fill in the blanks.

- Sleep episode                          • 4                          • 90                          • NREM
- REM                                      • Sleep cycles                  • 2

Each night, a person usually spends several hours sleeping before the next day. This time spent sleeping is referred to as a \_\_\_\_\_. Each sleep episode is broken up into a series of \_\_\_\_\_ that occur for approximately \_\_\_\_\_ minutes and involve distinct stages of \_\_\_\_\_ different types of sleep. This includes \_\_\_\_\_ sleep, which is broken up into \_\_\_\_\_ different stages. The other type of sleep, which is not broken up into any stages, is \_\_\_\_\_ sleep.

2 For the below scenarios a-d, identify if the sleeper is more likely to be experiencing REM or NREM sleep.

- a Muhammad's alarm is about to wake him up for school while he is in the middle of dreaming about going to a concert.
- b Jonah is in the middle of his sleep when his sister notices him twitching.
- c In the middle of the night, Sophy notices that her friend Lily is incredibly still while at a sleepover, not even moving an inch.
- d Christiano falls asleep in class and is immediately woken by his friend. Christiano does not remember having any dreams.

## 9A QUESTIONS

### Theory review questions

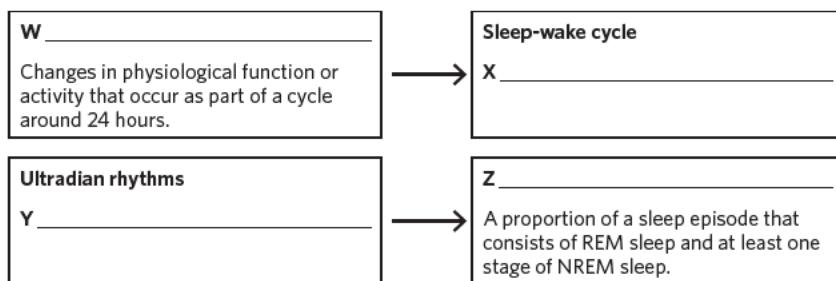
#### Question 1

Match the key term from the lesson to their corresponding definition.

- |                    |                    |              |                 |
|--------------------|--------------------|--------------|-----------------|
| • sleep            | • sleep-wake cycle | • REM sleep  | • sleep cycle   |
| • circadian rhythm | • ultradian rhythm | • NREM sleep | • sleep episode |
- a A proportion of a sleep episode that consists of at least one stage of NREM sleep and REM sleep \_\_\_\_\_
  - b The 24-hour cycle of everyday life that consists of time spent sleeping and time spent awake and alert \_\_\_\_\_
  - c A type of sleep that involves rapid eye movement \_\_\_\_\_
  - d A 24-hour cycle involving changes in our biological functions \_\_\_\_\_
  - e A type of sleep that is broken up into 4 stages and is characterised by an absence of rapid eye movement \_\_\_\_\_
  - f A naturally-occurring altered state of consciousness that involves a reduced ability to engage with internal and external stimuli \_\_\_\_\_
  - g A cycle occurring within 24 hours that involves changes in our biological functions \_\_\_\_\_
  - h A term used to describe the period of time we spend asleep each day \_\_\_\_\_

#### Question 2

Match the letter in the gaps to the correct sleep rhythms and their corresponding examples.



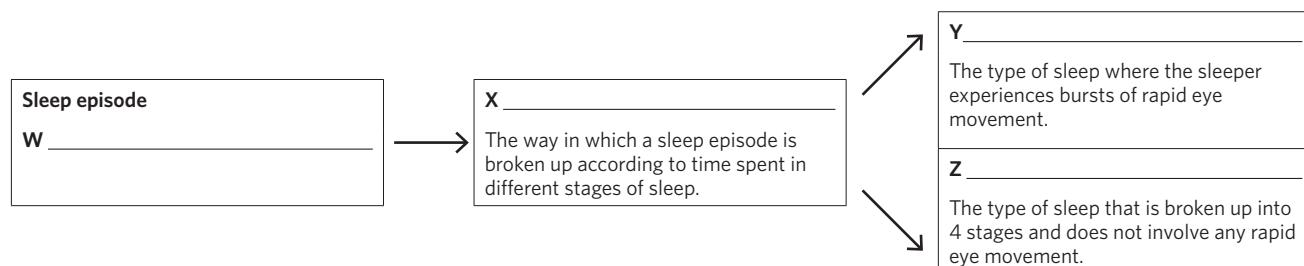
	<b>W</b>	<b>X</b>	<b>Y</b>	<b>Z</b>
<b>A</b>	A sleep cycle	Changes in physiological function as part of a 1-24 hour cycle	24-hour cycle spent sleeping and being awake/alert	Circadian rhythm
<b>B</b>	A sleep cycle	24-hour cycle spent sleeping and being awake/alert	Changes in physiological function as part of a 1-24 hour cycle	Circadian rhythm



C	Circadian rhythm	Changes in physiological function as part of a 1–24 hour cycle	24-hour cycle spent sleeping and being awake/alert	A sleep cycle
D	Circadian rhythm	24-hour cycle spent sleeping and being awake/alert	Changes in physiological function as part of a cycle which occurs within 24 hours	A sleep cycle

**Question 3**

Match the letter in the gaps to the corresponding label.



	W	X	Y	Z
A	The complete duration of our time spent sleeping each day	A sleep cycle	NREM sleep	REM sleep
B	The complete duration of our time spent sleeping each day	A sleep cycle	REM sleep	NREM sleep
C	A sleep cycle	The complete duration of our time spent sleeping each day	NREM sleep	REM sleep
D	A sleep cycle	The complete duration of our time spent sleeping each day	REM sleep	NREM sleep

**Exam-style questions***Remember and understand***Question 4** (1 MARK)

Non rapid eye movement (NREM) sleep is subdivided into \_\_\_\_\_ stages, whereas REM sleep is subdivided into \_\_\_\_\_ stages.

- A 4,1
- B 4,2
- C 1,4
- D 3,2

**Question 5** (1 MARK)

Non rapid eye movement (NREM) sleep constitutes approximately \_\_\_\_\_% of a sleep episode, whereas rapid eye movement (REM) sleep constitutes approximately \_\_\_\_\_% of a sleep episode.

- A 10-15, 85-90
- B 20-25, 75-80
- C 85-90, 10-15
- D 75-80, 20-25

**Question 6** (1 MARK)

As a sleep episode progresses, the chances of being in NREM stages 3-4

- A increase, while the chances of being in REM sleep decreases.
- B decrease, while the chances of being in REM sleep increases.
- C increase, while the chances of being in REM sleep also increases.
- D decrease, while the chances of being in REM sleep also decreases.

**Question 7** (2 MARKS)

Identify two differences between rapid eye movement (REM) and non-rapid eye movement (NREM) sleep.

**Question 8** (3 MARKS)

With the use of examples, identify a difference between circadian and ultradian rhythms.

**Apply and analyse****Question 9** (1 MARK)

Kyle had family staying over at his house and his cousin Sophie had to sleep on the couch in the living room. In the middle of the night, Kyle had to walk past the living room to get a drink of water. Sophie was completely motionless, but woke up when Kyle walked past her. When Kyle spoke to Sophie she could tell him all of the details of her dream.

Prior to being woken up, Sophie was most likely in

- A stage 3 non-rapid eye movement (NREM) sleep.
- B stage 4 NREM sleep.
- C rapid eye movement (REM) sleep.
- D stage 2 NREM sleep.

**Question 10** (2 MARKS)

Fredrick fell asleep on the couch after he came home from school. When it was time for him to wake up for dinner, his sister Alex was concerned by how motionless Fredrick appeared in his sleep. He was not tossing or turning at all, instead appearing completely still.

What stage of sleep is Fredrick most likely in? Justify your response.

**Questions from multiple lessons****Question 11** (1 MARK)

Physiological changes during rapid eye movement (REM) sleep include increased heart rate and blood pressure.

Identify the specific division of the nervous system that is responsible for these physiological changes.

**Question 12** (2 MARKS)

Explain why sleep is considered an altered state of consciousness.

**Key science skills****Question 13** (10 MARKS)

Dr Higgins is a research psychologist who is interested in studying the average sleep-onset time for University students during exam periods. Dr Higgins also lectures psychology classes at University and told one of his classes that they would get extra credit on their final exams if they participated in his experiment. Dr Higgins first asked these students to use a sleep diary to record sleep-onset time for a week before their exams started. Then, he asked his students to continue to record sleep-onset in their sleep diaries during the next week when they had a series of exams for all their subjects.

- a What sampling procedure did Dr Higgins use for his experiment? Justify your response. (2 MARKS)
- b Identify the experimental research design that Dr Higgins used and describe an advantage of using this research design. (2 MARKS)
- c Identify one relevant extraneous variable in Dr Higgins' experiment due to the experimental design. Suggest how this confounding variable could have been minimised. (3 MARKS)
- d Comment on Dr Higgins' ability to generalise the results. Justify your response. (2 MARKS)
- e A research psychologist at another university repeated Dr Higgins' experiment on their students using exactly the same procedure and obtained similar results.  
Identify what these similar results suggest. (1 MARK)

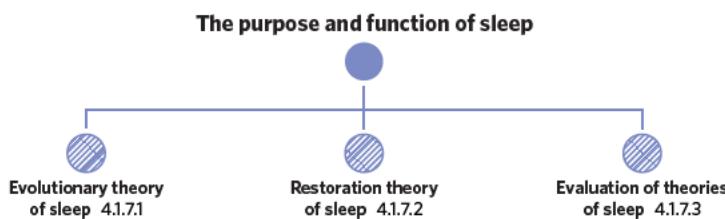


# 9B THE PURPOSE AND FUNCTION OF SLEEP

So far in this chapter you have learned how to define sleep and explored concepts relating to sleep such as circadian and ultradian rhythms. In this lesson, you will enhance your understanding of sleep by learning about its purpose and function; that is, why sleep is necessary and its effects on psychological and physiological functioning.

9A. Sleep rhythms	9B. The purpose and function of sleep	9C. Sleep across the lifespan
<b>Study design dot point</b>		
<ul style="list-style-type: none"> <li>theories of the purpose and function of sleep (REM and NREM) including restoration theory and evolutionary (circadian) theory</li> </ul>		
<b>Key knowledge units</b>		
Evolutionary theory of sleep		4.1.7.1
Restoration theory of sleep		4.1.7.2
Evaluation of theories of sleep		4.1.7.3

In this lesson, you will be learning about the evolutionary and restoration theories of sleep, which each have different explanations for the purpose and function of sleep. Due to these differences, you will also learn how to evaluate both of these theories, meaning that you will learn about their relative strengths and limitations.



## Evolutionary theory of sleep 4.1.7.1

### OVERVIEW

Sleep is often understood as having an adaptive quality, where humans have evolved to sleep at specific times to enhance our survival. This is reflected by the evolutionary theory of sleep.

### THEORY DETAILS

A fundamental aspect of the evolutionary theory of sleep, also known as the circadian theory of sleep, is how the circadian sleep–wake cycles revolves around the detection of light. As discussed in lesson 9A: Sleep rhythms, this means that humans sleep when the external environment is dark. According to the evolutionary theory, sleeping when it is dark serves very specific survival functions.

Humans are highly visual and daylight is therefore required to complete various activities that are crucial for survival. Humans need light to be able to search for food, water and shelter in order to survive. Also, humans adapted to sleep when it's dark to stay hidden from nocturnal predators. As such, the evolutionary theory recognises the adaptive quality of sleep and proposes that humans have evolved to sleep during the night in order to improve our ability to survive.

The evolutionary theory of sleep also applies to other species. To a large extent, the amount of time an animal spends asleep is linked to how much time they need to spend completing survival functions such as searching for food and hiding from or attacking other species.

**Evolutionary theory of sleep (also known as circadian theory of sleep)** a theory that proposes that sleep is adaptive and has evolved to meet specific survival needs

- Large predatory animals, such as tigers and gorillas, spend a lot of time sleeping as they are not at threat of being attacked and do not need significant periods of time to obtain food.
- Grazing animals that are vulnerable to larger predatory animals, such as deer and zebras, spend shorter periods of time asleep as they need to stay awake to escape any danger and search for food.
- Small animals that have the capacity to stay hidden from predators and have food readily available, such as possums or bats, therefore also have the ability to sleep for large periods of time each day.

### Restoration theory of sleep 4.1.7.2

#### OVERVIEW

Sleep is also known to have restorative qualities, where both REM and NREM sleep have specific effects on psychological and physiological functioning. This is reflected by the restoration theory of sleep.

#### THEORY DETAILS

Whenever humans feel sick or tired, it is well known that it is important to sleep in order to feel better again. During times of illness sleep duration typically increases, which supports the theory that sleep serves an important role in repairing the mind and body. This is expressed in the **restoration theory of sleep**. According to this theory, NREM and REM sleep both have specific restorative functions.

The restoration theory of sleep proposes that NREM sleep repairs mostly physiological functions. For example, it suggests that NREM sleep repairs damaged cells and muscles by detoxifying them and ridding them of waste products. It also mentions that NREM sleep helps to restore our energy when we are generally fatigued, particularly during NREM stages 3–4, and that it enables physical growth.

In contrast, REM sleep is said to restore psychological processes associated with brain activity. For example, enhancing learning and memory by preserving neural pathways and ensuring that there are adequate neurotransmitter levels in the brain. These processes suggest that REM sleep enhances memory consolidation. These restorative effects are summarised in table 1.

Table 1 Comparison of the restorative effects of REM and NREM sleep

REM sleep	NREM sleep
<ul style="list-style-type: none"> <li>• Replenishes psychological functioning</li> <li>• Restores adequate neurotransmitter levels</li> <li>• Maintains neural pathways through stimulation</li> <li>• Enhances learning</li> <li>• Promotes memory consolidation</li> </ul>	<ul style="list-style-type: none"> <li>• Replenishes physiological functioning</li> <li>• Repairs damaged cells and tissues</li> <li>• Detoxifies muscles</li> <li>• Removes waste products from muscles</li> <li>• Helps recover from general fatigue</li> <li>• Enables physical growth</li> </ul>

### Evaluation of theories of sleep 4.1.7.3

#### OVERVIEW

Although both the evolutionary and restoration theories of sleep offer a unique insight into the purpose and function of sleep, they each come with unique strengths and limitations and it is important to think about these theories critically.

#### THEORY DETAILS

A strength of the evolutionary theory of sleep is that it provides an explanation for the purpose of the circadian sleep–wake cycle. By highlighting the importance of sleeping when it is dark for our survival, the evolutionary theory of sleep provides an explanation for why our sleep–wake cycle is governed by light and why repeats itself across a 24-hour cycle.

However, this theory also comes with its limitations. The evolutionary theory of sleep does not explain our specific need to sleep, but rather focusses on why we sleep when we do. There is no reference to what happens while we are actually sleeping that is beneficial to the mind or body.

#### Useful tip

The evolutionary theory of sleep is also known by many other names, which you may come across in different resources. These include:

- Circadian theory
- Adaptive theory
- Survival theory

These terms all refer to the same theory of sleep. The VCAA study design uses the terms 'evolutionary' and 'circadian' theories of sleep, and as such you should be sure to also use these in your responses to exam questions.

#### Restoration theory of sleep

a theory that proposes that sleep replenishes psychological and physiological function

#### Useful tip

Are you falling asleep while reading this? Is it past midnight and do you just want to sleep? Go to sleep!

The restoration theory of sleep provides an important insight into why studying late is not effective and why sleep is more valuable.



It also does not account for how sleeping puts an organism at greater risk to predators due to loss of awareness.

In contrast, a strength of the restoration theory of sleep is that it does address our need to sleep. Instead of just suggesting why we sleep at certain times, it actually identifies that there are features of both REM and NREM sleep that enhance our psychological and physiological functioning. However, a fundamental limitation of this theory is that it does not account for the fact that physically/mentally disabled people sleep for the same amount of time as physically/mentally able people.

There are also some limitations that are consistent across both models. For example, neither model accounts for the benefit of sleep on mental health. Another limitation is that there is limited empirical evidence to support both theories.

These strengths and limitations are summarised in tables 2 and 3.

**Table 2** Strengths and limitations of the evolutionary theory of sleep

<b>Evolutionary theory of sleep</b>	
<b>Strengths</b>	<b>Limitations</b>
<ul style="list-style-type: none"> <li>• Furthers an understanding of the purpose and function of sleep</li> <li>• Provides a link between the circadian nature of sleep and when we sleep</li> </ul>	<ul style="list-style-type: none"> <li>• Does not address our specific need to sleep</li> <li>• Does not account for how sleep puts an organism at risk due to lack of awareness</li> <li>• Does not account for the benefits of sleep on mental health</li> <li>• Limited evidence to support the theory</li> </ul>

**Table 3** Strengths and limitations of the restoration theory of sleep

<b>Restoration theory of sleep</b>	
<b>Strengths</b>	<b>Limitations</b>
<ul style="list-style-type: none"> <li>• Furthers an understanding of the purpose and function of sleep</li> <li>• Addresses our specific need to sleep</li> </ul>	<ul style="list-style-type: none"> <li>• Does not account for why a physically/mentally disabled person sleeps for as long as a physically/mentally able person does</li> <li>• No conclusive cause and effect relationship between NREM and REM sleep and what exactly is restored</li> <li>• Does not account for the benefits of sleep on mental health</li> <li>• Limited evidence to support the theory</li> </ul>

## Theory summary

In this lesson, you have learned about the evolutionary and restoration theories of sleep. You should now be able to understand the distinctions between both theories of sleep in terms of what they propose is the purpose and function of sleep.

Within the restoration theory of sleep, you should now also understand the difference between the restorative effects of REM and NREM sleep. You should also have an ability to evaluate both theories of sleep. This involves understanding the relative strengths and limitations of each theory.

## 9B Activities

1 Use the terms below to fill in the blanks.

- |                       |                      |            |
|-----------------------|----------------------|------------|
| • evolutionary theory | • two                | • survival |
| • illness             | • restoration theory |            |

There are \_\_\_\_\_ theories of sleep that are covered in VCE psychology. The \_\_\_\_\_ proposes that sleep has an adaptive quality and that humans have evolved to sleep at particular times in order to enhance our \_\_\_\_\_. An example used to support this theory is how humans sleep at night because light is required to complete survival activities such as searching for food, water and shelter. In contrast, the \_\_\_\_\_ of sleep proposes that sleep repairs physiological and psychological functioning. An example used to support this theory is that you typically sleep for longer when you are experiencing \_\_\_\_\_.

--

**2** Identify if the strengths and weaknesses listed below are relevant to the evolutionary theory, the restoration theory or both.

- a Provides an explanation for the link between the circadian sleep-wake cycle and when we sleep.

Relevant theory/theories: \_\_\_\_\_

- b Addresses humans' specific need to sleep.

Relevant theory/theories: \_\_\_\_\_

- c Limited evidence to support theory.

Relevant theory/theories: \_\_\_\_\_

- d Does not account for how a physically/mentally disabled person sleeps for as long as a physically/mentally able person.

Relevant theory/theories: \_\_\_\_\_

## 9B QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- Evolutionary theory of sleep
  - Restoration theory of sleep
- a A theory of sleep which proposes that organisms sleep in order to restore physiological and psychological function \_\_\_\_\_
- b A theory of sleep which proposes that sleep is adaptive and that organisms have evolved to sleep at certain times to enhance survival \_\_\_\_\_

#### Question 2

Match the letter in the gaps to complete the table with features and examples of the different theories of sleep.

W	X
<ul style="list-style-type: none"> <li>• References the link between the circadian sleep-wake cycle and the adaptive quality of sleep</li> <li>• Does not address the specific need to sleep</li> <li>• Does not mention the value of either NREM or REM sleep</li> <li>• Y _____</li> </ul>	<ul style="list-style-type: none"> <li>• Z _____</li> <li>• Emphasises the need to sleep through its ability to repair physiological and psychological functions</li> <li>• Accounts for the value of both REM and NREM sleep</li> <li>• Uses the example of sleep duration typically increasing during times of illness</li> </ul>

	W	X	Y	Z
A	Restoration theory	Evolutionary theory	Includes the example of sleeping at night because light is needed to search for food	Includes the example of sleeping at night because light is needed to search for food
B	Restoration theory	Evolutionary theory	No reference to the circadian nature of sleep and its value	NREM sleep
C	Evolutionary theory	Restoration theory	Includes the example of sleeping at night because light is needed to search for food	No reference to the circadian nature of sleep and its value
D	Evolutionary theory	Restoration theory	No reference to the circadian nature of sleep and its value	Includes the example of sleeping at night because light is needed to search for food



**Exam-style questions****Remember and understand****Question 3** (1 MARK)

Which of the following most accurately describes the purpose of sleep according to the evolutionary theory?

- A Physical and mental functions are repaired.
- B Neural and memory functions are repaired.
- C Inactivity at night is adaptive to survival.
- D Energy is conserved.

*Adapted from VCAA 2017 Exam MCQ37*

**Question 4** (1 MARK)

Which of the following accurately describes a limitation of the restoration theory of sleep?

- A Loss of awareness at night is maladaptive to survival.
- B The brain is active during REM sleep, which is not consistent with conserving energy.
- C Animals that are smaller sleep for longer periods of time.
- D There is no explanation for why less active individuals experience the same amount of NREM sleep as active individuals.

*Adapted from VCAA 2017 Exam MCQ37*

**Question 5** (2 MARKS)

Identify two limitations that apply to both the evolutionary theory and the restoration theory of sleep.

**Question 6** (4 MARKS)

Using examples, describe the difference between the purpose of sleep according to evolutionary theory and the restoration theory of sleep.

**Apply and analyse****Question 7** (1 MARK)

Milo was incredibly stressed during his exam period and was having difficulties getting adequate sleep each night. During this period of time, Milo was also studying and hoping to learn some final information that he could use in his exams. However, he found that he was forgetting all this new information and was unable to use it in his exams.

Milo's difficulty forming and consolidating memories during exams was likely due to a lack of

- A rapid eye movement (REM) sleep.
- B non-rapid eye movement (NREM) stage 1 sleep.
- C non-rapid eye movement (NREM) stage 2 sleep.
- D non-rapid eye movement (NREM) stage 3 sleep.

*Adapted from VCAA 2018 Exam MCQ21*

**Question 8** (1 MARK)

Li has an upcoming long-distance running competition with her athletics club. On the day of the event, her athletic club won the competition and had a party to celebrate. Li didn't get much sleep after the party because she had to get up early for work and she noticed that the muscles in her legs were incredibly sore.

Li having sore leg muscles after the competition was likely due to a lack of

- A rapid eye movement (REM) sleep.
- B brief awakenings during her sleep episode.
- C consolidation.
- D non-rapid eye movement (NREM) sleep.

**Question 9** (1 MARK)

Alexis, a healthy adult female, is learning Arabic for the first time at university. At the end of her first semester, she has an exam that tests all the vocabulary that she has learned so far. In order to maximise her ability to remember what she has learned, the night before the examination Alexis should

- A** stay awake all night and study Arabic.
- B** stay up all night and study Arabic then have a brief nap before her exam.
- C** briefly revise her vocabulary and get as much sleep as possible.
- D** sleep during the day before the exam to protect herself from a potential threat.

**Question 10** (2 MARKS)

Stacey is an avid kayaker and had a race on the weekend. After the race, Stacey also had to attend a family dinner that did not finish until very late. As a result, Stacey did not get much sleep and had very sore arm muscles when she woke up the following morning. Identify the theory and type of sleep that accounts for Stacey being sore the following morning after the race.

**Questions from multiple lessons****Question 11** (1 MARK)

According to the restoration theory of sleep, changes to connections between neurons occur in order to enhance learning and memory during REM sleep. Identify the concept that relates to this ability for neural pathways to change across the lifespan.

**Question 12** (2 MARKS)

Identify a change in a person's psychological state that occurs during sleep. Explain how this could increase vulnerability to potential predators during sleep.

**Question 13** (6 MARKS)

Jose and Hiroshi both had an upcoming psychology SAC. While Jose is stressed about the SAC, he thinks that it could be an opportunity to demonstrate to his teacher what he does know and identify what he will need to revise before the exam. On the other hand, Hiroshi is worried that he is going to perform so poorly that it will bring down his average mark and he will no longer be able to achieve the study score that he desires.

- a** Explain how Jose and Hiroshi evaluated their situation differently in terms of the primary appraisal stage of Lazarus and Folkman's Transactional Model of Stress and Coping. (3 MARKS)  
*Adapted from VCAA 2017 sample exam SAQ5d*
- b** In the nights leading up to the SAC, Jose only studies before dinner and then goes to bed straight after to ensure that he sleeps as much as possible. In contrast, Hiroshi stays up past midnight desperately trying to cram as much information as possible. With reference to the restoration theory of sleep, explain why Jose's coping strategy for preparing for the SAC is more likely to be effective than Hiroshi's coping strategy. (3 MARKS)

**Key science skills****Question 14** (9 MARKS)

Dr Lee conducted an independent groups design in a hospital's sleep laboratory by using one group of seriously ill patients and one group of healthy patients. Dr Lee was interested in comparing the difference in the proportion of REM and NREM sleep experienced between the two groups.

- a** Explain why Dr Lee could not use a repeated measures design in her experiment. (2 MARKS)  
*Adapted from VCAA 2014 Exam MCQ6*
- b** Identify one relevant extraneous variable that Dr Lee could have considered in designing her investigation. Justify your response. (2 MARKS)  
*Adapted from VCAA 2018 Exam SAQ6c*
- c** What difference in the proportion of NREM sleep should Dr Lee expect to see if the participants in the experimental group had a muscular injury? Justify your response. (2 MARKS)
- d** Dr Lee shared her results with a colleague, who told her that her research was insignificant because the most important reason why humans sleep is to stay protected from potential threats when they are most vulnerable. Identify the theory of sleep that Dr Lee's colleague is referencing and describe two limitations of this theory. (3 MARKS)



# 9C SLEEP ACROSS THE LIFESPAN

So far in this chapter you have learned about key features of sleep, including REM and NREM sleep and their purpose and function. These features, however, do not remain consistent across the human lifespan. Various other features of sleep, such as sleep duration, also change as you progress through different ages in your life.

9A. Sleep rhythms	9B. The purpose and function of sleep	9C. Sleep across the lifespan
<b>Study design dot point</b>		
<ul style="list-style-type: none"> <li>the differences in sleep across the lifespan and how these can be explained with reference to the total amount of sleep and changes in a typical pattern of sleep (proportion of REM and NREM)</li> </ul>		
<b>Key knowledge units</b>		
Sleep across the lifespan		4.1.8.1

In this lesson, you will be learning about the differences in sleep across all different age groups of the human lifespan, including differences in sleep duration and the proportion of NREM and REM sleep.

## Sleep across the lifespan



### Sleep across the lifespan 4.1.8.1

#### OVERVIEW

Patterns of sleep such as duration, onset, awakenings and proportion of REM and NREM sleep change dramatically during different periods of your life. This is illustrated through the use of hypnograms during different periods of the lifespan.

#### THEORY DETAILS

As evident in figure 1, the characteristics of your sleep episode, such as your sleep duration and the proportion of REM and NREM sleep, change significantly across the human lifespan. In general, sleep duration and the proportion of REM sleep decreases as age increases. However, these trends occur at different rates as the proportion of REM sleep stops significantly decreasing from childhood onwards.

In order to gain a deeper understanding of these trends, you should first understand the characteristics of sleep across the following age groups:

#### Neonatal period (1-15 days):

- During this period, sleep duration is the highest it will ever be in the lifespan. New-born babies sleep for approximately 16 hours.
- Approximately 50% of the sleep episode is REM sleep and approximately 50% is NREM sleep.

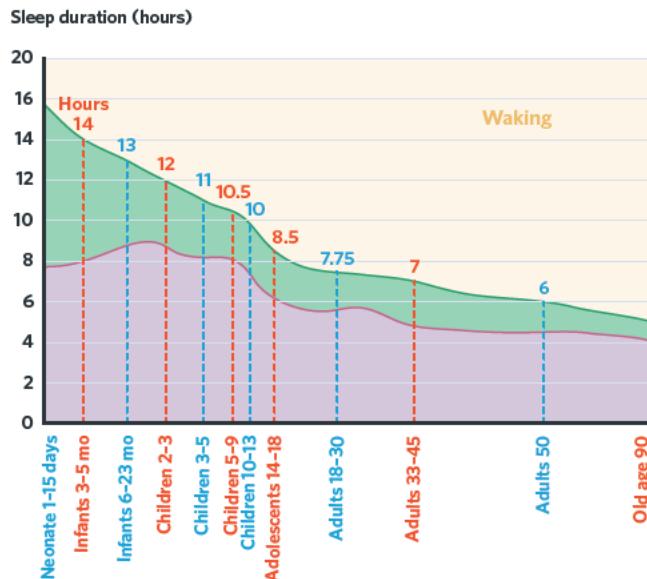


Figure 1 Proportion of REM and NREM sleep and sleep duration across the lifespan

### Infant period (3-24 months):

- Sleep duration decreases to approximately 13.5 hours.
- The proportion of REM and NREM sleep also changes to approximately 35% REM sleep and approximately 65% NREM sleep.

### Childhood (2-14 years):

- Sleep duration decreases again to approximately 11 hours.
- The proportion of NREM sleep increases slightly to around 80% of the sleep episode, while REM sleep decreases to approximately 20% of the sleep episode.
- As the childhood period is a significant amount of time, there are slight variations across this period. For example, sleep duration starts at around 12 hours when children are about 2 years old, and decreases to around 10 hours when children are 14 years old. REM sleep also starts at around 25% of the sleep episode and decreases to around 18.5% of the sleep episode.

### Adolescence (14-18 years):

- Sleep duration decreases again to approximately 8.5 hours.
- The proportion of REM and NREM sleep remain fairly constant at 20% REM and 80% NREM sleep.
- Social factors play a role in the decreased proportion of sleep during adolescence, such as having to wake up early for school and having social commitments during the nighttime.

### Adulthood (18-30 years):

- Sleep duration decreases again to approximately 7.75 hours.
- The proportion of REM and NREM sleep remain fairly constant at 20% REM and 80% NREM sleep.

### Adulthood (30-75 years):

- Sleep duration decreases again to approximately 6 hours.
- The proportion of REM and NREM sleep remain fairly constant at 20% REM and 80% NREM sleep.

### Old age (75+ years):

- Sleep duration continues to decrease to approximately 5.75 hours.
- The proportion of REM and NREM sleep remain fairly constant at 20% REM and 80% NREM sleep.

#### Want to know more?

A notable characteristic of sleep during old age is that there are increased brief awakenings during the sleep episode. As the sleep episode progresses, it is common for an elderly person to wake up briefly and then fall back asleep. This is demonstrated in figure 2, where brief awakenings are evident by the horizontal distance of the hypnogram corresponding to the 'awake' sleep stage on the vertical axis. This also occurs for newborn babies as they have very long sleep durations but do not sleep throughout the whole night without waking up at certain stages.

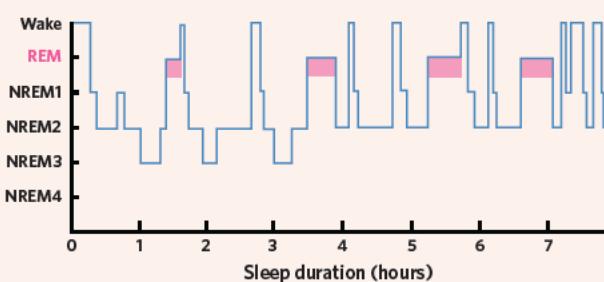


Figure 2 Hypnogram of an elderly person's sleep episode

Overall, sleep duration decreases from around 16 hours at birth to around 5 hours in old age. Significant changes in the proportion of REM and NREM sleep occur from birth to childhood. At birth, there is approximately 50% REM sleep and 50% NREM sleep, changing to approximately 20% REM sleep and 80% NREM sleep during adolescence. However, from this point onwards the proportion of REM and NREM sleep remains fairly consistent.



**Lesson 10C:**  
**Circadian phase disorders** in the following chapter will examine how the biological sleep-wake cycle shift also contributes to adolescents' decreased proportion of sleep.

#### Useful tip

The listed hours of sleep for each age group varies among different sources as there is not one correct answer as to how long each age group sleeps. This is due to the variation within these age groups. For this reason, it is more important for you to understand the trends of how sleep duration changes between the age groups, rather than the exact amount of hours of sleep duration.



**Useful tip**

If a question asks specifically to compare the proportion of REM and NREM sleep across the lifespan, you do not need to mention features such as sleep duration in your response. It is also important to note that you do not need to know the exact percentages of REM and NREM sleep or hours of sleep duration, but rather remember the approximate differences between each age group, as you are referring to such large groups with variations throughout.

**Theory summary**

In this lesson, you have learned about how sleep changes across the human lifespan. You should now be able to distinguish between the sleep of all significant age groups, including the neonatal period, infancy, childhood, adolescence, adulthood and old age. Features of sleep that you should now be able to compare across the lifespan include sleep duration and the proportion of REM and NREM sleep. This information is summarised in table 1.

**Table 1** Duration of sleep episode and proportion of REM and NREM sleep across the lifespan

Age group	Duration of sleep episode (hours)	Proportion of REM and NREM sleep
Neonatal (1-15 days)	16	50% REM and 50% NREM
Infant (3-24 months)	13.5	35% REM and 65% NREM
During childhood (2-14 years)	11	20% REM and 80% NREM
Adolescence (14-18 years)	8.5	20% REM and 80% NREM
Adulthood (18-75 years)	6-7.75	20% REM and 80% NREM
Old age (75+ years)	5.75	20% REM and 80% NREM



The proportions of REM and NREM sleep across the lifespan provide further evidence to support the restoration theory of sleep that was covered in lesson **9B: The purpose of sleep**. For example, REM sleep is highest during the neonatal period, which accounts for brain plasticity being highest during this period of time, with rapid periods of learning and memory consolidation. Likewise, the increase in NREM sleep during infancy and childhood accounts for increased physical growth during this period of time.

**9C Activities**

- 1 Sleep patterns change with age. Fill in the gaps with the terms provided below.

- |           |             |               |            |
|-----------|-------------|---------------|------------|
| a 50%     | b 20%       | c 12-13 hours | d stable   |
| e 20-25%  | f 5-7 hours | g decreases   | h 16 hours |
| i 9 hours | j 20-30%    |               |            |

As we get older, the amount of time we spend sleeping and the proportion of total sleep time spent in REM sleep \_\_\_\_\_ from infancy to adolescence, and then remains \_\_\_\_\_ in adulthood and old age.

A newborn infant sleeps for around \_\_\_\_\_ a day and spends around \_\_\_\_\_ of their total sleep time in REM sleep.

By the end of infancy, total sleep time drops to around \_\_\_\_\_ and \_\_\_\_\_ is spent in REM sleep.

In adolescence the total sleep time drops to about \_\_\_\_\_, with about \_\_\_\_\_ in REM sleep. The gradual decrease in total sleep time continues through adolescence and adulthood.

By late adulthood, the total sleep time averages around \_\_\_\_\_, with about \_\_\_\_\_ in REM sleep.

# 9C QUESTIONS

## Theory review questions

### Question 1

Match the age groups from the lesson to their likely corresponding sleep duration.

- |                          |                         |                         |
|--------------------------|-------------------------|-------------------------|
| • adult                  | • infant                | • children              |
| • neonatal               | • adolescent            | • old age               |
| <b>a</b> 16 hours _____  | <b>b</b> 11 hours _____ | <b>c</b> 14 hours _____ |
| <b>d</b> 8.5 hours _____ | <b>e</b> 6 hours _____  | <b>f</b> 7 hours _____  |

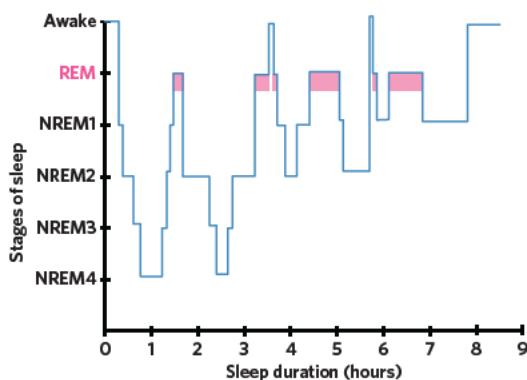
### Question 2

Identify the age group(s) across the lifespan associated with the following proportions of REM and NREM sleep.

- a** 50% REM, 50% NREM
- b** 20% REM, 80% NREM
- c** 35% REM, 65% NREM

### Question 3

Identify the age group based on the hypnogram provided.



## Exam-style questions

### Remember and understand

### Question 4 (1 MARK)

At birth, the proportion of non-rapid eye movement (NREM) sleep is

- A** lower than the proportion of REM sleep.
- B** equal to the proportion of REM sleep.
- C** higher than the proportion of REM sleep.
- D** 100 percent of all sleep.

*Adapted from VCAA 2013 Exam MCQ4*

### Question 5 (1 MARK)

What might a comparison of a typical night's sleep of an adolescent and an elderly person show?

- A** Elderly people experience significantly higher amounts of REM sleep.
- B** Adolescents experience significantly higher amounts of NREM sleep.
- C** Elderly people spend proportionately more time in rapid eye movement sleep (REM) sleep than adolescents.
- D** Elderly people typically have shorter sleep duration than adolescents.



**Question 6** (2 MARKS)

Compare how REM and NREM sleep would differ in a hypnogram of an infant and a hypnogram of a healthy adult.

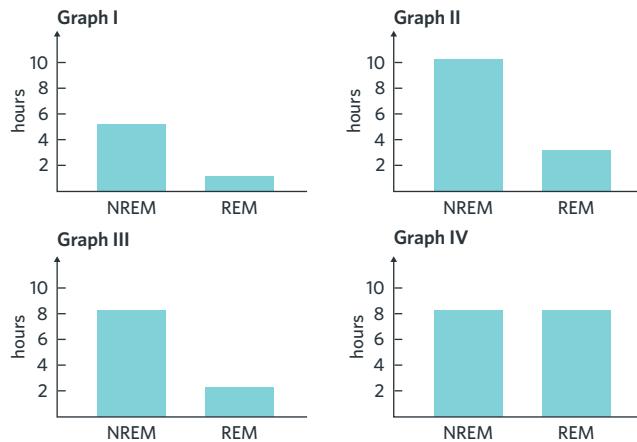
Adapted from VCAA 2018 Exam SAQ5b

**Apply and analyse****Question 7** (1 MARK)

Joseph is a healthy newborn baby and Gabby is a healthy 65-year old. Which of the graphs represents the amount of time spent in NREM sleep and REM sleep in a typical 24-hour period for Joseph and Gabby?

	Joseph	Gabby
A	III	I
B	II	IV
C	IV	I
D	IV	III

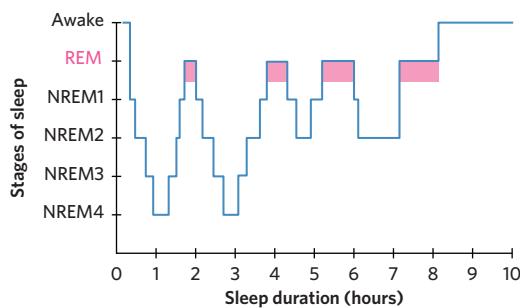
Adapted from VCAA 2017 Exam MCQ38

**Question 8** (1 MARK)

Osman is a healthy newborn baby who sleeps for an average of 16 hours per night. It is likely that his sleep pattern

- A is normal for a newborn baby.
- B demonstrates partial sleep deprivation.
- C is abnormally short for a newborn baby.
- D is likely to consist of proportionally more stages 3 and 4 sleep than any other stage.

Adapted from VCAA 2013 Exam MCQ35

**Question 9** (4 MARKS)

The figure is a hypnogram representing the sleep cycle of a healthy adolescent.

- a Outline two differences between rapid eye movement (REM) sleep and non-rapid eye movement (NREM) sleep evident in the hypnogram. (2 MARKS)

Adapted from VCAA 2018 Exam SAQ5a

- b Explain how the hypnogram of a healthy infant would differ to this hypnogram of a healthy adolescent. (2 MARKS)

### Questions from multiple lessons

#### Question 10 (1 MARK)

A psychologist studying the effects of sleep on infants is most likely to observe

- A** an increase in the detoxification of muscles.
- B** a decrease in growth.
- C** an increase in neural plasticity.
- D** a decrease in the overall number of neurons.

#### Question 11 (1 MARK)

Which of the following indicates a typical sleep cycle for an adolescent?

	Duration of sleep cycle (minutes)	Number of complete sleep cycles
<b>A</b>	30-40	1 or 2
<b>B</b>	60-70	1 or 2
<b>C</b>	10-15	4 or 5
<b>D</b>	90-120	4 or 5

*Adapted from VCAA 2016 Exam MCQ10*

#### Question 12 (2 MARKS)

With reference to the restoration theory of sleep, explain why newborn babies spend more time in REM sleep than other age groups.

*Adapted from VCAA 2017 Sample Exam MCQ42*

### Key science skills

#### Question 13 (7 MARKS)

Dr Arain is a sleep psychologist who is interested in exploring the differences in sleep patterns across the lifespan. Dr Arain selects participants from all distinct age groups and asks them to record a sleep diary so that he can then compare the results.

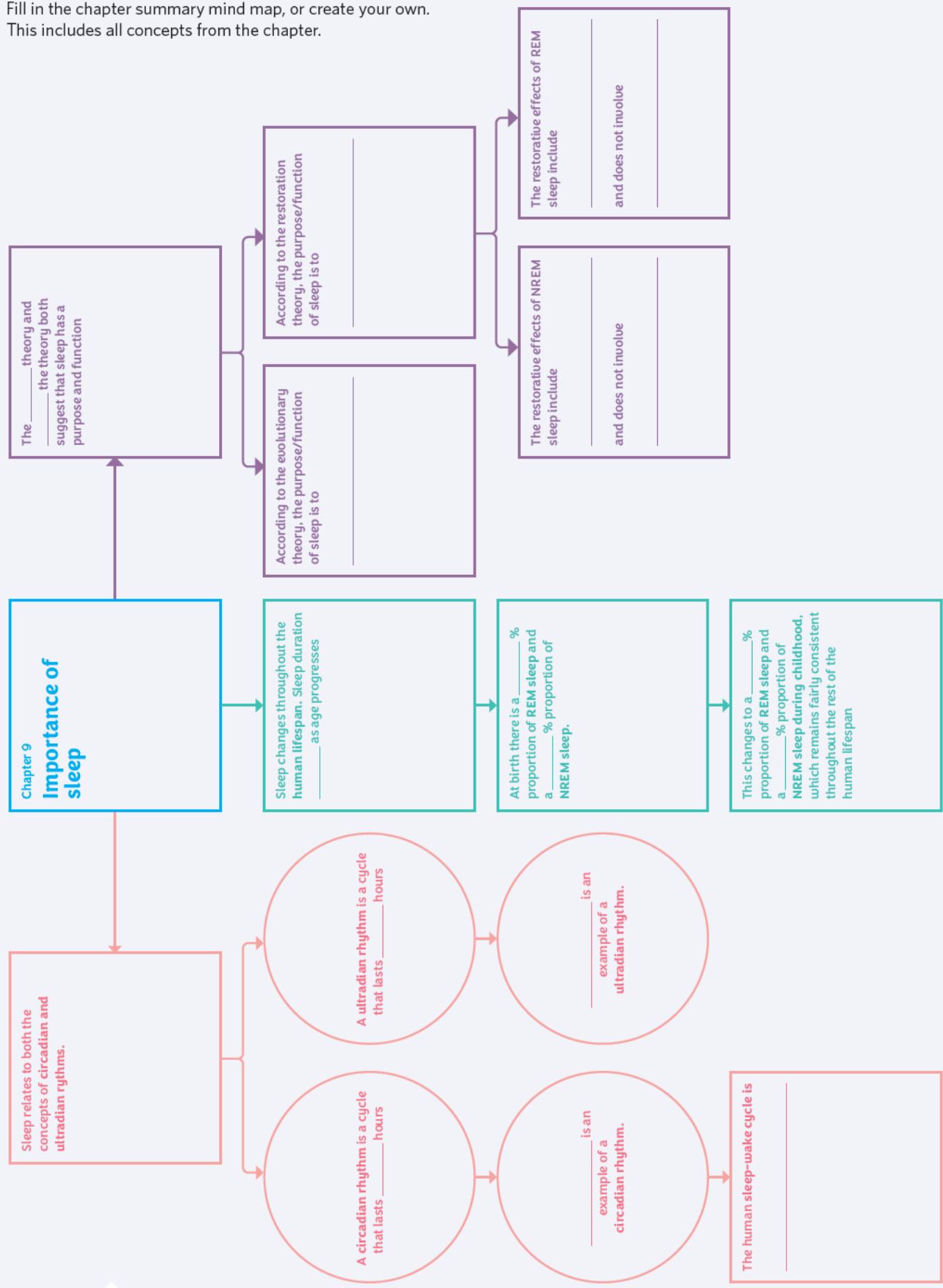
- a** Identify the research design used by Dr Arain. (1 MARK)
- b** Identify an extraneous variable related to obtaining data from the infant age group. Explain how this extraneous variable could be controlled. (2 MARKS)
- c** State if Dr Arain is able to determine participants' proportion of REM and NREM sleep? Justify your response. (2 MARKS)
- d** Identify a limitation of Dr Arain using sleep diaries in his experiment. (1 MARK)
- e** In terms of sleep duration, identify a likely difference between the child age group and the elderly age group results. (1 MARK)



# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

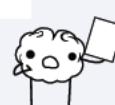
Fill in the chapter summary mind map, or create your own. This includes all concepts from the chapter.



**Review activity 2: Example bank**

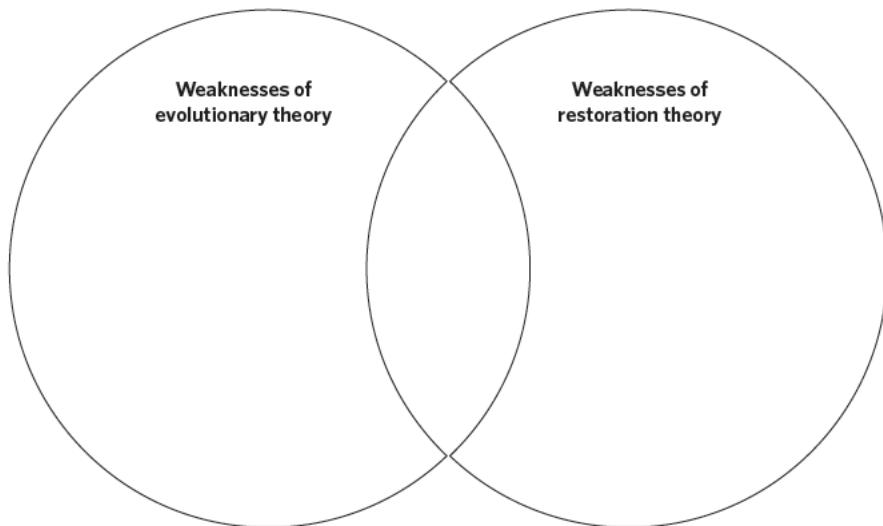
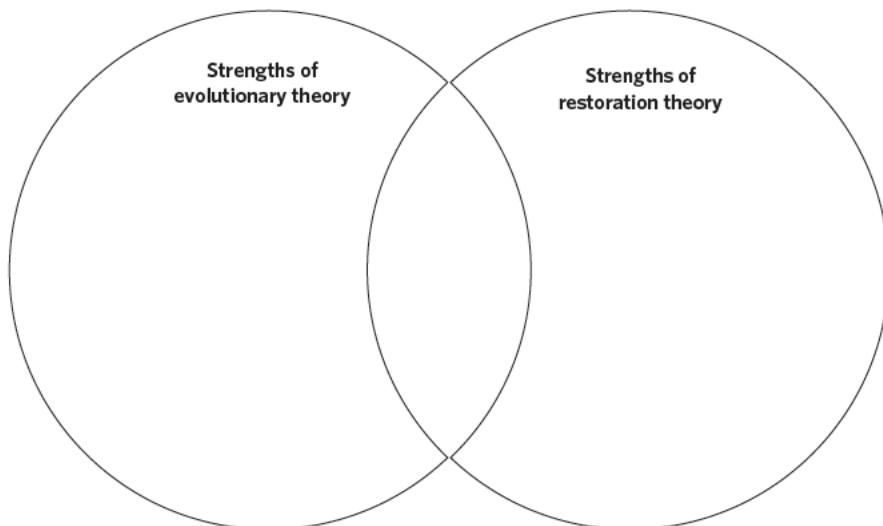
Fill in the table with your own notes. For a relevant example, you can draw upon instances in your life where this concept may be relevant.

Key terminology	Your own definition	Relevant example
Sleep		
Circadian rhythm		
Sleep-wake cycle		
Ultradian rhythm		
REM (Rapid eye movement) sleep		
NREM (Non-rapid eye movement) sleep		
Sleep episode		
Sleep cycle		
Evolutionary theory of sleep		
Restoration theory of sleep		



**Review activity 3: Venn diagrams**

Fill in the venn diagrams provided, thinking of as many strengths and weaknesses of the evolutionary and restoration theories of sleep as you can.

**Review activity 4: Summary**

Summarise the effects of REM and NREM sleep according to the restoration theory in the tables below.

**Restorative effects of REM sleep:**

**Restorative effects of NREM sleep:**

**Review activity 5: Create your own memory device for the importance of sleep**

In this chapter, you have learned the analogy of paradoxical sleep to help you to understand how the brain is incredibly active during REM sleep, but the body is paradoxically still. Try to come up with other ways to remember concepts covered in this chapter, such as mnemonics or other analogies. A key concept that might work well with a memory device is:

- Patterns of sleep across the lifespan. For example, an analogy for why babies have the highest proportion of REM sleep.

## CHAPTER TEST

### Multiple choice questions

**Question 1** (1 MARK)

A circadian rhythm is

- A a psychological cycle lasting between one and 24 hours.
- B a physiological cycle lasting around 24 hours.
- C a psychological cycle lasting around 24 hours.
- D a physiological cycle lasting between one and 24 hours.

**Question 2** (1 MARK)

REM sleep can be associated with

- A high levels of movement of the muscles surrounding the eyes.
- B minimal activity in the brain.
- C deep sleep.
- D muscle movement.

**Question 3** (1 MARK)

According to the restoration theory of sleep, NREM sleep

- A replenishes neurotransmitter levels in the brain.
- B restores psychological processes.
- C consolidates memory.
- D restores the body during periods of general fatigue.



**Question 4** (1 MARK)

Which of the following correctly identifies a limitation of the evolutionary theory and a strength of the restoration theory?

	<b>Limitation of evolutionary theory</b>	<b>Strength of restoration theory</b>
A	Does not account for how a physically disabled person sleeps as much as a physically able person	Provides a link between the circadian sleep-wake cycle and when we sleep
B	There is a large body of evidence to support the theory	Further our understanding of the purpose and function of sleep
C	No conclusive cause and effect relationship between NREM and REM sleep and what exactly is restored	Provides a link between the circadian nature of sleep and when we sleep
D	Does not account for the benefit of sleep on mental health	Addresses our specific need to sleep

**Use the following information for questions 5 and 6.**

Aapo is a healthy adolescent. Aapo loves football and trains multiple times per week and plays a match on the weekend. During one week, Aapo didn't manage to get adequate sleep and was frustrated by how sore he was even days after his weekend match.

**Question 5** (1 MARK)

What theory and type of sleep explains why Aapo was sore after not sleeping adequately?

	<b>Theory of sleep</b>	<b>Type of sleep</b>
A	Restoration	REM
B	Evolutionary	REM
C	Restoration	NREM
D	Evolutionary	NREM

**Question 6** (1 MARK)

How is Aapo's current proportion of REM and NREM sleep different to when he was first born?

- A Aapo has a greater proportion of REM sleep as an adolescent.
- B Aapo had a lower proportion of REM sleep when he was born.
- C Aapo has a greater proportion of NREM sleep as an adolescent.
- D There is no difference in the proportion of REM and NREM sleep.

**Question 7** (1 MARK)

A comparison between the sleep of a typical adolescent and elderly person would show that

- A sleep duration and the proportion of REM sleep is significantly higher for the adolescent.
- B sleep duration and the proportion of NREM sleep is significantly higher for the adolescent.
- C sleep duration is higher for the adolescent and both have a similar proportion of REM and NREM sleep.
- D both age groups have similar sleep duration and proportion of REM and NREM sleep.

**Use the following information for questions 8 and 9.**

Finton and Joseph were arguing with each other about why humans sleep. Finton tells Joseph that humans have evolved to sleep at night because light is required to complete tasks needed for survival. Joseph, on the other hand, thinks that humans sleep to help restore optimal psychological functioning and to repair the body.

**Question 8** (1 MARK)

Which of the following options identifies the theory of sleep that Finton is referring to and a strength of this theory?

Theory of sleep	Strength of theory
A Evolutionary	Accounts for the significance of the circadian nature of sleep
B Restoration	Accounts for the effects of both REM and NREM sleep
C Evolutionary	Accounts for the significance of the ultradian nature of sleep
D Restoration	Identifies our need to sleep

**Question 9** (1 MARK)

A limitation of both the theories that Finton and Joseph are referring to is that neither theory

- A accounts for why physically/mentally disabled people sleep as long as physically/mentally able people.
- B identifies the specific need to sleep.
- C identifies the significance of the circadian nature of sleep.
- D has sufficient evidence to entirely support its claims.

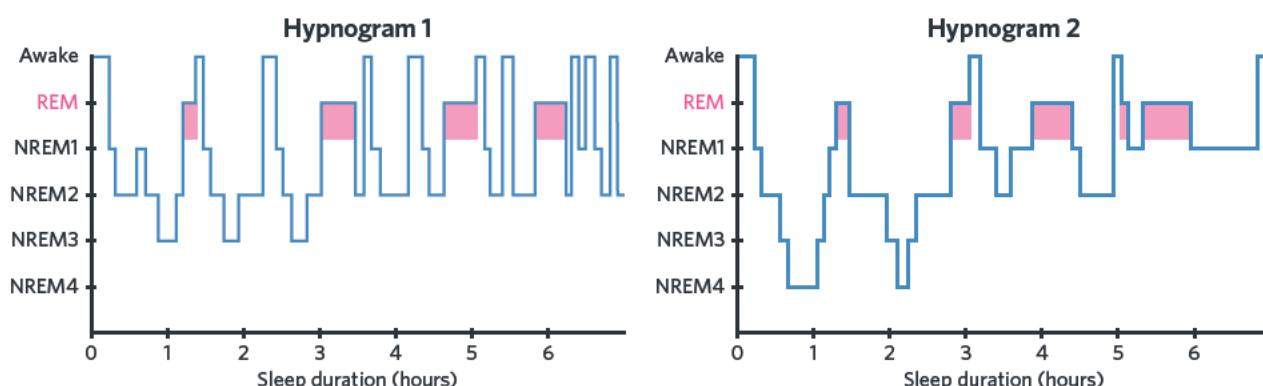
**Question 10** (1 MARK)

A comparison between the sleep of a typical newborn baby and adult would show that

- A sleep duration and the proportion of REM sleep is significantly higher for the adult.
- B sleep duration and the proportion of NREM sleep is significantly higher for the newborn baby.
- C sleep duration and the proportion of NREM sleep is significantly higher for the adult.
- D sleep duration and the proportion of REM sleep is significantly higher for the newborn baby.

**Short answer questions****Question 11** (2 MARKS)

Comment on sleep duration and the proportion of REM and NREM sleep as humans transition from adolescence to adulthood.

**Question 12** (2 MARKS)

Identify which of the hypnograms displays an elderly person's sleep episode. Justify your response.

**Question 13** (2 MARKS)

Define sleep cycles and describe why they are an example of an ultradian rhythm.

**Question 14** (3 MARKS)

Identify a difference between REM and NREM sleep. Describe an effect of both types of sleep according to the restoration theory of sleep.



**Question 15** (3 MARKS)

Describe circadian rhythms and provide an example relevant to humans in your response. Explain the significance of circadian rhythms in relation to the evolutionary theory of sleep.

**Key science skill questions****Question 16** (8 MARKS)

Dr Bilmore was interested in studying changes in sleep for adolescents compared to when they were first born. Dr Bilmore set up her experiment by having one group made up of only 16 year olds and the other group of only babies who were born in the past 5 days. Dr Bilmore worked at the hospital and was able to use the babies who were just born at her hospital as participants. Dr Bilmore recorded their sleep duration in the hospital's sleep laboratory and compared results between the groups.

- a Explain why Dr Bilmore could not use a repeated measures experimental design in this experiment. (2 MARKS)
- b What sampling technique did Dr Bilmore use? Justify your response. (2 MARKS)
- c Identify the likely results for the sleep duration of the newborn babies and the adolescents. (2 MARKS)
- d Comment on Dr Bilmore's ability to generalise her results. (2 MARKS)

**Extended response****Question 17** (10 MARKS)

Essie is a healthy teenager who is currently in year 11. Essie lives an active lifestyle, waking up early every morning for rowing training and going to school during the day. Essie tries her best to go to bed early each night because her parents say that she will be sore from sport and not be able to remember what she was taught at school if she does not. Whenever Essie complains to her parents about not getting enough sleep, they tell her that she shouldn't complain because they sleep far less than she does and still feel fine.

Analyse how the following concepts about the importance of sleep could apply to the scenario:

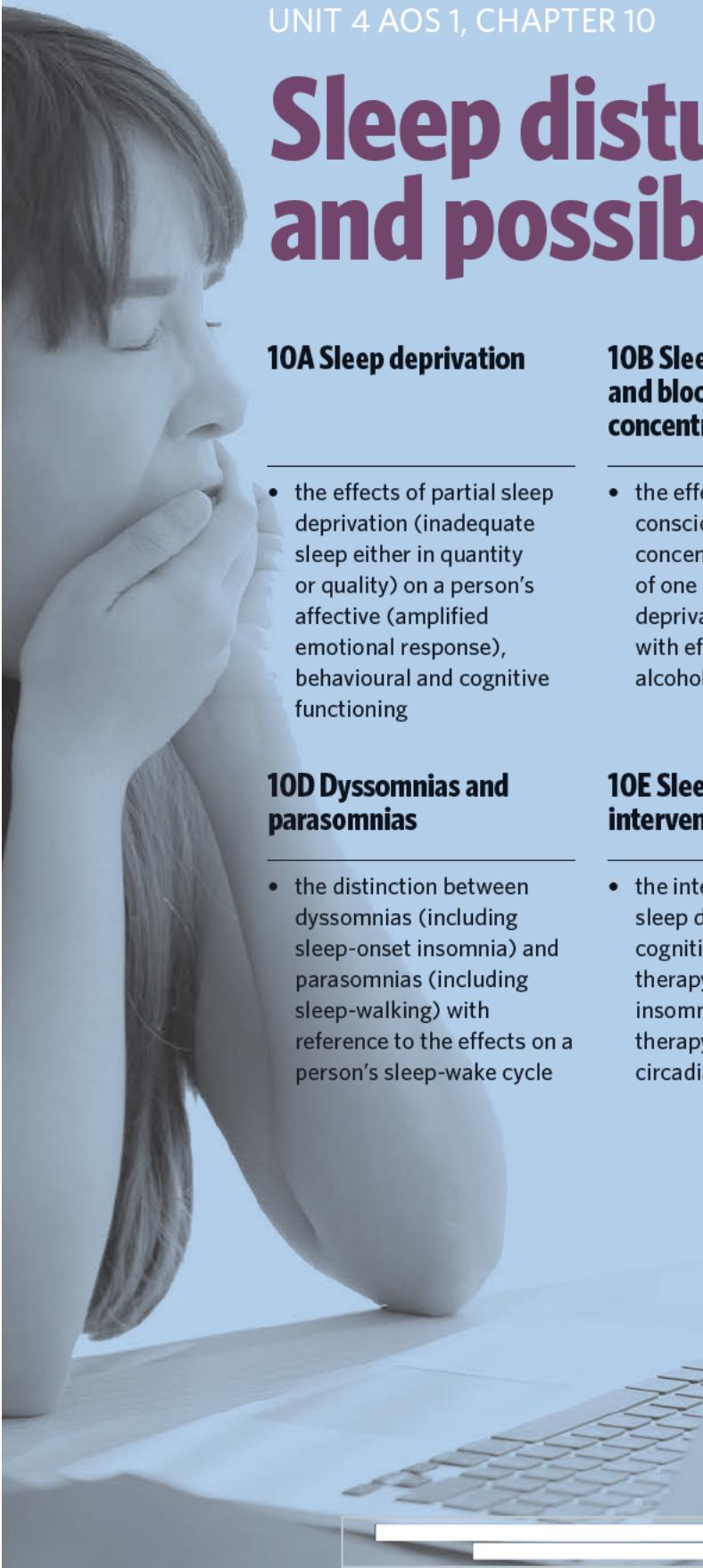
- Circadian rhythms
- Ultradian rhythms
- Restoration theory of sleep
- A comparison of sleep between adolescents and adults



UNIT 4 AOS 1, CHAPTER 10

# 10

## Sleep disturbances and possible treatments



### 10A Sleep deprivation

- the effects of partial sleep deprivation (inadequate sleep either in quantity or quality) on a person's affective (amplified emotional response), behavioural and cognitive functioning

### 10B Sleep deprivation and blood alcohol concentrations

- the effects on consciousness (cognition, concentration and mood) of one night of full sleep deprivation as a comparison with effects of legal blood-alcohol concentrations

### 10C Circadian phase disorders

- changes to a person's sleep-wake cycle and susceptibility to experiencing a circadian phase disorder, including sleep-wake shifts in adolescence, shift work and jet lag

### 10D Dyssomnias and parasomnias

- the distinction between dyssomnias (including sleep-onset insomnia) and parasomnias (including sleep-walking) with reference to the effects on a person's sleep-wake cycle

### 10E Sleep disorder interventions

- the interventions to treat sleep disorders including cognitive behavioural therapy (with reference to insomnia) and bright light therapy (with reference to circadian phase disorders)

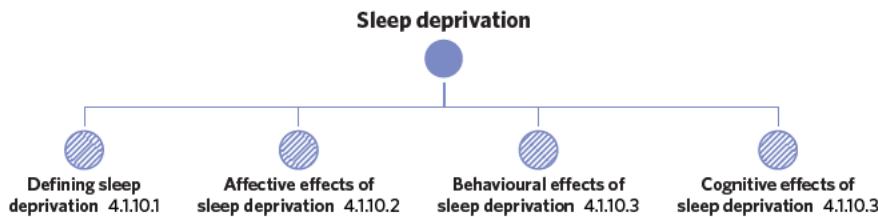


# 10A SLEEP DEPRIVATION

In the previous chapter, you learned about the importance of sleep. But what happens when you don't get enough sleep? How does this affect your emotions, behaviour and thoughts? This lesson explores the effect of sleep deprivation on a person's ability to function.

10A. Sleep deprivation	10B. Sleep deprivation and blood alcohol concentrations	10C. Circadian phase disorders	10D. Dyssomnias and parasomnias	10E. Sleep disorder interventions
<b>Study design dot point</b>				
<ul style="list-style-type: none"> <li>the effects of partial sleep deprivation (inadequate sleep either in quantity or quality) on a person's affective (amplified emotional response), behavioural and cognitive functioning</li> </ul>				
<b>Key knowledge units</b>				
Defining sleep deprivation				4.1.10.1
Affective effects of sleep deprivation				4.1.10.2
Behavioural effects of sleep deprivation				4.1.10.3
Cognitive effects of sleep deprivation				4.1.10.4

In this lesson, you will be learning about **sleep deprivation** and how not enough, or poor quality sleep affects a person's ability to function. Specifically, you will be looking at the effects that sleep deprivation has on a person's **affect (emotional responses), behaviours and cognition**.



## Defining sleep deprivation 4.1.10.1

### OVERVIEW

Sleep deprivation occurs when an individual experiences inadequate sleep, whether in quantity or quality of sleep.

### THEORY DETAILS

In the previous chapter, you learned about the importance and purpose of sleep, including how much sleep an individual should have at different stages of their life. When a person does not get enough sleep or has poor quality sleep, their experience is called **sleep deprivation**.

Though most people tend to think that sleep deprivation is only about the quantity (number of hours or duration) of sleep, the quality of sleep can also affect a person's functioning. For example, if an individual sleeps for eight hours a night, but only gets light (NREM stages 1 and 2) sleep, they will still show the symptoms of sleep deprivation. It is therefore important to remember that both quality and quantity of sleep affect whether or not a person is sleep deprived.

Sleep deprivation can be understood in terms of two broad categories: total sleep deprivation and partial sleep deprivation.

- **Total sleep deprivation**, also referred to as full sleep deprivation, is defined as an individual not sleeping for a period of at least 24 hours. This involves a complete lack of sleep over one night or for several nights in a row.

**Sleep deprivation** inadequate duration, or poor quality of sleep

**Total/full sleep deprivation** when an individual has no sleep within a 24 hour period

- **Partial sleep deprivation** is defined as inadequate sleep based on an individual's needs. Individuals who are partially sleep deprived have had some quantity of sleep in the past 24 hour period, but either the sleep duration was too short, or the quality of their sleep was poor.

Both total and partial sleep deprivation have negative effects on an individual's ability to function. Specifically, they have adverse effects on people's emotions, behaviours and ability to think clearly.

#### **Useful tip**

One way to remember the effects of sleep deprivation is ABC. This stands for the three types of effects a person might experience: **A**ffective, **B**ehavioural or **C**ognitive.



#### **Want to know more?**

Are you sleep deprived? It is easier to know the quantity of sleep you are getting, but hard to know the quality. There are many free apps that you can download on your phone to track your sleep patterns and determine whether you are getting quality sleep.

## **Affective effects of sleep deprivation** 4.1.10.2

### **OVERVIEW**

Sleep deprivation can cause an individual to have amplified emotional responses, which involve abnormal or heightened emotional reactions to different stimuli.

### **THEORY DETAILS**

Have you ever found yourself laughing at inappropriate times or displaying reactions that are not appropriate to the situation? Does this occur particularly when you are sleep deprived? The ability to regulate your emotions, which involves being able to recognise them and display them appropriately, is affected when you have not had enough sleep.

**Affect** is a term used in psychology to describe the expression of emotions. When a person is sleep deprived, they often display **amplified emotional responses**. This means that a person's emotional reactions are exaggerated or inappropriate for the situation they are in. You may have experienced this, where you have felt grumpy about a small issue or were more easily irritated by a family member because you were sleep deprived.

Some effects of sleep deprivation on affective functioning include:

- Increased irritability, due to a reduced ability to regulate emotions
- Depressed mood
- Heightened anxiety
- Inappropriate emotional reactions
- Decreased motivation

**Partial sleep deprivation** when an individual sleeps for some duration within a 24 hour period, but the sleep duration is too short, or the quality of sleep is poor



How many hours of sleep counts as sleep deprivation? As you learned in lesson **9C: Sleep across the lifespan**, the number of hours of sleep a person requires changes during different stages of life. Sleep deprivation is different for each person depending on their stage in life. The important thing to keep in mind about sleep deprivation is that a person is considered sleep deprived if they haven't had enough or adequate sleep in comparison to how much sleep they normally need; this varies between individuals.

## **Behavioural effects of sleep deprivation** 4.1.10.3

### **OVERVIEW**

Sleep deprivation also affects an individual's ability to control their behaviour. Sleep deprived individuals generally have less control over their actions.

### **THEORY DETAILS**

Sleep deprivation also affects how people behave. Generally, your self-control is decreased when sleep deprived.

Some behavioural effects of sleep deprivation include:

- Reduced motor control, or clumsiness
- Reduced spatial awareness

**Affect** the expression of emotions

**Amplified emotional response** disproportionate emotional reactions in response to an event or stimuli

#### **Want to know more?**

Although sleep deprivation mainly leads to amplified emotional responses, studies have shown that it can also occasionally dull emotional reactions. This can include having damped facial expressions, which often leads to reduced social and emotional wellbeing if experienced for a long period of time.  
(Minkel et al., 2011)



- Slower reaction times
- Increased likelihood of engaging in risk-taking behaviours
- Fatigue, or lack of energy
- Microsleeps, where the individual might briefly fall asleep for a few seconds without awareness of doing so

## Cognitive effects of sleep deprivation 4.1.10.4

### OVERVIEW

Sleep deprivation also has effects on a person's cognitive functioning. People who are sleep deprived perform poorly on cognitive tasks, demonstrating a decreased ability to maintain control over their cognition (thoughts).

### THEORY DETAILS

Have you ever tried to study when you were really tired and found it hard to concentrate? Maybe you had to read the same paragraph three or four times but still found it difficult to understand what you were reading. Sleep deprivation affects cognitive functioning, making tasks that are typically easy to do much more difficult.

**Cognition** is broadly understood as the mental processes an individual performs in order to understand and process information. The ability to perform these mental processes is hindered when an individual is sleep deprived.

Some effects of sleep deprivation on cognitive functioning include:

- Decreased ability or inability to concentrate and direct attention
- Poorer performance and increased error rates in cognitive tasks, such as completing mathematical tasks or problem solving tasks that require logical reasoning
- Reduced ability to cope with, and make decisions under stress
- Negative effects on memory or increased forgetfulness
- Illogical or irrational thoughts
- Difficulty completing simple, repetitive tasks

**Cognition** the mental processes an individual performs in order to understand and process information

### Useful tip

A question that often comes up on exams requires students to link the effects of sleep deprivation and automatic and controlled processing, which you learned about in lesson **8B: Features of states of consciousness**.

- Controlled processing is used for more complex tasks, requiring more mental effort. You might be surprised to learn that the ability to complete these tasks are not usually affected by sleep deprivation because the sleep deprived person puts in more energy and mental effort to successfully complete the task.
- Automatic processing is used for simpler tasks, requiring minimal mental effort. The ability to complete these tasks is often impaired, as individuals who are sleep deprived are prone to making more errors due to reduced mental effort.

### Theory summary

In this lesson, you learned about sleep deprivation. You should be able to distinguish between partial and total sleep deprivation, commenting on the quantity of sleep in particular. You should also be able to outline the effects of partial sleep deprivation on a person's affect, behaviour and cognition, listing examples of each.

Terminology such as the psychological and physiological effects of sleep deprivation have appeared in previous exams. As such, it is important for you to understand the relationship between psychological, physiological, affective, behavioural and cognitive effects of sleep deprivation. Broadly, psychological effects correlate with the affective and cognitive effects – that is, your thoughts and feelings are psychological functions. Physiological functioning broadly correlates with behavioural effects, but behavioural components can be either psychological or physiological. This is summarised in table 1.

**Table 1** Physiological and psychological effects of sleep deprivation

	<b>Affective</b>	<b>Behavioural</b>	<b>Cognitive</b>
<b>Psychological</b>	<ul style="list-style-type: none"> <li>• Irritability</li> <li>• Heightened anxiety</li> <li>• Depressed mood</li> <li>• Confusion</li> <li>• Lack of motivation</li> </ul>	<ul style="list-style-type: none"> <li>• Slowed reaction times</li> <li>• More likely to engage in risk-taking behaviour</li> <li>• Difficulty performing simple and monotonous tasks</li> <li>• Reduced motor control</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced ability to maintain attention and concentration</li> <li>• Reduced ability to cope with stress</li> <li>• Hallucinations</li> <li>• Impaired memory</li> <li>• Decreased ability to think creatively</li> </ul>
<b>Physiological</b>		<ul style="list-style-type: none"> <li>• Lack of energy</li> <li>• Hand tremors</li> <li>• Headaches</li> <li>• Muscle aches</li> </ul>	

**Want to know more?**

Long term sleep deprivation (also known as chronic sleep deprivation) can also lead to an increased risk for many diseases and health problems, including:

- Raised blood pressure
- Increased risk of developing diabetes
- Lowered immunity, increasing susceptibility to illness
- Increased risk of cardiovascular disease
- Increased risk of obesity
- Increased risk of depression and anxiety

## 10A Activities

- 1 Are you sleep deprived?** Complete the Cleveland Adolescent Sleepiness Questionnaire. For each statement, mark the response that fits with how often it applies to you. It's important to answer them for yourself - don't have people help you. There are no right or wrong answers.

Sleepiness questions	Never (0 times per month)	Rarely (<3 times per month)	Sometimes (1-2 times per week)	Often (3-4 times per week)	Almost every day (5+ times per week)
1. I fall asleep during my morning classes					
2. I go through the whole school day without feeling tired					
3. I fall asleep during the last class of the day					
4. I feel drowsy if I ride in a car for longer than five minutes					
5. I feel wide-awake the whole day					
6. I fall asleep at school in my afternoon classes					
7. I feel alert during my classes					
8. I feel sleepy in the evening after school					
9. I feel sleepy when I ride in a bus to a school event like a field trip or sports game					
10. In the morning when I am in school, I fall asleep					
11. When I am in class, I feel wide-awake					
12. I feel sleepy when I do my homework in the evening after school					
13. I feel wide-awake the last class of the day					
14. I fall asleep when I ride in a bus, car, or train					
15. During the school day, there are times when I realise that I have just fallen asleep					
16. I fall asleep when I do schoolwork at home in the evening					

Source: Spilsbury et al. (2007)



Once you complete the questionnaire, use the scoring keys below to determine your score for each statement. Then add the numbers together to get your total sleepiness score.

Sleepiness Statements	Scoring Key: Sleepiness Statements	Alertness Statements	Scoring Key: Alertness Statements
1. _____	10. _____	2. _____	11. _____
3. _____	12. _____	5. _____	13. _____
4. _____	14. _____	7. _____	
6. _____	15. _____		
8. _____	16. _____		
9. _____			
		Total score: _____	

How sleepy are you? A higher score means that you are sleepy during the day and need to get more sleep on school nights. A higher score also could be a sign that you may have a sleep disorder called obstructive sleep apnoea.

You should discuss your score with your parents and your doctor.

- 2** Think about your sleep over the past week. Considering the conditions in your bedroom and personal factors such as your emotions and thoughts, describe any factors that may have prevented you from getting a good night's sleep.

*Reproduced from Edrolo and A.Muller, 2017.*

## 10A QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- total sleep deprivation                          • partial sleep deprivation
  - affect    • cognition
- a The mental processes involved when an individual processes and understands information \_\_\_\_\_
- b When an individual does not sleep during a 24 hour period \_\_\_\_\_
- c The expression of a person's emotions \_\_\_\_\_
- d When an individual gets either inadequate or poor quality sleep \_\_\_\_\_

#### Question 2

Categorise each of the effects of partial sleep deprivation by ticking the correct box.

Effect of partial sleep deprivation	Affective	Behavioural	Cognitive
Difficulty concentrating			
Slower performance			
Poor memory abilities			
Clumsiness			
Delusions			
Decreased emotional control			
Irritability			
Anxiety			
Hallucinations			
Difficulties making decisions			
Impaired creativity			

*Reproduced from Edrolo and A.Muller, 2017.*

**Exam-style questions***Remember and understand***Question 3** (1 MARK)

Which of the following statements is the most correct?

- A Partial sleep deprivation only accounts for the quality of sleep.
- B Total sleep deprivation is when an individual does not sleep at all for a period of 24 hours or more.
- C Total sleep deprivation is when an individual gets some, but not adequate, sleep within a 24 hour period.
- D Partial sleep deprivation only accounts for the quantity of sleep.

**Question 4** (1 MARK)

A person who is partially sleep deprived would likely perform

- A well on both simple and complex tasks.
- B poorly on both simple and complex tasks.
- C worse on complex tasks compared to simple tasks.
- D worse on simple tasks compared to complex tasks.

*Adapted from VCAA 2014 exam MCQ17*

**Question 5** (3 MARKS)

Identify three physiological changes a person might experience if they are sleep deprived.

**Question 6** (3 MARKS)

Identify three psychological changes a person might experience if they are sleep deprived.

*Apply and analyse***Question 7** (1 MARK)

Ahmed is a healthy 34 year old man. On Sunday night he stayed up late to watch the midnight screening of a new movie and didn't get to bed until 2am. At work on Monday, he is partially sleep deprived. Which of the following changes to Ahmed's affective and behavioural functioning are likely to occur due to his lack of sleep?

	Affective changes	Behavioural changes
A	Increased negative mood	Reduced retention of information
B	Increased irritability	Slowed reaction times
C	Decreased number of errors for complex tasks	Increased risk taking
D	Hand tremors	Reduced spatial awareness

**Question 8** (3 MARKS)

Evan travels a lot for work and does not sleep well on flights. On his last work trip, he had to fly 29 hours from the UK to Australia, and during that time he only slept for 5 hours.

State three cognitive changes Evan might experience due to sleep deprivation.

*Questions from multiple lessons*

**Use the following information for questions 9–11.**

Julia recently had a SAC for her psychology class. The night before the SAC Julia stayed up until 3am finishing her revision notes, and did not sleep well because she was feeling anxious for the SAC. In the morning, when she woke at 7am, she could not find her shoes and was worried that she would be late for school. She started to panic, her heart started beating rapidly and she could feel her palms were getting sweaty.



**Question 9** (1 MARK)

Which of the following is an example of how Julia's **affective** functioning might change following her sleep deprivation?

- A more short-tempered
- B poorer completion of complex tasks
- C greater difficulty undertaking simple tasks
- D reduced ability to process declarative memories

Adapted from VCAA 2018 exam MCQ42

**Question 10** (1 MARK)

Which of the following is an example of how Julia's **cognitive** functioning might change following her sleep deprivation?

- A more short-tempered
- B poorer completion of complex tasks
- C greater difficulty understanding tasks
- D increased ability to process declarative memories

Adapted from VCAA 2018 exam MCQ42

**Question 11** (1 MARK)

Which branch of the nervous system was active when Julia started to feel panicked?

- A autonomic nervous system
- B parasympathetic nervous system
- C somatic nervous system
- D sympathetic nervous system

**Question 12** (3 MARKS)

Tyke is studying year 12 psychology. In class today, his teacher told him that he needs to get at least 8 hours of sleep a night, otherwise, he would show the symptoms of sleep deprivation. At dinner that night, he told his parents that they were not getting enough sleep as they only sleep 6 hours most nights, and he is worried that they are sleep deprived. Is Tyke's comment to his parents correct? Justify your response.

**Question 13** (3 MARKS)

Referring to the restoration theory of sleep, explain why people might experience muscle aches when they are sleep deprived.

**Question 14** (4 MARKS)

Referring to automatic and controlled processes, explain why someone who is sleep deprived is able to have a better performance on complex tasks when compared to simple tasks.

**Key science skills****Question 15** (8 MARKS)

Dr Lee wanted to investigate the effects of partial sleep deprivation on cognitive performance and recruited her first year undergraduate students to participate.

In her study, she asked students to record how many hours they slept each night over the period of a month. She also asked them to complete daily cognitive tasks during this time and record their performance on these tasks by measuring the number of errors they made.

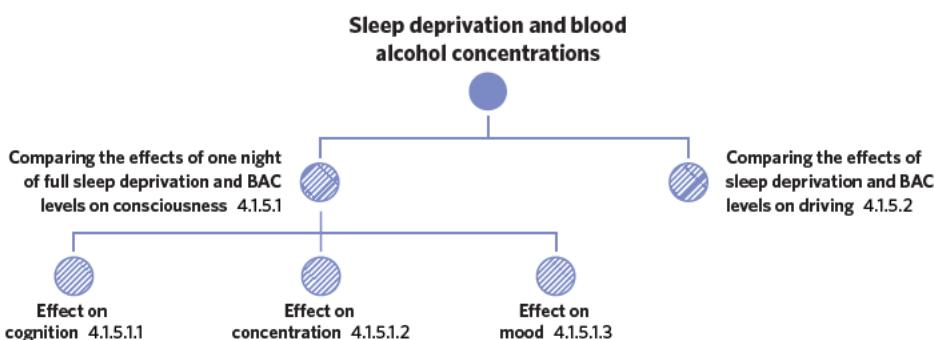
- a Identify the sampling method Dr Lee used for her experiment. (1 MARK)
- b Write a possible hypothesis for this experiment. (3 MARKS)
- c Outline two ethical considerations Dr Lee might consider when running this experiment. (2 MARKS)
- d Predict the likely results of Dr Lee's experiment. (2 MARKS)

# 10B SLEEP DEPRIVATION AND BLOOD ALCOHOL CONCENTRATIONS

In this chapter, you are learning about different types of sleep disturbances and how to treat them. In the previous lesson, you learned about two types of sleep deprivation: total and partial, and their effects. In this lesson, you will compare the effects on consciousness of different blood alcohol concentration levels and sleep deprivation.

10A. Sleep deprivation	10B. Sleep deprivation and blood alcohol concentrations	10C. Circadian phase disorders	10D. Dyssomnias and parasomnias	10E. Sleep disorder interventions
<b>Study design dot point</b>				
▪ the effects on consciousness (cognition, concentration and mood) of one night of full sleep deprivation as a comparison with effects of legal blood-alcohol concentrations.				
<b>Key knowledge units</b>				
Effect on cognition (Comparing the effects of one night of full sleep deprivation and BAC levels on consciousness)				4.1.5.1.1
Effect on concentration (Comparing the effects of one night of full sleep deprivation and BAC levels on consciousness)				4.1.5.1.2
Effect on mood (Comparing the effects of one night of full sleep deprivation and BAC levels on consciousness)				4.1.5.1.3
Comparing the effects of sleep deprivation and BAC levels on driving				4.1.5.2

**In this lesson, you will be learning** about how having a **blood alcohol concentration** of 0.10 can have the same effect on an individual's consciousness as a **full night of sleep deprivation**. You will compare the effect of these two things on a person's **consciousness** by examining their effect on people's **cognition, concentration and mood**. You will also examine how this might affect people's ability to drive.



## Comparing the effects of one night of full sleep deprivation and BAC levels on consciousness 4.1.5.1

### OVERVIEW

One full night of sleep deprivation has some comparable effects on consciousness to having a blood alcohol concentration of 0.10.

### THEORY DETAILS

**Blood alcohol concentration (BAC)** is a measure of how much alcohol is in a person's bloodstream. If a person's BAC is 0.05, there is 0.05 grams of alcohol for every 100 millilitres of blood in that person's body. The higher a person's BAC, the more their cognition, concentration and mood might be impaired or changed compared to normal waking consciousness. The effects of a BAC of 0.10 on these elements of consciousness are very similar to the effects of one night of sleep deprivation.

**Blood alcohol concentration (BAC)** a measure of how much alcohol is in a person's blood



Most importantly, you should remember that in regards to consciousness:

- The effects of a BAC level of 0.05 are roughly equivalent to 17 hours of sleep deprivation (partial sleep deprivation).
- The effects of a BAC level of 0.10 are roughly equivalent to 24 hours of sleep deprivation (total sleep deprivation).

#### Want to know more?

The comparison of the effect of BAC and sleep deprivation on consciousness comes from the research of Australian psychologists Dawson and Reid (1997). Their participants were required to complete cognitive-motor tasks in one of two conditions: after sleep deprivation or after alcohol consumption. A repeated measures design was used.

Both the alcohol and the sleep deprivation conditions gave similar results. Dawson and Reid (1997) found that 24 hours of sleep deprivation had comparable effects on the way the participants performed these tasks to when they had a BAC of 0.10. Participants who had 17 hours of sleep deprivation performed similarly to when they had a BAC of 0.05.

#### Useful tip

Keep in mind that BAC is not just a measure of how much alcohol a person has consumed. Different people, depending on variables like age, gender, body mass, type of alcohol etc. will reach a BAC of 0.10 or 0.05 with different amounts of alcohol. As such, be careful when answering questions about the effect of alcohol on consciousness and make sure the question has specified a BAC level if you are going to comment on it.

#### Effect on cognition 4.1.5.1.1

As you've learned in previous lessons, **cognition** includes the ways individuals process and understand information from the world. Having a BAC of 0.10 impairs cognition in a way that is comparable to having 24 hours of sleep deprivation. Some of these impairments to cognition include:

- Reduced speed and accuracy when performing tasks
- Slower mental processes
- Decreased ability to reason and problem solve
- Greater difficulty making sense of the world
- Reduced ability to make decisions quickly and effectively
- Cognitive distortions

#### Effect on concentration 4.1.5.1.2

**Concentration** refers to a person's ability to focus on tasks or stimuli. Alcohol consumption and sleep deprivation both may contribute to a reduced ability to concentrate on certain stimuli or tasks at hand. Again, research demonstrates that the effects of a BAC of 0.10 and 24 hours of sleep deprivation both reduce the ability to concentrate to a similar degree.

#### Effect on mood 4.1.5.1.3

A person's **mood** refers to the way they are feeling or their emotional state at a given point in time. The consumption of alcohol and sleep deprivation can both affect a person's mood, but this might occur in different ways. Generally speaking, sleep deprivation negatively affects someone's mood, making them more irritable or sensitive. Alcohol on the other hand can have a range of effects on someone's emotions, making them feel happy and excited, or alternatively more angry or sad. While sleep deprivation and alcohol consumption can have different effects, they both alter someone's mood when compared to how they might feel in normal waking consciousness. This can, in turn, affect people's concentration and cognition particularly if their mood occupies their thoughts.



In the last lesson **10A: Sleep deprivation**, you compared the affective, behavioural and cognitive effects of sleep deprivation. Those cognitive effects will largely cross over with the effects in this lesson.



Figure 1 A cartoon showing how alcohol consumption and sleep deprivation can affect mood in different ways

**Cognition** the mental processes an individual performs in order to understand and process information

**Concentration** the ability to focus on certain stimuli or tasks

**Mood** the emotional state a person is in at a given time

## Comparing the effects of sleep deprivation and BAC levels on driving 4.1.5.2

### OVERVIEW

To drive legally in Australia, you must have a BAC below 0.05 as a full licence driver. As mentioned, one full night of sleep deprivation has effects on consciousness comparable to twice this limit (0.10), having significant implications for road safety.

### THEORY DETAILS

A BAC level of 0.05 or more is considered to impair a person's driving skills in a way that is dangerous and therefore illegal. As a person's cognition, concentration and mood are affected in comparable ways by 17 hours of sleep deprivation, the impact on driver safety is then similar. This is especially important when you consider that twice the legal limit, or 0.10, affects consciousness in similar ways to having no sleep over a 24 hour period. Although not as emphasised by Australian law and media, sleep deprivation may endanger drivers and those on the road in the same way as driving under the influence of alcohol.

A BAC level of 0.05 or more and sleep deprivation of 17 hours or more might cause drivers to have:

- Slowed reaction times
- Impaired cognition
- Perceptual distortions
- Decreased levels of alertness or awareness
- Poor concentration
- Less predictable experiences of mood which may impair their ability to concentrate or process information clearly



The elements of consciousness affected by alcohol consumption and sleep deprivation are directly related to features of states of consciousness you learned in lesson **8B: Features of states of consciousness**. It is helpful to consider the way each of the following might be affected, especially in relation to driving, this is seen in table 1.

Table 1 How sleep deprivation and BAC levels may affect different features of states of consciousness

Feature of state of consciousness	Effect of having a BAC of over 0.05 or 17 hours or more of sleep deprivation
Levels of awareness	May reduce one's level of awareness, making people less observant of the world and stimuli.
Levels of processing	May decrease one's ability to perform automatic processes with accuracy, as well as the ability to perform controlled processes. May make driving a controlled process for someone when it is usually an automatic process.
Content limitations	May prompt thoughts and mental processes that would not usually occur in normal waking consciousness, potentially causing distraction.
Perceptual and cognitive distortions	Likely to increase the chances of perceptual and cognitive distortions occurring, affecting clarity of vision and other senses important for driving.
Emotional awareness	Likely to change a person's mood, affecting their concentration and cognition in a variety of ways.
Self-control	Likely to reduce self-control, impairing precision and concentration when driving.
Time orientation	Likely to distort someone's perception of time, sometimes resulting in slow reaction times.



Figure 2 Driving is affected by both sleep deprivation and alcohol consumption in similar ways

### Want to know more?

If you would like to learn more about the penalties you can face for driving with a BAC of 0.05 or more search Drink-driving penalties on the VicRoads website. (VicRoads, 2018)

### Theory summary

In this lesson, you have learned about how the effects of a full night of sleep deprivation affect people's consciousness in a way that is comparable to having a BAC of 0.10, or twice the legal driving limit. You should now be able to discuss their effects in relation to people's cognition, concentration and mood. You should also have an awareness about the different hours of sleep deprivation and their similarity to approximate BAC levels.



## 10B Activities

- 1 Fill in the table below, listing as many effects of BAC levels of 0.05+ and sleep deprivation of 17 hours on cognition, concentration and mood as you can.

Effects on cognition	Effects on concentration	Effects on mood

## 10B QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- Cognition
  - Concentration
  - Mood
  - Blood alcohol concentration (BAC)
- a The mental processes an individual performs in order to understand and process information \_\_\_\_\_
- b A measure of the amount of alcohol one has in their blood system \_\_\_\_\_
- c Focusing on one or a few select tasks or stimuli to the exclusion of others \_\_\_\_\_
- d The way a person is feeling and the emotions they are experiencing at one time \_\_\_\_\_

### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

In terms of effects on consciousness, the effects of one full night of sleep deprivation are similar to having

- A a BAC of 0.05.
- B a BAC of 1.00.
- C a BAC of 0.10.
- D a BAC of 0.5.

#### Question 3 (1 MARK)

Cognition, concentration and mood are

- A about equally affected by one night of sleep deprivation and a BAC level of 0.10.
- B more affected by a full night of sleep deprivation than a BAC level of 0.10.
- C more affected by a BAC of 0.05 than a full night of sleep deprivation.
- D about equally affected by one night of sleep deprivation and a BAC of 0.05.

#### Question 4 (1 MARK)

A person with a BAC of 0.10 compared to someone with partial sleep deprivation would likely show

- A about the same concentration levels.
- B a greater sensitivity in mood.
- C a greater cognitive ability.
- D about the same cognitive ability.

Adapted from VCAA 2017 exam MCQ22

**Question 5** (2 MARKS)

Suggest whether a person who has had one full night of sleep deprivation would experience similar cognitive abilities to when they have a blood alcohol concentration (BAC) level of 0.05. Justify your response.

**Question 6** (2 MARKS)

This table details the blood alcohol concentration (BAC) level next to the hours of sleep deprivation that cause similar effects on consciousness. Providing an example, compare the relative effects that conditions A and B might have on cognition.

	BAC	Hours of sleep deprivation
Condition A	0.05	17
Condition B	0.10	24

**Apply and analyse****Question 7** (1 MARK)

Solomon and Terry have a test at university today. Last night, Solomon didn't get any sleep as he was studying all night. Terry went out drinking and got enough sleep, but still has a BAC of 0.05 at the time of the test. It is likely that

- A Solomon would have a greater ability to concentrate on the test than Terry.
- B Terry would have a greater ability to concentrate on the test than Solomon.
- C Solomon and Terry would have about the same ability to concentrate on the test.
- D both Solomon and Terry would not be able to concentrate on the test.

**Question 8** (4 MARKS)

A person from a road safety company is proposing a campaign to encourage drivers not to drive when sleep deprived and inform them of the associated risks. They wish to draw comparisons between having an illegal driving blood alcohol concentration (BAC) level of 0.05 or above, and sleep deprivation. They want to make the case that both are dangerous to driver safety.

What comparisons can this person draw about the effects of these conditions on cognition, concentration and mood in relation to driving?

**Questions from multiple lessons****Question 9** (1 MARK)

A person with a BAC of 0.05 compared to a person in normal waking consciousness would likely show

- A faster reaction times.
- B about the same cognitive ability.
- C a more positive mood.
- D reduced concentration.

Adapted from VCAA 2017 exam MCQ22

**Question 10** (4 MARKS)

Alcohol is considered a depressant. A blood alcohol concentration (BAC) level of 0.10 is twice the legal limit for driving in Australia.

- a Describe the effect alcohol has on brain wave patterns and explain in terms of levels of alertness how this might affect concentration and cognition when driving. (2 MARKS)
- b How might a BAC of 0.10 affect time orientation and how might this be dangerous for driving? (2 MARKS)

**Question 11** (5 MARKS)

George has been camping in a forest with some friends and is terrified of all the sounds he hears at night. He has not slept in 24 hours. Today he and his friends are going to a nearby mountain. His friends have all been drinking, and have a blood alcohol concentration (BAC) level of about 0.10. George has had nothing to drink.

- a Outline how one physiological measure of consciousness could be used to compare George's state of consciousness to his friends. (3 MARKS)
- b In terms of consciousness, would it be safer for George or one of his friends to drive to the mountain? Justify your response. (2 MARKS)



***Key science skills*****Question 12** (5 MARKS)

Dawson and Reid's influential 1997 study compared the effects of sleep deprivation to blood alcohol concentration (BAC) levels. They used computer-simulated concentration tasks as a measure of participants' concentration and cognition levels, getting the same participants to complete them in the different experimental conditions of alcohol consumption and sleep deprivation.

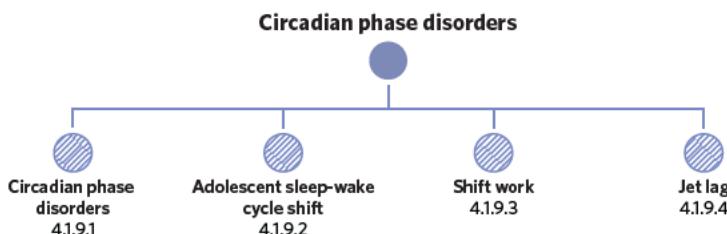
- a What was the experimental design used by Dawson and Reid? (1 MARK)
- b Why might results from a computer-simulated concentration task be difficult to generalise to real life settings of driving a car? (2 MARKS)
- c Describe what the mean measures in this experiment and the role it has in informing results. (2 MARKS)

# 10C CIRCADIAN PHASE DISORDERS

So far in this chapter, you have learned about the effects of partial sleep deprivation, including the affective, behavioural and cognitive effects. You have also compared these effects to the effects of blood alcohol concentration (BAC), where you learnt that a full night of sleep deprivation has the same effect on consciousness as a BAC of 0.10. Now, you will learn about changes to an individual's sleep-wake cycle in relation to circadian phase disorders.

10A. Sleep deprivation	10B. Sleep deprivation and blood alcohol concentrations	10C. Circadian phase disorders	10D. Dyssomnias and parasomnias	10E. Sleep disorder interventions
<b>Study design dot point</b>				
▪ changes to a person's sleep-wake cycle and susceptibility to experiencing a circadian phase disorder, including sleep-wake shifts in adolescence, shift work and jet lag				
<b>Key knowledge units</b>				
Circadian phase disorders				4.1.9.1
Adolescent sleep-wake cycle shift				4.1.9.2
Shift work				4.1.9.3
Jet lag				4.1.9.4

In this lesson, you will be learning about the different types of circadian phase disorders and how they can lead to changes in a person's sleep-wake cycle. Specifically, you will be learning about the circadian phase disorders of the **adolescent sleep-wake cycle shift, shift work and jet lag**.



## Circadian phase disorders 4.1.9.1

### OVERVIEW

Circadian phase disorders interfere with the normal sleep-wake cycle, disrupting your circadian rhythm.

### THEORY DETAILS

As you have learned, circadian rhythms involve changes to physiological functions which occur as part of a 24 hour cycle. **Circadian phase disorders** are sleep disorders which interfere with an individual's circadian rhythm. A circadian phase disorder leads to disruptions in the normal sleep-wake cycle and can result in excessive sleepiness during the day and an inability to initiate sleep at night. Examples of circadian phase disorders include the adolescent sleep-wake cycle shift, shift work and jet lag.

Some symptoms of circadian phase disorders include:

- Amplified emotional responses
- Fatigue
- Irritability
- Reduced ability to concentrate

**Circadian phase disorder** a sleep disorder which interferes with the normal regulation of the circadian rhythm of sleep, leading to a change in the sleep-wake cycle



Bright light therapy is often used to treat circadian phase disorders. You will explore this in lesson **10E: Sleep disorder interventions**.



## Adolescent sleep-wake cycle shift 4.1.9.2

### OVERVIEW

The adolescent sleep-wake cycle shift is an example of a circadian phase disorder. It occurs due to adolescents experiencing a biological delay in sleep-onset, meaning that they don't feel tired until later in the day.

### THEORY DETAILS

Have you ever found yourself unable to fall asleep at the same time as your parents? This may be explained by the **sleep-wake cycle shift in adolescence**, where you, as an adolescent, find yourself feeling sleepy later than your parents and older siblings.

The sleep-wake cycle shift in adolescence involves a delayed onset of your sleep-wake cycle. This results in the desire to fall asleep and wake up later than you did previously.

This desire to fall asleep and wake later occurs due to adolescents experiencing a delayed release of melatonin, the sleep-inducing hormone. Due to the delayed release of melatonin, an adolescent's circadian rhythm becomes delayed so that they naturally feel sleepy later. This is called delayed sleep-onset. Melatonin is estimated to be released around two hours later for adolescents than for adults, shifting the adolescent sleep-wake cycle by around two hours. This may contribute to an adolescent's ability to get up for activities such as school and their ability to concentrate.

#### Example:

For a child aged 12, melatonin is usually released at around 8pm, causing them to feel sleepy at around 10pm. During adolescence, melatonin is usually not released until around 10pm, leading to adolescents not feeling sleepy until around midnight.

However, it is important to note that many adolescents also engage in lifestyle behaviours which may further disrupt their sleep-wake cycle and lead to delayed sleep-onset. These behaviours include staying up late to:

- Complete homework
- Attend parties
- Talk to friends on the phone
- Watch TV
- Work at a part-time job after school

#### *Useful tip*

Exam questions may ask you to apply your understanding of the biopsychosocial model to sleep disorders. The delayed melatonin release is an example of a biological cause of the sleep-wake shift in adolescents, whereas lifestyle behaviours are an example of social causes.

## Shift work 4.1.9.3

### OVERVIEW

Shift work refers to any occupation that requires an individual to work during hours which are inconsistent with the rest of society, such as working overnight. These abnormal hours can lead to the development of sleep disorders.

### THEORY DETAILS

Individuals who engage in **shift work** have unusual working hours. These individuals can experience rotating shift work, which may involve working a week of morning shifts, followed by a week of night shifts. This particularly impacts an individual's sleep-wake cycle as their circadian rhythm is constantly changing and adapting to their environment, often leading to individuals having difficulty initiating sleep and waking while adjusting from one shift to another.

**Sleep-wake cycle shift in adolescence** a type of circadian phase disorder where adolescents experience delayed sleep-onset and hence delayed wake

#### *Want to know more?*

Melatonin is secreted from the pineal gland to indicate that it is time to go to sleep. Many factors can impact how much melatonin is secreted from the pineal gland. One example is exposure to the blue light which radiates from your phone. This blue light reduces the amount of melatonin being secreted and can therefore disrupt your sleep-cycle by making you go to sleep later in the night. There are plenty of features on your phone to make sure that this does not occur, such as the use of night mode to lower the amount of blue light emitted from your phone. Try this yourself and see if your sleep quality improves!

There are a number of factors which contribute to individuals who experience shift work having disrupted sleep-wake cycles. One factor is due to their inconsistent exposure to light, which regulates the circadian rhythm. If individuals work at night and sleep during the day, they may find themselves feeling tired at work due to a lack of daylight, and unable to sleep during the day due to the presence of daylight. This can lead to an inability to fall asleep, and can potentially lead to sleep-onset insomnia and other sleep disorders.



Shift work can often negatively impact the sleep-wake cycle and lead to sleep deprivation, a topic you explored in **10A: Sleep deprivation**. Some of the effects of sleep deprivation involve an inability to concentrate and reduced motor control and clumsiness, which may make individuals more susceptible to mistakes or accidents at work. This is particularly dangerous as individuals who experience shift work are often in health care or construction industries, and therefore mistakes on the job could lead to serious injuries.

### Want to know more?

Shift work can often lead to the development of sleep disorders due to having significant impacts on the sleep-wake cycle. In particular, it can often lead to shift work disorder. Shift work disorder is a type of circadian phase disorder which often involves experiences of insomnia and extreme fatigue.

## Jet lag 4.1.9.4

### OVERVIEW

Jet lag can negatively impact an individual's sleep-wake cycle by interfering with their natural circadian rhythm.

### THEORY DETAILS

Travelling rapidly across multiple time zones can often lead to a mismatch between an individual's circadian rhythm and their environment. This mismatch is called jet lag, a circadian phase disorder which is associated with several symptoms, such as fatigue.

Jet lag can therefore lead to disruptions in a person's sleep-wake cycle. Individuals experiencing jet lag may find it difficult to wake up at a time that aligns with the time zone of their environment, as well as fall asleep at an appropriate time. It often takes individuals many days to realign their sleep-wake cycle with their environment to no longer experience the effects of jet lag.

**Jet lag** the mismatch between an individual's internal circadian rhythm and the time of their environment, which occurs after rapidly travelling across time zones

### Want to know more?

Travelling west is best! When travelling west, the sleep-wake cycle is delayed, meaning that individuals will need to adjust to fall asleep and wake up later. In contrast, travelling east requires the sleep-wake cycle to become advanced, meaning that individuals need to fall asleep and wake earlier. Having an advanced sleep-wake cycle is harder for the biological body clock to adjust to. This means that if you travel west, you will experience less severe symptoms of jet lag and for a reduced amount of time than if you travelled east.

## Theory summary

In this lesson, you have learned about circadian phase disorders and the impact they have on the sleep-wake cycle. Specifically, you have learned about the adolescent sleep-wake cycle shift, shift work and jet lag, and how these circadian phase disorders can disrupt an individual's circadian rhythm. This has been summarised in table 1.

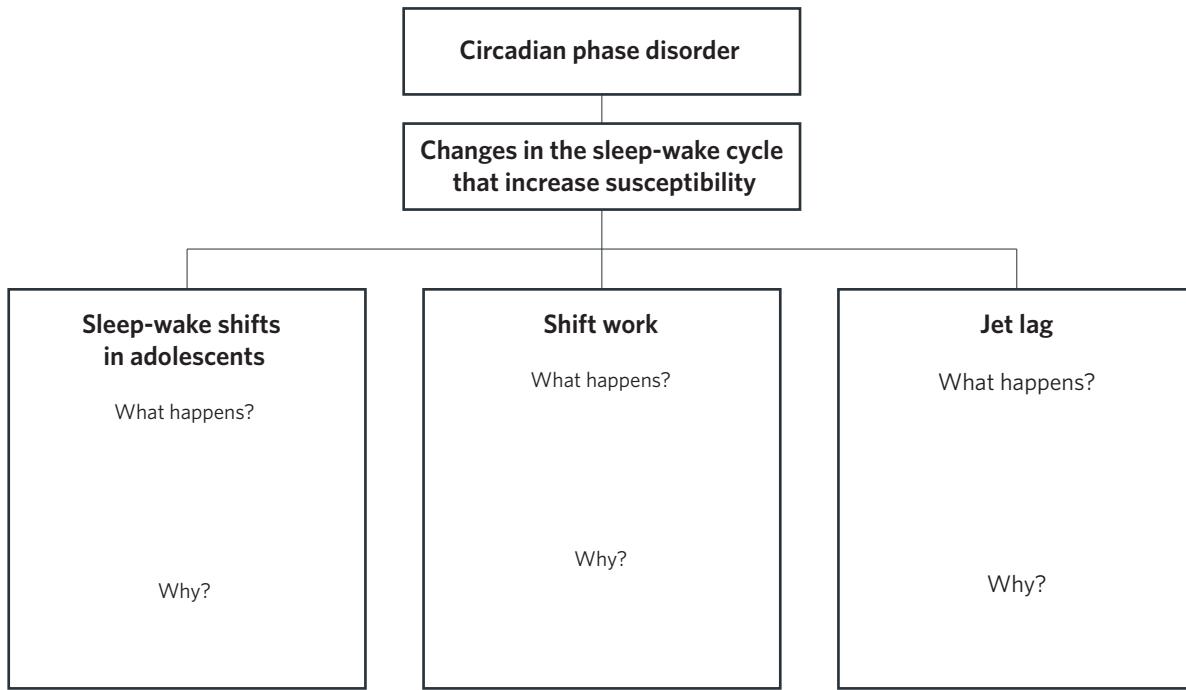
Table 1 Types of circadian phase disorders

Type of circadian phase disorder	Impact on the sleep-wake cycle and symptoms
Adolescent sleep-wake cycle shift	<ul style="list-style-type: none"> <li>Delayed sleep-onset: Sleep and wake later</li> <li>Fatigue during the day</li> </ul>
Shift work	<ul style="list-style-type: none"> <li>Unable to maintain a consistent sleep-wake cycle</li> <li>Inability to sleep at a set time</li> <li>Increases risk of mistakes/injuries at work</li> </ul>
Jet lag	<ul style="list-style-type: none"> <li>A mismatch between the circadian rhythm and the environment</li> <li>Experiences of fatigue and irritability during waking hours</li> <li>Difficulty initiating sleep at an appropriate time which aligns with the environment, such as at night</li> </ul>



## 10C Activities

- 1 Complete this mind map about Circadian phase disorders.



*Reproduced from Edrolo and A.Muller, 2017.*

## 10C QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definitions.

- |                                     |              |
|-------------------------------------|--------------|
| • Circadian phase disorder          | • Jet lag    |
| • Adolescent sleep-wake cycle shift | • Shift work |
- a An occupation which involves working at unusual hours, such as working at night or having alternating shifts \_\_\_\_\_
- b A type of circadian phase disorder in which adolescents experience a delayed desire to sleep and wake up \_\_\_\_\_
- c The mismatch between an individual's internal circadian rhythm and the time of their environment, which occurs after rapidly travelling across time zones \_\_\_\_\_
- d A sleep disorder which interferes with the normal regulation of the circadian rhythm of sleep, leading to a change in the sleep-wake cycle \_\_\_\_\_

### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

The delayed release of sleep-inducing hormones is characteristic of which circadian phase disorder?

- A Shift work
- B Jet lag
- C Sleep debt
- D Adolescent sleep-wake cycle shift

*Adapted from VCAA 2018 exam MCQ27*

**Question 3** (1 MARK)

Jet lag is typically caused by

- A the reduced air pressure in a plane cabin.
- B crossing into a timezone that a person's sleep-wake cycle is not aligned with.
- C the unison of your circadian rhythm and your current timezone.
- D travelling for long hours.

**Question 4** (2 MARKS)

Explain how jet lag can impact an individual's sleep-wake cycle.

**Apply and analyse****Question 5** (1 MARK)

Rowan, Cloe and Sara are all travelling with Sunrise airlines to different locations. Their travel journeys have been recorded in the table.

	Travel duration (in hours)	Number of flights	Time zones crossed	Destination
Rowan	10	1	2	Hawaii
Cloe	4	3	0	Sydney
Sara	27	2	5	Hungary

Upon landing in Sydney, Cloe is likely to be experiencing

- A jet lag.
- B a circadian phase disorder.
- C fatigue due to taking two flights.
- D no effect on her sleep-wake cycle.

**Question 6** (1 MARK)

Yolanda is a construction worker. Her work schedule usually consists of one week of morning shifts, followed by a week of afternoon shifts and then followed by a week of night shifts. During the week of morning shifts, she feels extremely fatigued.

It is likely that Yolanda is experiencing

- A a dyssomnia.
- B delayed sleep-onset.
- C a circadian phase disorder.
- D disrupted ultradian rhythms.

*Adapted from VCAA 2017 sample exam MCQ44*

**Question 7** (2 MARKS)

Koko is a year 12 student. During the week, she begins to feel sleepy at around midnight even though she has to wake up for school at 6 am. Her older brother Connor is 28 and works full time. Connor begins to fall asleep at around 10.30pm and consistently wakes between 7am to 8am both during the week and on the weekend.

Referring to the scenario, describe the biological reason as to why Koko tends to fall asleep later than her brother.

*Adapted from VCAA 2017 sample exam MCQ43*

**Question 8** (2 MARKS)

Morgan is finding it difficult to cope in her final year of high school. Although she has a fantastic group of friends and is doing subjects that she loves, she has trouble getting out of bed every morning and is often late to school. This has become so bad that her parents have decided to take her to Dr Luk-Tung, a sleep specialist. Dr Luk-Tung discovers that Morgan does not go to bed until around 2am because she says that she does not feel tired until that time.

With reference to the changes in her sleep-wake cycle, explain why adolescents like Morgan find it difficult to get up for school in the mornings.

*Adapted from Edrolo and A.Muller, 2017.*



**Questions from multiple lessons****Question 9** (1 MARK)

Carter's dream job was to work as a flight attendant. After being hired, he found it hard to cope with the long night shifts and was often tired. On one particular flight, he started to doze off when he sat down.

How might his brain wave patterns change from when he was alert to when he sat down and began to doze off?

- A** There was no change.
- B** Increased frequency, decreased amplitude.
- C** Decreased frequency, increased amplitude.
- D** Decreased frequency, decreased amplitude.

**Question 10** (3 MARKS)

Mustafa constantly argues with his mum about his sleeping habits. She insists that he must go to bed at 9:30pm, the same time that she does. However, he argues that he can never fall asleep at this time, and instead often stays on his phone until around 11pm.

- a** Identify the circadian phase disorder Mustafa is experiencing. (1 MARK)
- b** After a family wedding, both Mustafa and his mum go to sleep at 12am.

If both Mustafa and his mum wake at the same time the following day, who is more likely to experience greater levels of fatigue? Justify your response. (2 MARKS)

**Question 11** (5 MARKS)

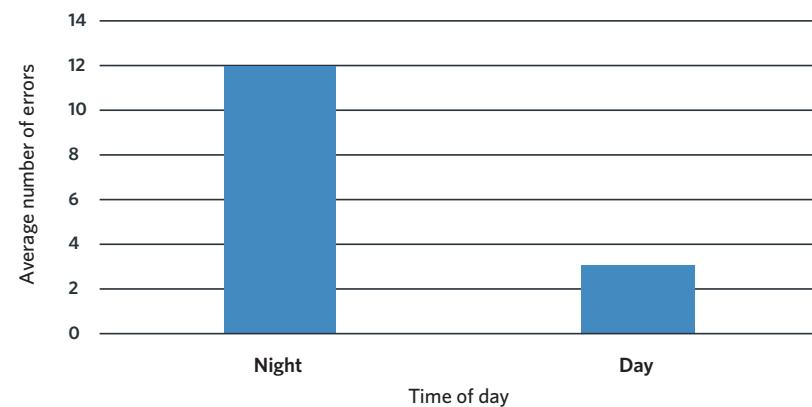
Tahlia is a sleep specialist. She has many clients who are shift workers and have difficulty sleeping. They report feeling extremely fatigued, many of them seeking her help after an accident occurring at their workplace due to excessive sleepiness. Tahlia helps her clients by implementing measures to change their sleep-wake cycles, allowing for better quality and quantity of sleep.

- a** Describe the restoration theory of sleep. (1 MARK)
- b** Explain whether the experiences of Tahlia's clients support the restoration theory. (2 MARKS)
- c** Identify an effect of sleep deprivation evident in the scenario, using an example. (2 MARKS)

**Key science skills****Question 12** (4 MARKS)

A sleep scientist, Dr Mitra, approached a road construction company and requested to research the effects of shift work on the cognitive functioning of employees. After receiving permission, Dr Mitra observed the employees during a night shift on three occurrences as well as during a day shift on three occurrences. Dr Mitra followed the same five employees, their average results are displayed in the table:

**Effects of shift work on cognitive functioning**



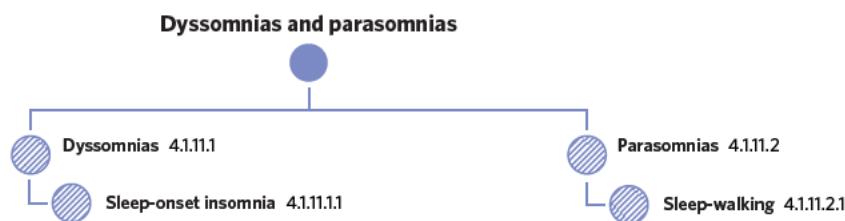
- a** Outline one advantage of using a repeated measures design. (1 MARK)
- b** What conclusion could Dr Mitra draw from his results about the effect of shift work on cognitive functioning? Refer to the results shown in the graph. (3 MARKS)

# 10D DYSSOMNIAS AND PARASOMNIAS

So far in this chapter, you have learned about sleep deprivation and its affective, behavioural and cognitive effects. You have also learned to compare the effects of sleep deprivation and blood alcohol concentration (BAC), as well as the impact of circadian phase disorders on the sleep-wake cycle. Now you will be learning about the difference between dyssomnias and parasomnias, as well as the impact of sleep-onset insomnia (a dyssomnia) and sleep-walking (a parasomnia) on the sleep-wake cycle.

10A. Sleep deprivation	10B. Sleep deprivation and blood alcohol concentration	10C. Circadian phase disorders	10D. Dyssomnias and parasomnias	10E. Sleep disorder interventions
<b>Study design dot point</b>				
▪ the distinction between dyssomnias (including sleep-onset insomnia) and parasomnias (including sleep-walking) with reference to the effects on a person's sleep-wake cycle				
<b>Key knowledge units</b>				
Sleep-onset insomnia (Dyssomnias)				4.1.11.1.1
Sleep-walking (Parasomnias)				4.1.11.2.1

In this lesson, you will be learning about dyssomnias and parasomnias, both of which are types of sleep disorders. In particular, you will be learning about **sleep-onset insomnia**, which is a type of dyssomnia, and **sleep-walking**, which is a type of parasomnia.



## Dyssomnias 4.1.11.1

### OVERVIEW

Dyssomnias are a type of sleep disorder which involve a difficulty to initiate or maintain sleep.

### THEORY DETAILS

**Sleep disorders** involve consistent sleep disturbances which impact an individual's sleep-wake cycle. Individuals who experience sleep disorders also experience significant disruptions to their level of functioning while awake. **Dyssomnias** are one type of sleep disorder, characterised by difficulty falling, staying or appropriately timing sleep.

Dyssomnias disrupt the sleep-wake cycle and can cause an individual to lack an adequate quality or quantity of sleep. The consistent difficulty to initiate or maintain sleep can lead to excessive levels of sleepiness.

Some causes of dyssomnias include:

- Genetic predisposition
- Inadequate coping strategies to deal with stress
- Poor sleep habits

### Useful tip

To help remember the definition of dyssomnias, you can remember that dyssomnias begin with **D** and involve **Difficulty** initiating, maintaining or timing sleep.

**Sleep disorder** a consistent presence of a particular sleep disturbance which has profound impacts on an individual's sleep, leading to persistent effects on day to day functioning

**Dyssomnias** sleep disorders characterised by consistent problems with falling asleep, staying asleep, or timing sleep

**lesson link** Dyssomnias often lead to excessive sleepiness which may result in partial sleep deprivation, an area you have already explored in lesson 10A: **Sleep deprivation**. If you need a refresher, return to this lesson where you learned the affective, cognitive and behavioural effects of sleep deprivation.



### Sleep-onset insomnia 4.1.11.1

**Sleep-onset insomnia** is a type of dyssomnia as it involves consistent difficulty initiating sleep. However, once asleep, individuals with sleep-onset insomnia are typically able to sleep through the night.

Sleep-onset insomnia significantly impacts the sleep-wake cycle by:

- reducing the quality of sleep.
- causing frustration about the inability to fall asleep, which may make it even harder to initiate sleep.

Key characteristics include:

- Consistent inability to fall asleep
- Complaints of poor sleep
- Negative impacts on day to day functioning e.g. concentration, mood and fatigue
- Inability to initiate sleep even with appropriate opportunities

A diagnosis is often achieved through the use of a sleep diary, sleep questionnaires and, occasionally, a sleep laboratory study.

**Sleep-onset insomnia** a type of dyssomnia characterised by consistent difficulty initiating sleep



If sleep-onset insomnia regularly occurs, it can lead to delayed sleep-onset which involves falling asleep and waking later than normal, such as in the adolescent sleep-wake cycle shift. Turn back to lesson 10C: **Circadian phase disorders** if you need a refresher on delayed sleep-onset.

#### Want to know more? -

To be diagnosed with sleep-onset insomnia, you must experience certain characteristics. These characteristics include:

- Consistent inability to fall asleep within 20-30 minutes
- Inability to fall asleep at least three times a week
- These conditions must occur for at least three months



Figure 1 Being unable to fall asleep can cause frustration for many people with sleep-onset insomnia

#### Useful tip

In the exam, be careful when identifying sleep-onset insomnia from a scenario. Some characteristics which don't qualify as sleep-onset insomnia are:

- Occasionally being unable to fall asleep
- Being unable to fall asleep as a side effect of medication or treatment

### Parasomnias 4.1.11.2

#### OVERVIEW

Parasomnias are a type of sleep disorder which involves engaging in abnormal behaviours while initiating sleep or during sleep.

#### THEORY DETAILS

Parasomnias are a type of sleep disorder which involves abnormal events or activities that occur during sleep. These activities can be either physiological (e.g. sleep-walking, abnormal movement) or psychological (e.g. nightmares).

Parasomnias can disrupt sleep, leading to the occurrence of excessive sleepiness while awake. However, some individuals are unaware that they are experiencing a parasomnia, such as sleep-walking, and may only discover their behaviour when told by others who have observed it.

#### Sleep-walking 4.1.11.2.1

Also known as somnambulism, **sleep-walking** is characterised as a parasomnia as it involves standing up and engaging in actions or tasks while sleeping. Sleep-walking often involves undertaking everyday tasks, as well as socially inappropriate behaviours which you would not usually complete while awake. An example of this is urinating in a cupboard while sleep-walking. Sleep-walkers are often unaware of their behaviours, as they are most likely to occur in deep sleep, mainly NREM stages 3 and 4.

**Parasomnias** a type of sleep disorder which involves engaging in abnormal activities or tasks while sleeping

**Sleep-walking** a type of parasomnia which involves standing up and undertaking actions or tasks while asleep

Key characteristics when sleep-walking includes individuals having:

- An unfocused, empty gaze
- Usually, a lack of responsiveness to other people's voices
- A sense of confusion and disorientation if woken during an episode

Sleep-walking can disrupt the sleep-wake cycle by:

- Causing sleepiness during the day due to a poor quality of sleep
- Making someone unable to fall back asleep if woken, which may cause a loss of deep sleep

#### Want to know more? —

Parasomnias often occur due to the central nervous system activating inappropriately and stimulating inappropriate activities while asleep.

### Theory summary

In this lesson, you have learned about the difference between dyssomnias and parasomnias, as outlined in table 1. You have also specifically learned about sleep-onset insomnia (a dyssomnia) and sleep-walking (a parasomnia), their characteristics, and the impacts they have on the sleep-wake cycle.

**Table 1** Comparison of dyssomnias and parasomnias

	Dyssomnias	Parasomnias
<b>Definition</b>	A type of sleep disorder characterised by consistent problems with falling asleep, staying asleep, or timing sleep.	A type of sleep disorder which involves engaging in abnormal activities or tasks while initiating sleep or during sleep.
<b>Example</b>	Sleep-onset insomnia	Sleep-walking

**Table 2** Comparison of sleep-onset insomnia and sleep-walking

	Sleep-onset insomnia	Sleep-walking
<b>Characteristics</b>	<ul style="list-style-type: none"> <li>• Consistent inability to fall asleep</li> <li>• Complaints of poor sleep</li> </ul>	<ul style="list-style-type: none"> <li>• Walking or engaging in activity while sleeping</li> <li>• Unfocused gaze</li> <li>• Disoriented if woken</li> <li>• Unresponsive to others</li> </ul>
<b>Impact on sleep-wake cycle</b>	<ul style="list-style-type: none"> <li>• Reduces the quality and quantity of sleep</li> <li>• Impacts day-to-day functioning e.g. concentration/mood</li> </ul>	<ul style="list-style-type: none"> <li>• Sleepiness during the day</li> <li>• Inability to fall asleep if woken during an episode</li> </ul>

Image: Anna Violet /Shutterstock.com

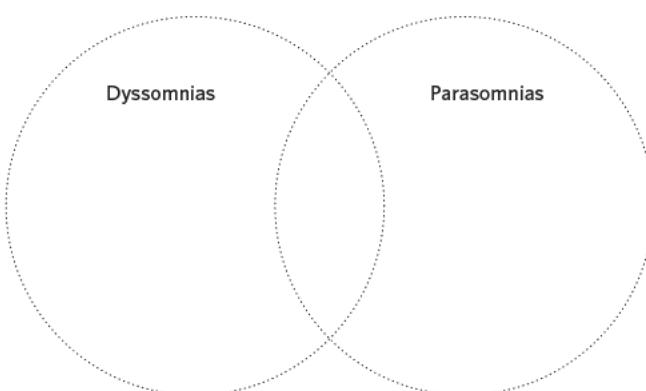
**Figure 2** A visual representation of sleep-walking where an individual is disengaged from their environment.

#### Want to know more? —

It is actually a myth that it is dangerous to wake someone who is sleep-walking. Although they may appear disoriented once awoken, it is safer to wake them as they won't be able to engage in any dangerous activities while sleep-walking.

## 10D Activities

- 1 Compare and contrast dyssomnias and parasomnias in the Venn diagram.



Reproduced from Edrolo and A.Muller, 2017

- 2 From the scenarios below, indicate the sleep disorder each patient is likely suffering from.

- a Nathan's parents are concerned about his wellbeing after witnessing him clean the bathroom at 3am. His mother reports that Nathan's eyes were glassy and he didn't remember this incident in the morning.  
Nathan is likely suffering from \_\_\_\_\_



- b** Josh has been selected to play in a very important football match that will decide if he gets drafted into the AFL. There is a lot of pressure on him to play well and Josh reports that he has been struggling to fall asleep at night because he lies awake thinking about tactics he could use.  
 Josh is likely suffering from \_\_\_\_\_
- c** Although Georgia lives alone, she recently woke up one morning to find that her fridge was open, and all of her milk was gone.  
 Georgia is likely suffering from \_\_\_\_\_

*Reproduced from Edrolo and A.Muller, 2017*

## 10D QUESTIONS

### Theory review questions

#### Question 1

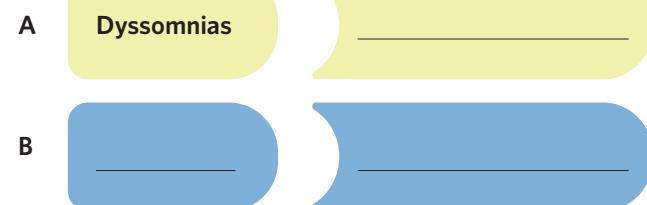
Match the key term from the lesson to the corresponding definition.

- |               |                        |                  |
|---------------|------------------------|------------------|
| • Dyssomnias  | • Sleep-onset insomnia | • Sleep disorder |
| • Parasomnias | • Sleep-walking        |                  |
- a** A type of sleep disorder characterised by getting out of bed and completing actions or behaviours while sleeping \_\_\_\_\_
- b** Sleep disorders characterised by consistent problems with falling asleep, staying asleep, or timing sleep \_\_\_\_\_
- c** Sleep disorders involving inappropriate behaviours or actions while sleeping \_\_\_\_\_
- d** A type of sleep disorder characterised by repeated difficulties when initiating sleep \_\_\_\_\_
- e** A consistent presence of a particular sleep disturbance which has profound impacts on an individual's sleep and day to day functioning \_\_\_\_\_

#### Question 2

Fill in the blanks with the key term from the lesson

- |                        |                 |                        |
|------------------------|-----------------|------------------------|
| • Parasomnias          | • Sleep-walking | • Sleep-onset insomnia |
| Type of sleep disorder | Example         |                        |



### Exam-style questions

#### Remember and understand

#### Question 3 (1 MARK)

Sleep-onset insomnia involves

- A** sometimes being unable to fall asleep.
- B** medications reducing sleep quality.
- C** inappropriate opportunities to fall asleep.
- D** consistent inability to fall asleep.

#### Question 4 (1 MARK)

One key difference between dyssomnias and parasomnias is that

- A** parasomnias involve abnormal behaviours during a sleep episode, whereas dyssomnias involve difficulty initiating or maintaining sleep.
- B** mentally healthy people can experience dyssomnias, whereas only mentally unhealthy people experience parasomnias.

- C** dyssomnias occur unintentionally, whereas parasomnias are intentional.  
**D** dyssomnias can lead to partial sleep deprivation but parasomnias cannot.

**Question 5** (1 MARK)

Which of the following most accurately represents a characteristic of sleep-walking and sleep-onset insomnia?

	Sleep-walking	Sleep-onset insomnia
<b>A</b>	A focused gaze	Reduced quantity and quality of sleep
<b>B</b>	Disorientation if awoken	Difficulty falling asleep despite adequate opportunity
<b>C</b>	A type of parasomnia	Inappropriate activities
<b>D</b>	Difficulty falling back asleep if woken	A type of parasomnia

**Question 6** (2 MARKS)

Using examples, outline the key difference between dyssomnias and parasomnias.

**Apply and analyse****Question 7** (1 MARK)

Yasmine regularly gets up while sleeping and walks around her house. One particular night, Gemma found her heating up food in the microwave and woke her up, interrupting Yasmine's sleep cycle.

Yasmine is likely to be experiencing

- A** sleep-onset insomnia.  
**B** a parasomnia.  
**C** an ultradian rhythm.  
**D** extreme hunger.

**Use the following information to answer questions 8 and 9.**

Hayden's sleep-wake cycle was monitored in a sleep laboratory after he reported difficulty falling asleep. His sleeping patterns were monitored through video recordings conducted by a sleep scientist. Hayden also recorded a personal reflection each night in a sleep diary.

The amount of time it took Hayden to fall asleep in his first week at the laboratory was recorded and is shown in the following table.

**Recording of how long it took Hayden to fall asleep**

	Amount of time Hayden spent trying to fall asleep
<b>Day 1</b>	28 minutes
<b>Day 2</b>	46 minutes
<b>Day 3</b>	13 minutes
<b>Day 4</b>	35 minutes
<b>Day 5</b>	7 minutes
<b>Day 6</b>	29 minutes
<b>Day 7</b>	17 minutes

Adapted from VCAA 2018 exam MCQ25

**Question 8** (1 MARK)

Based on these findings, the sleep scientist can infer that

- A** Hayden may be experiencing sleep-onset insomnia.  
**B** Hayden is experiencing a parasomnia.  
**C** Hayden is experiencing sleep-onset insomnia.  
**D** Hayden needs sleeping tablets.



**Question 9** (1 MARK)

To be diagnosed with this sleep disorder, Hayden needs to display

- A occasional difficulty falling asleep.
- B inability to fall asleep within an hour on one of the seven nights.
- C consistent inability to fall asleep despite adequate opportunity.
- D appropriate reflections in his sleep diary.

**Question 10** (4 MARKS)

Emmet often wakes up feeling exhausted even though he makes sure to go to sleep early. In the mornings, he often finds his belongings in a different place to where he left them. For example, one day, Emmet heard his phone ringing and found it in the freezer.

- a Referring to the scenario, identify the type of sleep disorder Emmet is likely to be experiencing. (2 MARKS)
- b Is this sleep disorder a dyssomnia or parasomnia? Use examples from the scenario to justify your response. (2 MARKS)

**Questions from multiple lessons**

**Use the following information to answer questions 11 and 12.**

Xander is a construction manager who alternates between two weeks of night shifts and then one week of day shifts. Due to his sleep pattern constantly changing, he finds it consistently difficult to initiate sleep.

**Question 11** (1 MARK)

Due to Xander working as a shift worker, he is likely experiencing

- a a parasomnia.
- b a circadian-phase disorder.
- c sleep-walking.
- d stress.

**Question 12** (1 MARK)

Xander's experience has led to the development of sleep-onset insomnia. Some key characteristics he may be experiencing include

- a complaints of poor sleep and feeling disoriented if awoken.
- b inability to respond to others and an occasional inability to fall asleep.
- c consistent inability to fall asleep despite adequate opportunity and a negative impact on daily functioning.
- d consistent inability to initiate sleep and sleep walking.

**Question 13** (3 MARKS)

Molly consistently struggles to fall asleep at night. For the past five months she has struggled to concentrate at school and has found it hard to get out of bed in the morning.

- a Identify the sleep disorder Molly is likely to be suffering from. (1 MARK)
- b Comment on whether Molly's sleep disorder has led to sleep deprivation. Justify your response. (2 MARKS)

Adapted from VCAA 2017 sample exam SAQ5b

**Key science skills****Question 14** (5 MARKS)

A researcher wanted to investigate the relationship between the amount of caffeine consumed by someone and the likelihood of them experiencing sleep-onset insomnia. The researcher selected participants by asking people at his local coffee shop to be in his study. Using an independent groups design, the control group consumed no caffeine while the experimental group consumed 400mg of caffeine each day. This is considered to be the healthy daily amount of caffeine for adult consumption. After a week in these conditions, each participant provided an estimate of how long it had taken them to fall asleep each night.

They had the choice between the following options:

- 0-9 minutes
- 10-19 minutes
- 20-29 minutes
- 30+ minutes

The quantitative results reported that the participants in the experimental condition were more likely to report taking 20-29 or 30+ minutes to fall asleep, compared to the control group who were likely to report taking 0-9 or 10-19 minutes to fall asleep. The researcher concluded that there was a relationship between caffeine and sleep-onset insomnia, stating that consuming 400mg of caffeine makes people more likely to experience sleep-onset insomnia.

- a Is this conclusion valid? Justify your response by making references to the investigation. (2 MARKS)
- b Outline how the use of a placebo in this experiment may control for extraneous variables. Give an example of an extraneous variable the placebo may control for. (3 MARKS)



# 10E SLEEP DISORDER INTERVENTIONS

In this chapter, you have learned about various sleep disorders and difficulties surrounding sleep. In this lesson, you will focus on two possible treatments for sleep disorders.

10A. Sleep deprivation	10B. Sleep deprivation and blood alcohol concentration	10C. Circadian phase disorders	10D. Dyssomnias and parasomnias	10E. Sleep disorder interventions
<b>Study design dot point</b>				
• the interventions to treat sleep disorders including cognitive behavioural therapy (with reference to insomnia) and bright light therapy (with reference to circadian phase disorders)				
<b>Key knowledge units</b>				
Cognitive behavioural therapy to treat insomnia				4.1.12.1
Bright light therapy to treat circadian phase disorders				4.1.12.2

**In this lesson, you will be learning** how some of the sleep disorders discussed in previous lessons can be treated with various interventions. Specifically, you will look at **cognitive behavioural therapy as an intervention to treat insomnia**, and **bright light therapy as an intervention to treat circadian phase disorders**.



## Cognitive behavioural therapy to treat insomnia 4.1.12.1

### OVERVIEW

Cognitive behavioural therapy is a form of therapy that emphasises the relationship between thoughts and behaviour, and can be used as a method for treating insomnia.

### THEORY DETAILS

Cognitive behavioural therapy (CBT) can be used to treat insomnia by replacing unhealthy thoughts (cognitions) and behaviours with more healthy ones. This involves identifying a person's thoughts and behaviours that inhibit sleep, and then substituting them with thoughts and behaviours that promote sleep.

Some unhelpful cognitions a person with insomnia might identify include:

- A feeling that sleep is very difficult to initiate
- Racing thoughts when it's time for sleep
- A fear of the dreams or events that might occur when sleeping
- Anxiety about sleep or anything occurring in their life

In CBT, a person is encouraged to challenge and replace unhealthy cognitions.

For example, a person who believes sleep will always be difficult to initiate might be asked to question whether this is a fact, or whether there is something they can change about their thoughts that is more conducive to sleep. Once a person recognises that their thoughts are not necessarily true, the cognitive component of CBT often encourages the individual to replace their thoughts with more positive ones. For the person who believes they can't fall asleep, this might be a thought like 'it is possible for me to fall asleep.'

**Cognitive behavioural therapy (CBT)** a form of psychotherapy which encourages individuals to substitute unhealthy cognitions and behaviours with healthier ones

On the other hand, behaviours that might contribute to insomnia include:

- Taking naps throughout the day
- Doing lots of stimulating activities in the bedroom or place of sleep, in turn associating the bedroom with activity rather than sleep
- Going on screens or being exposed to bright light before sleep
- Taking stimulants before bed

**lesson link** In lesson 13C:

**Interventions for phobia**, you will learn more about how CBT can be used to treat psychological disorders, specifically in relation to phobias.

In order to substitute these behaviours, a psychologist might:

- Teach meditation and relaxation strategies to use before bed.
- Conduct sleep hygiene education. This involves teaching a person about ways they can promote sleep such as avoiding activities like study in the bedroom that stimulate thought. This helps associate the bedroom as a place of sleep.
- Teach behavioural strategies which may include encouraging a person to keep a fairly consistent sleep-wake cycle.

CBT generally takes several sessions over 6-8 weeks, with the change in behaviour and thoughts being gradual, though fairly successful with about an 80% success rate.

## Bright light therapy to treat circadian phase disorders 4.1.12.2

### OVERVIEW

Bright light therapy is an intervention used to help someone adjust their sleep-wake cycle.

### THEORY DETAILS

As you've learned, circadian phase disorders are those disorders that are characterised by difficulties and misalignments of circadian rhythms. **Bright light therapy** aims to treat these disorders by using bright light to adjust the sleep-wake cycle. Exposure sessions to high-intensity artificial light are used to mimic the role of sunlight. Light hormonally induces wakefulness in the body.

Exposure sessions can last from about 15 minutes to a couple of hours and are conducted up to a few times a day. In order to readjust the sleep wake cycle, a person needs to conduct these sessions for at least a few consecutive days. This helps to gradually shift a person's sleep-wake cycle, as they can adjust the time of the exposure session each day to reach their desired waking time.

Factors essential to successful bright light therapy include:

- Appropriate timing of exposure sessions:  
They must occur at the right time in order to make a person feel awake at the right time. For example, people who feel sleepy by dinner time can conduct an exposure session in the evening.
- The right amount of light:  
The intensity of the light and the length of exposure sessions must be appropriate to the person's disorder and desired changes to their circadian rhythm. The intensity and length should also be built up gradually in order to avoid negative side effects like headaches.
- Safe exposure:  
A person does not have to look directly at the light, and their face should be an adequate distance away from the light source. Figure 1 shows a person undergoing an exposure session.

**Bright light therapy** a method used to adjust a person's circadian rhythm through exposure to a high-intensity light source



Image: Image Point Fr /Shutterstock.com

Figure 1 A woman undergoing bright light therapy.

### Want to know more?

As mentioned in lesson 9A: **Sleep rhythms**, the sleep-wake cycle is regulated by the release of melatonin, a hormone which causes sleepiness. Melatonin release is induced by the suprachiasmatic nucleus (SCN), which is a part of the brain that responds to light levels received by the eyes. When exposed to light, the suprachiasmatic nucleus blocks the release of melatonin, making the brain feel awake and alert.





You should be able to explain how bright light therapy can be used to treat each of the circadian phase disorders identified in lesson **10C: Circadian phase disorders**. Table 1 summarises how it might be used to treat these disorders.

**Table 1** Applying bright light therapy to different circadian phase disorders

Sleep-wake cycle shift in adolescence	Shift work	Jet lag
<ul style="list-style-type: none"> <li>Because adolescents generally find it difficult to wake up in the morning, exposure sessions during the morning might help to induce wakefulness.</li> <li>Avoidance of light in the evening and screens before bed should be used in conjunction with bright light therapy.</li> </ul>	<ul style="list-style-type: none"> <li>If a person works night shift, then they should conduct exposure sessions during the evening before a shift.</li> <li>They should also avoid exposure to daylight during the day if that is when they are supposed to be asleep.</li> </ul>	<ul style="list-style-type: none"> <li>The best time for an exposure session will vary depending on the timezone a person has to adjust their sleep-wake cycle to.</li> <li>If a person's sleep wake cycle needs to be advanced (i.e. waking time needs to be brought forward), they should conduct an exposure session in the morning at their travel destination.</li> <li>If a person's sleep cycle needs to be delayed (i.e. sleep time needs to be pushed back), an exposure session should be conducted prior to flying to keep a person awake on the flight.</li> </ul>

## Theory summary

In this lesson, you have learned about two interventions for sleep disorders. You should now be familiar with the use of CBT for treating sleep onset insomnia, as well as the use of bright light therapy for treating circadian phase disorders. You should be able to explain the purpose of each therapy, as well as the specific processes involved in their application.

## 10E Activities

- 1 Use the following table to summarise your knowledge on the sleep disorders in this lesson

Cognitive behavioural therapy	Bright light therapy
Used to treat:	Used to treat:
Processes involved:	Processes involved:

## 10E QUESTIONS

### Theory review questions

#### Question 1

Match the definition to the key terms, including the corresponding therapy treatment defined and the type of sleep disorder it treats.

- Insomnia
- Cognitive behavioural therapy
- Circadian phase disorders
- Bright light therapy

- a A form of therapy used to adjust the sleep-wake cycle through exposure to a light source.

Therapy: \_\_\_\_\_ Sleep disorder type: \_\_\_\_\_

- b A form of therapy which involves replacing unhealthy thoughts and behaviours with healthy ones.

Therapy: \_\_\_\_\_ Sleep disorder type: \_\_\_\_\_

**Exam-style questions*****Remember and understand*****Question 2** (1 MARK)

Cognitive behavioural therapy and bright light therapy are respectively used to treat

- A insomnia, circadian phase disorders.
- B circadian phase disorders, night terrors.
- C insomnia, muscle paralysis.
- D ultradian phase disorders, insomnia.

**Question 3** (1 MARK)

Which of the following is the least likely to be used in cognitive behavioural therapy to treat insomnia?

- A Education about how to associate the bedroom with sleep.
- B Discussion of the deep psychological causes behind sleep anxiety.
- C Teaching of meditation and relaxation techniques.
- D Identification of unhelpful thoughts surrounding sleep.

**Question 4** (3 MARKS)

Outline how cognitive behavioural therapy (CBT) could be used to treat insomnia.

*Adapted from VCAA 2017 sample exam SAQ5c*

***Apply and analyse******Use the following information for questions 5 and 6.***

Poppy is a baker who has to work night shifts. Five nights a week she has to work from 2am to 7am, and suffers from difficulty sleeping on the nights she does not have to work as she feels very awake. Poppy's doctor has recommended that she use bright light therapy.

**Question 5** (1 MARK)

Bright light therapy would work best if

- A conducted in the morning of the days Poppy does not have work.
- B conducted in the evening of the days Poppy does not have work.
- C conducted in the morning of the days Poppy does have work.
- D conducted in the evening of the days Poppy does have work.

**Question 6** (1 MARK)

Bright light therapy will help Poppy by resetting

- A her ultradian rhythms as she is experiencing a parasomnia.
- B her ultradian rhythms as she is experiencing a circadian phase disorder.
- C her circadian rhythms as she experiencing a parasomnia.
- D her circadian rhythms as she is experiencing a circadian phase disorder.

*Adapted from 2017 VCAA sample exam MCQ44*

**Question 7** (2 MARKS)

Hale is an actress who often has to travel for work. She recently got a role in a film in Europe, and has to travel there from Australia. Her schedule is very tight and she has to start working the day after she arrives. In order to combat her jet lag, her doctor recommended she try bright light therapy.

Outline how bright light therapy could be used to help Hale manage her jet lag.

*Adapted from VCAA 2018 exam SAQ6e*



**Questions from multiple lessons**

**Use the following information for question 8 and 9.**

Eddie is currently undergoing cognitive behavioural therapy (CBT) to treat his insomnia. After talking with a psychologist, Eddie identified that he had been doing stressful activities in his bedroom like studying on his computer before trying to sleep. His psychologist has since been teaching him about sleep hygiene and how he can learn to associate his bedroom with feeling sleepy. The psychologist asked Eddie to put only warm, low-lighting in his bedroom.

**Question 8** (1 MARK)

In CBT, Eddie doing stressful activities like studying before bed may be considered a

- A behavioural component that needs to be changed.
- B cognitive component that needs to be changed.
- C emotional component that needs to be changed.
- D psychological component that needs to be changed.

**Question 9** (1 MARK)

The pairing of Eddie's bedroom with warm, low-lighting uses which type of learning to form the association of the bedroom and sleepiness?

- A Observational learning
- B Trial and error learning
- C Classical conditioning
- D Operant conditioning

**Question 10** (4 MARKS)

Each morning Rohan finds it very difficult to get out of bed and wakes up feeling extremely drowsy due to his experience of a circadian phase disorder. Rohan is about to begin bright light therapy after his doctor advised him to. Rohan was instructed to conduct exposure sessions to the bright light each morning.

- a Outline how bright light therapy could be used to help Rohan get up in the morning. (2 MARKS)
- b Describe what might happen to Rohan's alertness and brain wave patterns from when he wakes up feeling drowsy, to when he feels more awake after exposure to the bright light source. (2 MARKS)

**Question 11** (4 MARKS)

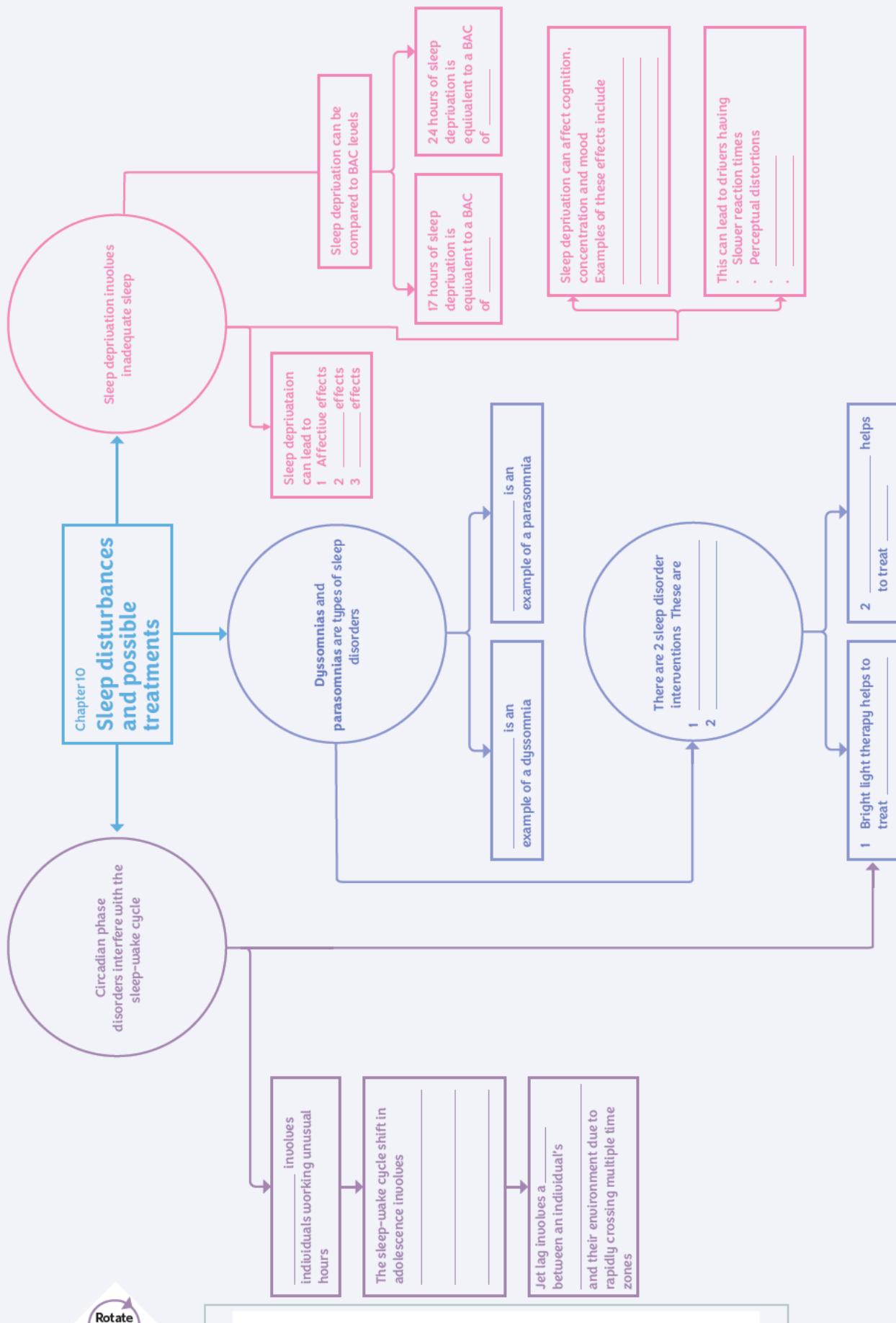
Beau recently divorced from his wife and is adjusting to living in a house by himself. He feels very sad and stressed. He is suffering from insomnia, and thinks his inability to sleep is because he isn't comfortable sleeping alone.

- a In terms of sources of stress, what kind of stress is Beau currently experiencing? Justify your response. (2 MARKS)
- b What might a psychologist who conducts cognitive behavioural therapy with Beau suggest as a behavioural strategy he can employ to help with his insomnia? (2 MARKS)

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own that includes all concepts from the chapter.



**Review activity 2: Example bank**

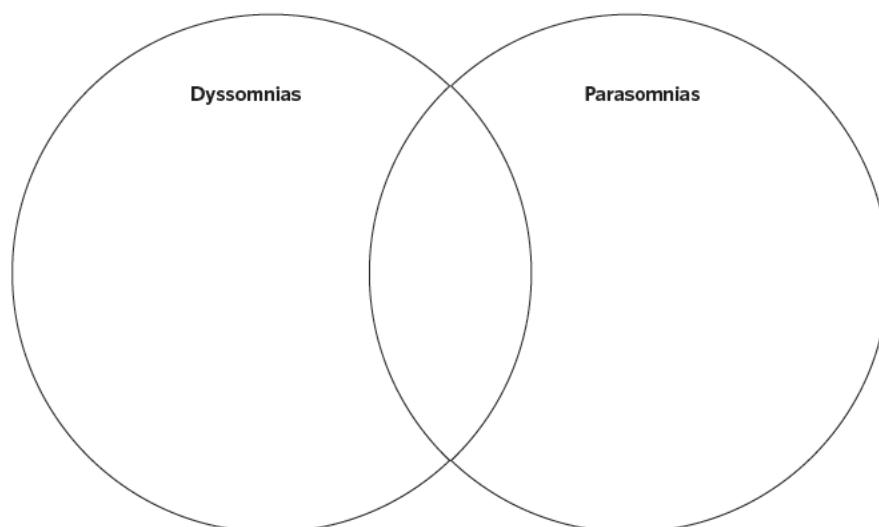
Fill in the table with your own notes.

Key terminology	Your own definition	Example
Affect		
Amplified emotional response		
Cognition		
Blood alcohol concentration (BAC)		
Concentration		
Mood		
Circadian phase disorder		
Sleep-wake cycle shift in adolescence		
Shift work		
Jet lag		
Sleep disorder		
Dyssomnias		

Key terminology	Your own definition	Example
Sleep-onset insomnia		
Parasomnias		
Sleep-walking		
Cognitive behavioural therapy (CBT)		
Bright light therapy		

### Review activity 3: Venn diagram

Fill in the venn diagram below, thinking of as many differences and similarities between dyssomnias and parasomnias as you can.



**Review activity 4: Notes from Ted Talk video**

Go to the TedTalks website ([Ted.com](https://www.ted.com)) and find the video called *Sleep is your superpower* by Matt Walker. (TED, 2019)

Take notes on what is said about the following concepts.

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Learning and memory

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Alzheimer's disease

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Restoration theory of sleep

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Sleep deprivation

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Shift work

---

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---

Stimulants and depressants

---

---

## CHAPTER TEST

### Multiple choice questions

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**Question 1** (1 MARK)

Both a person who has not slept for 24 hours as well as a person with a BAC of 0.10 will

- A have faster reaction times than normal.
- B have more restricted content limitations.
- C have impaired precision and concentration.
- D have an accurate sense of time.

---

**Question 2** (1 MARK)

Shift work can disrupt the sleep-wake cycle due to

- A creating a mismatch between the internal ultradian rhythm and the environment.
- B the circadian rhythm being unable to constantly adapt to changing sleep and wake times.
- C the delayed release of melatonin.
- D causing sleep cycles to be less than 90 minutes.

**Question 3** (1 MARK)

The consumption of alcohol and the effects of sleep deprivation will not lead to

- A enhanced concentration abilities.
- B reduced reaction times and cognitive distortions.
- C a lower level of awareness while driving.
- D reduced concentration and an increased likelihood of errors.

**Question 4** (1 MARK)

A delayed release of melatonin may lead to

- A a parasomnia.
- B an ultradian phase disorder.
- C shift work.
- D the sleep-wake cycle shift in adolescence.

**Question 5** (1 MARK)

Olympia has recently been promoted to junior partner at the law firm where she works. Although she is extremely excited about her new role, she is finding it difficult to keep up with the workload. She is often awake late at night, continuously drinking coffee to stay awake. When she finally goes to bed, she finds it difficult to initiate sleep due to her racing mind.

If a sleep psychologist were to use cognitive behavioural therapy to treat Olympia's insomnia, which of the following behaviours would Olympia **not** be advised to do?

- A Take more naps throughout the day.
- B Use meditation techniques before bed.
- C Question whether her unhealthy thoughts about sleep are realistic.
- D Try to go to bed and wake up at the same time each day.

**Question 6** (1 MARK)

Sleep deprivation can impact an individual's ability to function during waking hours. An example of a behavioural effect of sleep deprivation is

- A increased motivation.
- B slower reaction times.
- C a reduced level of fatigue.
- D increased motor control.

***Use the following information for questions 7 and 8.***

Kamal is a surgeon who constantly has to work overnight at the hospital. When she gets home after a night shift, she often finds it difficult to fall asleep.

**Question 7** (1 MARK)

The circadian phase disorder Kamal is experiencing is due to

- A sleep-onset insomnia.
- B jet lag.
- C shift work.
- D a parasomnia.



**Question 8** (1 MARK)

Kamal visits a psychologist who suggests that bright light therapy could be used as a treatment for Kamal. Which of the following correctly explains what is involved in bright light therapy?

- A Exposure to bright light which mimics the role of sunlight, leading to individuals feeling sleepy directly after exposure to the light.
- B Exposure sessions to light occur once every two months to adjust an individual's sleep-wake cycle.
- C Individuals are exposed to bright artificial light to induce feelings of wakefulness.
- D Individuals are exposed to bright light directly before attempting to fall asleep.

**Question 9** (1 MARK)

Shift work, jet lag, and the sleep-wake cycle shift in adolescence are all examples of

- A mental health conditions.
- B factors that affect the circadian rhythm.
- C sleep disturbances caused by stress.
- D sleep disturbances which can be treated by cognitive behavioural therapy.

*Adapted from VCAA 2017 exam MCQ6*

**Question 10** (1 MARK)

In relation to cognition, when compared to an individual who is experiencing total sleep deprivation, an individual with a BAC of 0.05 is likely to experience

- A a greater amount of cognitive distortions.
- B a more distorted sense of time.
- C the same level of reduced speed and accuracy.
- D a slightly better ability to make decisions effectively.

**Short answer questions****Question 11** (4 MARKS)

Keisha was worried the night before her driving test when she realised that she would only get 5 hours of sleep that night.

- a Outline which type of sleep deprivation Keisha is likely to be experiencing on the day of her driving test. Justify your response. (2 marks)
- b Identify examples of how Keisha's cognitive and behavioural functioning could be impacted during her driving test due to her sleep deprivation. (2 marks)

**Question 12** (7 MARKS)

Carter is a mature age student returning to university after spending five years working as a legal secretary. During one of his psychology lectures, he learnt that adults need around 7 hours of sleep a night to fully function during the day. He came home and told his family, including his 10-year-old sister, that everyone needs to sleep for 7 hours. Carter's mother told Carter that his sister needs more than 7 hours of sleep otherwise she will be sleep deprived.

Carter always tries to fall asleep at 12am and has to wake up for university or work at 6am each day. However, he often finds it hard to fall asleep and sometimes finds himself still awake at 2am.

- a Identify the likely sleep disorder that Carter is suffering from. (1 mark)

*Adapted from VCAA 2017 sample exam SAQ5b*

- b Identify the type of sleep disorder intervention which could be used to help treat Carter's sleep disorder and outline how this intervention could be used. (3 marks)
- c Is Carter's mother's comment correct? Justify your response. (3 marks)

**Question 13** (4 MARKS)

Damon's partner has recently been telling him that he has been getting up out of bed and walking around the house while sleeping. His partner often tries to talk to him while this occurs but he never responds.

- a Identify whether Damon is experiencing a dyssomnia or parasomnia. Justify your response. (2 marks)
- b Referring to the scenario, explain whether Damon is likely to be experiencing a high level of self-control. (2 marks)

**Key science skills questions****Question 14** (5 MARKS)

Florence was admitted to St Alfred's Hospital for two weeks after getting in a car accident. During her stay, the nurses reported her performing abnormal behaviours while sleeping and told one of the sleep specialists at the hospital, Dr Navi. After Florence's second night, Dr Navi decided to set up a camera in Florence's room and the hallway outside her room to record her actions while sleeping. This camera was set up without Florence's knowledge.

The actions he recorded from the cameras over the next 10 days are outlined in the following table.

Action while sleeping	Number of occurrences
Putting her shoes on	4
Attempting to jog around the corridors	2
Trying to walk out of the hospital	1
Removing her clothes in the corridor	1

- a Based on this information, name the sleep disorder Dr Navi might conclude that Florence is experiencing. (1 mark)

*Adapted from VCAA 2018 exam MCQ25*

- b Identify an example of a cognitive and affective effect of sleep deprivation that Florence may experience on a day to day basis due to the actions she performs while sleeping. (2 marks)
- c Identify an ethical consideration that Dr Navi has not complied with during this study. Justify your response by referring to the scenario. (2 marks)

**Extended response****Question 15** (10 MARKS)

Fabio is part of a large international technology corporation. Part of his role is to fly to meet prospective clients, some of which are overseas. This often leads to Fabio travelling to an overseas country at least once every three weeks.

After noticing their employees become progressively fatigued the more travel they do, the corporation decided to run a day-long seminar on the effects of jet lag. Unfortunately, at the time of this seminar, Fabio was in America meeting with an important client. Fabio's boss asked the psychologists running the session to put together a brochure with all the information Fabio would need to learn about the effects of jet lag and the behaviours he could implement into his lifestyle to minimise these effects. Information in the brochure referred to the biological processes involved in circadian phase disorders, especially jet lag, the effects of sleep deprivation and the use of bright light therapy as a sleep disorder intervention. The brochure also referred to the biological rhythms involved in the sleep-wake cycle.

Considering the above information, create a detailed set of notes which covers the information Fabio would likely receive from the brochure.

*Adapted from VCAA 2017 exam SAQ8*





# UNIT 4

# AOS2

## What influences mental wellbeing?

**In this area of study, students examine what it means to be mentally healthy. They explore the concept of a mental health continuum and factors that explain how location on the continuum for an individual may vary over time. Students apply a biopsychosocial approach to analyse mental health and mental disorder, and evaluate the roles of predisposing, precipitating, perpetuating and protective factors in contributing to a person's mental state. Specific phobia is used to illustrate how a biopsychosocial approach can be used to explain how biological, psychological and social factors are involved in the development and management of a mental disorder. Students explore the concepts of resilience and coping and investigate the psychological basis of strategies that contribute to mental wellbeing.**

## Outcome 2

On completion of this unit the student should be able to explain the concepts of mental health and mental illness including influences of risk and protective factors, apply a biopsychosocial approach to explain the development and management of specific phobia, and explain the psychological basis of strategies that contribute to mental wellbeing.





# 11

UNIT 4 AOS 2, CHAPTER 11

## Defining mental health

### 11A Mental health continuum

- mental health as a continuum (mentally healthy, mental health problems, mental disorders) influenced by internal and external factors that can fluctuate over time

### 11B Characteristics of a mentally healthy person

- the typical characteristics of a mentally healthy person, including high levels of functioning, social and emotional wellbeing and resilience to life stressors

### 11C Mental health and ethics

- ethical implications in the study of, and research into, mental health, including informed consent and use of placebo treatments

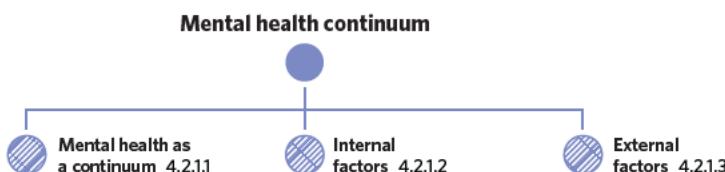


# 11A MENTAL HEALTH CONTINUUM

In the previous chapter, you learned about the different types of sleep disturbances and their treatments. Now, you will learn about the concept of mental health and how this sits on a continuum. You will also learn about the influence of internal and external factors on an individual's mental health at any particular point in time.

11A. Mental health continuum	11B. Characteristics of a mentally healthy person	11C. Mental health and ethics
<b>Study design dot point</b>		
<ul style="list-style-type: none"> <li>mental health as a continuum (mentally healthy, mental health problems, mental disorders) influenced by internal and external factors that can fluctuate over time</li> </ul>		
<b>Key knowledge units</b>		
Mental health as a continuum		4.2.1.1
Internal factors		4.2.1.2
External factors		4.2.1.3

**In this lesson, you will be learning about the mental health continuum** and the difference between **mental health, a mental health problem and a mental health disorder**. You will also learn about **internal and external factors** which influence mental health.



## Mental health as a continuum 4.2.1.1

### OVERVIEW

The mental health continuum involves the progression of levels of mental health. This ranges from an individual being mentally healthy, to having a mental health problem, and finally, to having a mental health disorder.

### THEORY DETAILS

An individual's **mental health**, or their current psychological state of functioning and wellbeing, constantly fluctuates over time. This leads to individuals being placed at different points on the mental health continuum over their lifetime.

The **mental health continuum** refers to a progression which ranges from mentally healthy, through to mental health problems, and then to mental health disorders. Every individual is placed at a certain category of this continuum at a certain time. However, as mental health is a dynamic state, an individual's placement on the continuum is not fixed and can fluctuate over time.

**Mental health** the current state of a person's psychological wellbeing and functioning

**Mental health continuum**  
a tool used to track progression of mental health which constantly fluctuates over time, progressing from mentally healthy, to mental health problems, to mental health disorders

**The mental health continuum**



**Figure 1** The mental health continuum ranges from mentally healthy, to mental health problems, and then to mental health disorders

**Want to know more?**

The World Health Organisation provides a definition of the state of being mentally healthy which may help to consolidate your understanding of mental health.

Mental health: a state of wellbeing in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.

(WHO, 2014)

**Mentally healthy** a psychological state that allows an individual to function independently and effectively within their environment, display resilience and have high social and emotional wellbeing

**Useful tip**

It is extremely important to remember that an individual's placement on the mental health continuum at a particular point in time is never static. Due to an individual's mental health fluctuating over time, their position on this continuum is subject to constant change.

The state of being **mentally healthy** is at one end of the continuum. This end of the continuum describes individuals who are able to independently and effectively function within their everyday life. This includes coping with the everyday demands of life without showing an excessive level of distress and dysfunction.

Characteristics of a mentally healthy individual include:

- High levels of functioning
- Able to cope with stress
- Able to meet the demands of everyday life and be productive
- Displays resilience
- Maintains positive relationships with others
- Able to regulate emotions and express them appropriately

**Useful tip**

It is important to understand that mentally healthy individuals still experience stress, sadness and anger during their lives. However, they are mentally healthy due to their ability to cope with these experiences, regulate their emotions and express them appropriately.

 There are many characteristics individuals must display within their everyday life to be considered mentally healthy. These are explored in the next lesson  
**11B: Characteristics of a mentally healthy person.**

In the middle of the continuum are **mental health problems**. Mental health problems involve a degree of disturbance or dysfunction within an individual which reduces their ability to function at an optimal level. Mental health problems can have a negative and considerable impact on an individual's daily functioning. However, in comparison to a mental health disorder, this impact is less profound and typically only experienced temporarily.

Characteristics of a mental health problem include:

- Not functioning at an optimal level
- Temporary impact on mental health
- Experiencing amplified emotions and high levels of stress
- Difficulty concentrating and experiencing irrational thought patterns

**Example:**

An individual is unable to cope with their year 12 exams. During this time, this individual may be unable to sleep because of their intense stress and may be constantly crying. However, after the exams finish, the individual is able to restore independent functioning. For this reason, the temporary and less severe nature of this individual's dysfunction demonstrates that they would most likely be placed on the mental health problem category on the continuum, rather than at the mental health disorder category.

**Mental health disorders** cause severe and profound disturbances to an individual's ability to function. When experiencing mental health disorders, individuals are not likely to be described as mentally healthy due to showing high levels of distress, being unable to independently complete tasks and meet the demands of their environment. Individuals with mental health disorders typically display behaviour which does not meet the norms of society and may be deemed as inappropriate.

Mental health disorders are diagnosable and may be treated through psychotherapy or medication.

**Mental health problem**

a psychological state that is temporarily hindered by the presence of a disturbance to normal functioning, which has negative, but not severe impacts on everyday functioning

**Mental health disorder**

a psychological state characterised by the presence of a severe disturbance and sense of distress which significantly impacts an individual's ability to function independently



### Example – Anxiety disorders:

One example of a mental health disorder is an anxiety disorder. This type of mental health disorder is characterised by an extreme level of distress which significantly disrupts an individual's daily functioning and ability to cope with the demands of their everyday life. Individuals diagnosed with an anxiety disorder may experience panic attacks and irrational thoughts, indicating that they may not be considered mentally healthy. At this particular point in their life, they would be placed at the end of the mental health continuum due to displaying the characteristics of a mental health disorder. With this in mind, it is important to remember that this is just one example of a mental health disorder. There are many more types of mental health disorders which impact individuals in different ways.

### Want to know more?

Individuals who are diagnosed with a mental health disorder display the '3 Ds':

**Deviance:** acting in rare or unusual ways which violate social norms

**Dysfunction:** unable to function independently within their environment

**Distress:** profound personal suffering

### Want to know more? –

The mental health continuum supports the recent shift in approaching the diagnosis of mental health disorders. This involves shifting from the former approach, which involved rigid definitions and categories accompanied by certain symptoms of each mental health disorder.

The more recent approach involves identifying what it means to have good mental health. Accompanied by the mental health continuum, this is a more flexible and personal approach to mental health and mental health disorders.

## Internal factors 4.2.1.2

### OVERVIEW

Internal factors which contribute to mental health arise from within an individual.

### THEORY DETAILS

An individual's mental health can be influenced by **internal factors**. These factors stem directly from an individual and can change over time. Internal factors have a profound impact on an individual's particular placement on the mental health continuum at different stages of their life. Originating from within an individual, internal factors stem from either a biological or psychological source.

Examples of internal factors which impact an individual's mental health include:

- Stress response
- Amount of sleep
- Thought patterns
- Genetic predisposition

### Example:

One type of internal factor is an individual's genetic vulnerability which is also known as genetic predisposition. If an individual has a family history of a particular mental health disorder, they may have an increased likelihood of developing this disorder, therefore impacting their mental health.

## External factors 4.2.1.3

### OVERVIEW

External factors arise from an individual's surroundings or outside environment and also contribute to an individual's mental health.

### THEORY DETAILS

External factors influence an individual's mental health and are directly linked to an individual's environment. An individual can experience many fluctuations of their external factors due to the constant changes in their environment. These fluctuations may impact an individual's position on the mental health continuum, either moving closer towards or further away from being mentally healthy.

Have you ever felt less able to cope with stress when going through a tough time with a friend? Would you say that you were less mentally healthy during this time? An individual's social relationships are an example of an external factor which can impact mental health.

**Internal factors** factors which arise from within the individual and contribute to their mental health



Image: Rvector/Shutterstock.com

**Figure 2** An individual's DNA may be an example of an internal factor as it may contain a genetic predisposition for certain mental health disorders.



Due to the internal factors of mental health arising from within an individual, they mainly consist of biological and psychological risk factors.

Some examples of biological risk factors which are internal include genetic vulnerability and poor sleep. These are explored in lesson **12B: Biological risk factors**.

Poor self-efficacy, stress, impaired reasoning and memory and rumination are all examples of psychological risk factors which are also internal factors. You will learn more about these factors in lesson **12C: Psychological risk factors**.

**External factors** factors which arise from the environment of an individual and contribute to their mental health

Examples of external factors which impact an individual's mental health include:

- Loss of a significant relationship
- Level of education
- Experiencing difficulty within certain environments, such as at work or school

#### **Useful tip**

It is important to remember that an individual's external environment can lead to changes to their internal environment, causing fluctuations of internal factors over time. For example, being exposed to drugs (external) can impact an individual's internal factors, such as leading to increased levels of stress and dysfunction. This may lead to a negative impact on an individual's mental health.

This demonstrates how internal and external factors interrelate and can influence each other, both contributing to an individual's level of mental health.



Social risk factors can contribute to the external factors which influence an individual's mental health. Examples of social risk factors include disorganised attachment and loss of a significant relationship, which you can explore in lesson 12D: *Social risk factors*.

## Theory summary

In this lesson, you have learned about the mental health continuum and the impacts of internal and external factors on an individual's mental health. You should be able to understand the progression of the mental health continuum, including the range from mentally healthy, to mental health problems, to mental health disorders. In addition, you should also be able to understand the difference between internal and external factors, and how these can lead to fluctuations in an individual's placement on the mental health continuum over time.

**Table 1** Comparison of the categories of the mental health continuum

Categories	Description	Characteristics
<b>Mentally healthy</b>	Able to meet the demands of everyday life and function independently and effectively	<ul style="list-style-type: none"> <li>▪ Able to cope with stress</li> <li>▪ Can meet the demands of everyday life</li> <li>▪ Displays resilience</li> </ul>
<b>Mental health problem</b>	Presence of a recognisable but not severe disturbance to normal functioning	<ul style="list-style-type: none"> <li>▪ Unable to function at their optimal level</li> </ul>
<b>Mental health disorder</b>	Presence of a severe disturbance which significantly disrupts functioning and leads to a sense of excessive distress	<ul style="list-style-type: none"> <li>▪ Unable to function independently and effectively</li> <li>▪ Displays a high level of distress</li> </ul>

**Table 2** Comparison of internal and external factors

Factor	Description	Examples
<b>Internal</b>	Arise from within an individual	<ul style="list-style-type: none"> <li>▪ Level of stress</li> <li>▪ Genetic predisposition</li> </ul>
<b>External</b>	Arise from an individual's environment	<ul style="list-style-type: none"> <li>▪ Loss of a significant relationship</li> <li>▪ Trouble at work or school</li> </ul>

#### **Want to know more?**

There are many support services in the community if you want to talk to someone about your own mental health, or the mental health of someone you know.

This includes visiting:

- Your GP
- Your school counsellor
- Non-profit organisation mental health resources.

Headspace and BeyondBlue provide assistance for young adults, with many resources including online chats and forums.

You can visit Headspace at [www.headspace.org.au](http://www.headspace.org.au) and BeyondBlue at [www.beyondblue.org.au](http://www.beyondblue.org.au).



Image: © Beyond Blue



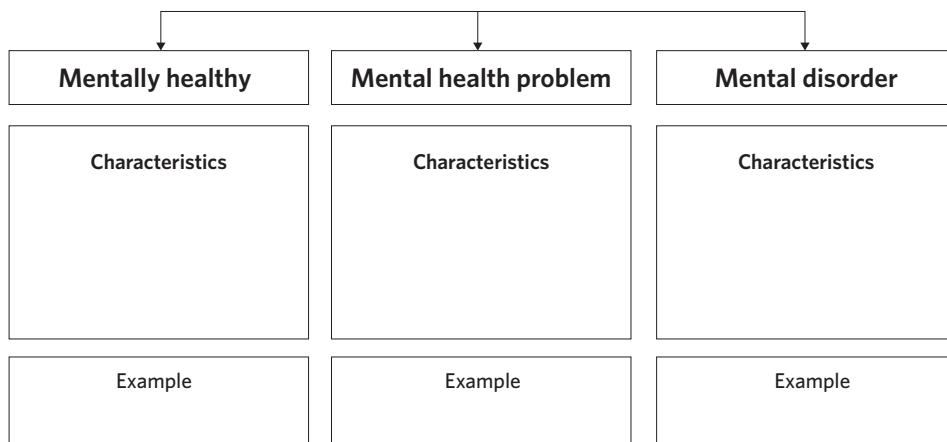
## 11A Activities

- 1 Tick the appropriate column to indicate what mental state each situation refers to.

Situation	Mentally healthy	Mental health problem	Mental health disorder
Sleeping significantly fewer hours each night in the lead up to your VCE exams, resulting in irritation at your friends and family.			
Going to the dog races and betting more than you can afford each week, even though you keep trying to quit. This makes you unable to pay for food and shelter and makes you feel highly distressed.			
Being optimistic and seeing your friends on a regular basis.			
Experience of a constant, unwanted thought you can't control, that negatively affects your ability to do things you normally do.			
Suffering hallucinations that impairs daily functioning.			

Adapted from Edrolo and A.Muller, 2017.

- 2 Complete this activity by filling out the characteristics and an example of each category on the mental health continuum.



Adapted from Edrolo and A.Muller, 2017.

## 11A QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                           |                          |
|---------------------------|--------------------------|
| • Mental health           | • Mental health disorder |
| • Mental health continuum | • Internal factors       |
| • Mentally healthy        | • External factors       |
| • Mental health problem   |                          |
- a A severe disturbance which significantly disrupts an individual's ability to function \_\_\_\_\_
- b Factors which arise from within the individual and contribute to their mental health \_\_\_\_\_
- c The current state of a person's psychological wellbeing and functioning \_\_\_\_\_
- d Involves an individual who is able to meet the demands of everyday life and function independently within their environment, display resilience and have high social and emotional wellbeing \_\_\_\_\_
- e A tool used to track progression of mental health which constantly fluctuates, progressing from mentally healthy, to mental health problems, to mental health disorders \_\_\_\_\_
- f A disturbance to normal functioning, which has recognisable but not severe impacts on everyday functioning \_\_\_\_\_
- g Factors which arise from the environment of an individual and contribute to their mental health \_\_\_\_\_

**Question 2**

Use the following list of key terms to match the name of a category of the mental health continuum to the characteristics of that category.

- Mentally healthy
- Mental health problem
- Mental health disorder

a. _____	b. _____	c. _____
Displays a level of distress	Can cope with stress	Doesn't function at optimal level
Unable to carry out tasks independently	Functions independently	Difficulty concentrating
Can't function independently	No excessive levels of distress or dysfunction	Recognisable impact on the individual

**Exam-style questions***Remember and understand***Question 3** (1 MARK)

An individual experiencing a mental health problem is most likely to be

- A displaying a lesser ability to function independently compared to those who are mentally healthy.
- B in a mentally unhealthy state for the rest of their life.
- C experiencing a greater amount of external than internal factors which contribute to mental health.
- D physically unwell.

**Question 4** (1 MARK)

Which of the following best describes the mental health continuum?

- A A classification system which diagnoses mental health disorders.
- B A categorical approach used to classify mental illnesses.
- C A tool which tracks the progression of fluctuations in mental health.
- D A tool which permanently assigns an individual as mentally healthy, having mental problems or having a mental disorder.

**Question 5** (2 MARKS)

Identify two differences between a mental health problem and a mental health disorder.

**Question 6** (4 MARKS)

Explain the difference between internal and external factors that influence mental health, giving an example for each.

*Apply and analyse*

**Use the following information to answer questions 7 and 8.**

Rohan has always been an extremely confident and outgoing guy who loves to spend time with his family and friends. However, when his uncle died two weeks ago, he began to spend more time in his room, refusing to see his friends or family anymore. Rohan used to go on skiing trips with his uncle during the winter, but he now refuses to even look at skis. He has also been finding it hard to sleep, sometimes only managing to sleep 3 hours a night.

*Adapted from VCAA 2014 exam SAQ10*



**Question 7** (1 MARK)

The death of Rohan's uncle is an example of a/an

- A daily hassle.
- B external factor.
- C catastrophe.
- D internal factor.

**Question 8** (1 MARK)

Which of the following is the most accurate description of Rohan's situation?

- A Rohan has a mental health disorder as he should not care about his uncle's death.
- B Rohan is mentally healthy as teenagers are meant to spend lots of time alone in their rooms.
- C Rohan is experiencing a mental health problem due to having a reduced level of functioning.
- D Rohan's mental health following the death of his uncle is only being impacted by external factors.

**Question 9** (4 MARKS)

Clara has recently moved from her old workplace, where she worked for six years. She is finding her new job highly stressful due to having much more responsibility. At her new job, she has to manage 10 direct reports and often finds herself staying back late after work. She has begun to doubt her ability to effectively manage her job and has been finding it difficult to unwind at the end of the day. When she realised that she was stressed out, she approached her sister who also has a demanding job and asked her for some advice.

- a If Clara was to approach a psychologist about her current mental health, explain where the psychologist might be likely to place Clara on the mental health continuum. Justify your response. (2 MARKS)

Adapted from VCAA 2018 exam SAQ7

- b Identify an internal factor from the scenario and explain how it impacted Clara's mental health. (2 MARKS)

**Questions from multiple lessons****Use the following information to answer questions 10-12.**

Despina's mother recently passed away after being ill for a long time. She has taken some time off work to organise the funeral and is attempting to grieve while also being there for her kids. Despite these challenges, Despina has a strong support network of family and friends and has still managed to find time to shop, take her kids to school and complete household chores. Her sister Matisse has been unable to cope, and has turned to alcohol in an attempt to cope with her loss.

**Question 10** (1 MARK)

Despina and Matisse's loss of their mother is an example of which type of stress?

- A A catastrophic event
- B Acculturative stress
- C Life event
- D Daily hassle

**Question 11** (1 MARK)

Despina would be considered as mentally healthy due to displaying

- A a profound disturbance to her normal functioning.
- B an inappropriate level of distress, demonstrating that she is emotionally unstable.
- C a lack of care for her mother.
- D resilience and an ability to function independently.

Adapted from VCAA 2017 exam MCQ39

**Question 12** (1 MARK)

In turning to alcohol in an attempt to cope with the death of her mother, Matisse is adopting which approach to deal with stress?

- A Avoidance coping
- B The fight-flight-freeze response
- C Coping flexibility
- D Exhaustion

**Question 13** (4 MARKS)

Ethan has been experiencing partial sleep deprivation due to only sleeping four to five hours each night for the past two weeks. Because of this, he has been irritable, causing him to experience relationship conflicts and constant stress.

- a At which category of the mental health continuum is Ethan most likely to be placed? Justify your response. (2 MARKS)
- b Is sleep deprivation an example of an internal or external factor that influences mental health? Justify your response. (2 MARKS)

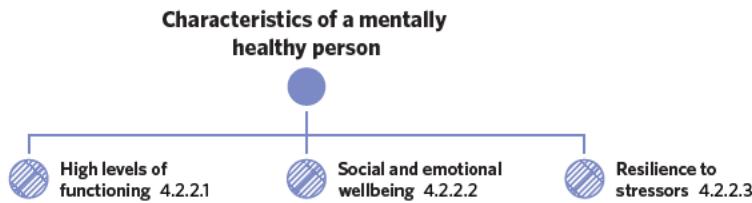


# 11B CHARACTERISTICS OF A MENTALLY HEALTHY PERSON

So far in this chapter, you have learned about the mental health continuum. You have learned how multiple factors influence the mental health of an individual, potentially leading to them being mentally healthy, having a mental health problem or having a mental health disorder. In this lesson, you will be learning about the typical characteristics of a mentally healthy person.

11A. Mental health continuum	11B. Characteristics of a mentally healthy person	11C. Mental health and ethics
<b>Study design dot point</b>		
<ul style="list-style-type: none"> <li>the typical characteristics of a mentally healthy person, including high levels of functioning, social and emotional wellbeing and resilience to life stressors</li> </ul>		
<b>Key knowledge units</b>		
High levels of functioning		4.2.2.1
Social and emotional wellbeing		4.2.2.2
Resilience to stressors		4.2.2.3

In this lesson, you will be learning about how **high levels of functioning, social and emotional wellbeing and resilience** are typical characteristics of a mentally healthy person.



## High levels of functioning 4.2.2.1

### OVERVIEW

High levels of functioning are associated with mentally healthy people as they have the ability to independently and effectively carry out every day tasks.

### THEORY DETAILS

In general, **functioning** refers to the way in which an individual operates and responds to everyday, environmental demands. **High levels of functioning** refers to an individual's ability to complete day-to-day tasks in an independent and effective manner. It plays a role in increasing an individual's sense of capability, prevents them from becoming easily overwhelmed, and allows them to function as a mentally healthy person within their environment.

Some examples of high levels of functioning include the ability to:

- Carry out everyday tasks, such as maintaining personal hygiene
- Communicate and maintain relationships with others
- Be productive in achieving tasks
- Set goals and take steps towards achieving them
- Be independent
- Adapt to changes in the environment

If an individual cannot successfully meet the demands of their everyday life, they are not achieving a high level of functioning. Low levels of functioning may lead to a sense of hopelessness, reducing an individual's self-belief and, in turn, mental health.

**Functioning** the way in which an individual approaches everyday demands and operates within their environment

**High levels of functioning** the ability for an individual to approach day-to-day tasks independently and effectively meet everyday demands

***Useful tip***

Some aspects of high levels of functioning, such as communication skills and the ability to adapt, are also aspects of resilience and social and emotional wellbeing. In the exam, it is common for a scenario to cover all of these, as these concepts are interrelated. It is important to read the particular scenario carefully and figure out which characteristics are the most relevant to the question being asked.

## Social and emotional wellbeing 4.2.2.2

### OVERVIEW

High levels of social and emotional wellbeing reflect the ability of an individual to create strong relationships, communicate effectively and appropriately regulate their own emotions. This is an important characteristic of a mentally healthy person.

### THEORY DETAILS

**Wellbeing** refers to a state in which an individual is healthy and secure. Wellbeing may be evaluated as poor or good, and there are many components which make up an individual's wellbeing including physical, mental, and social wellness. For a person to be mentally healthy, achieving social and emotional wellbeing is important. **Social wellbeing** involves forming strong relationships with others and communicating effectively, while **emotional wellbeing** involves appropriately controlling and expressing emotions. Having both strong social wellbeing and emotional wellbeing equips individuals with the ability to navigate through many situations in their everyday life, and is therefore an important characteristic of a mentally healthy person.

#### Social wellbeing:

A mentally healthy person has strong social wellbeing and is therefore able to develop a sense of connection to others. Social wellbeing is important, as interacting with others is essential in most environments, such as at school and at home. Strong social wellbeing helps individuals to have a level of confidence and create positive interactions in a social setting.

Some aspects of strong social wellbeing include:

- Having a strong support network
- Feeling valued by others
- An ability to form new relationships
- Having empathy for others
- An ability to effectively communicate

#### Emotional wellbeing:

A mentally healthy person has strong emotional wellbeing as they can regulate their own emotions, express positive emotions at a suitable time and have empathy for others. Individuals with strong emotional wellbeing still experience negative emotions as they are an inevitable part of life. They are mentally healthy due to their ability to regulate these negative emotions and appropriately display them.

Some aspects of strong emotional wellbeing include:

- Being sensitive to the emotions of others
- Having a wide range of emotions
- Expressing emotions at an appropriate time
- Appropriately responding to and coping with stressors

***Useful tip***

Social and emotional wellbeing are often considered together as they complement each other. In past VCAA exams, it has been important for students to be able to write about both social wellbeing and emotional wellbeing as separate concepts, and therefore, it is important that you understand their differences.

**Wellbeing** a state in which an individual is mentally, physically, and socially healthy and secure

**Social wellbeing** the ability for an individual to form bonds with others and maintain positive relationships

**Emotional wellbeing** the ability for an individual to appropriately control and express their own emotions in an adaptive way, as well as understand the emotions of others



Image: SvtDesign/Shutterstock.com

**Figure 1** An individual with strong emotional wellbeing is able to effectively process and express their emotions

***Useful tip***

In past VCAA exams, strong emotional wellbeing has been linked to the ability to appropriately manage responses to stress. As you are preparing for the exam, practice linking these ideas together to make sure you are prepared for the exam.



## Resilience to stressors 4.2.2.3

### OVERVIEW

Resilience involves the ability to effectively adapt to stressors that arise and recover from them. This is a characteristic of a mentally healthy person as it is necessary to cope with the stressors that arise in everyday life.

### THEORY DETAILS

It is inevitable for stress to occur in everyday life. A mentally healthy person has the ability to overcome these stressors and recover from the challenges presented. This shows a high level of resilience as an individual is able to deal with difficulties presented and continue on with their lives without solely focusing on the cause of stress.

High levels of resilience can reflect and lead to an individual having:

- High self-esteem
- More confidence in carrying out tasks
- Increased flexibility, therefore being able to cope with a range of stressors

### Theory summary

In this lesson, you have learned about the typical characteristics of a mentally healthy person. These characteristics include a high level of functioning, social and emotional wellbeing, and resilience, which are summarised in table 1. Specifically, you have learned how these characteristics contribute to and reflect good mental health. You should be able to identify these characteristics from a scenario in an exam and be able to comment on each of these characteristics.

**Table 1** Description of typical characteristics of a mentally healthy person

Characteristic	High levels of functioning	Social wellbeing	Emotional wellbeing	Resilience
<b>Description</b>	Involves the ability to approach day-to-day tasks independently and with the capacity to meet the demands in your environment	Involves the ability to form bonds with others and maintain positive relationships	Involves the ability to appropriately control and express your own emotions in a positive way, and understand the emotions of others	Involves the ability to adapt to the environment and cope when stressors arise in order to return to a functioning state
<b>Example</b>	Carrying out everyday tasks e.g. personal hygiene	Having a strong support network	Ability to appropriately regulate and express emotions	Ability to bounce back after experiencing adversity

### 11B Activities

- 1 For the past six months, Darrell has been acting out of character. Despite being in physically good health, he has not left the house for several weeks and has asked his parents to shop for groceries for him. Whenever his parents visit, they notice that Darrell has not showered for days and is often wearing the same clothes. He lost his job because of extended absences. His friends are concerned, as Darrell is no longer responding to their text messages or phone calls and he refuses to go to any social events. He has also shown a lack of interest in physical activity despite previously having completed many cycling races.
  - a Considering the description of Darrell, explain whether his thoughts, feelings and behaviours reflect a mentally healthy person with reference to high levels of functioning, social and emotional wellbeing and resilience.
  - b Discuss some strategies that Darrell could use to improve his mental health.

*Adapted from Edrolo and A.Muller, 2017.*

**Resilience** the ability to adapt to the environment and cope when stressors arise in order to return to a functioning state

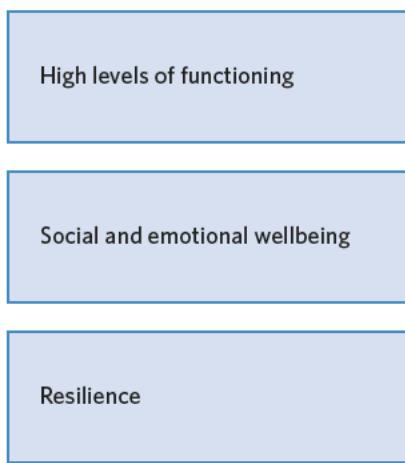
 Resilience is further explored in lesson **14A: Resilience**, as a way for individuals to maintain good mental health.

 The ability to adapt to multiple stressors and show a high level of coping flexibility has already been explored in lesson **3D: Coping with stress**.

Return back to this lesson if you need a refresher.

2 Draw a line to link each characteristic of a mentally healthy person to an example. One line has already been drawn for you.

### Characteristic of a mentally healthy person



### Examples

- Strong communication skills
- Complete tasks independently
- Having a strong support network
- Aware of other's emotions
- Demonstrating high levels of productivity
- High level of self-esteem
- Can deal with stressors and return to functioning state

## 11B QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |   |                              |
|---|------------------------------|
| • Resilience  | • Social wellbeing           |
| • Emotional wellbeing   | • High levels of functioning |
| a Involves the ability to adapt to the environment and return to a functioning state after being exposed to stressors or adversity _____  |                              |
| b Involves the ability to create and maintain positive relationships with others and is supported by strong communication skills and a strong support network _____                 |                              |
| c Involves the ability to carry out everyday tasks effectively and meet demands _____   |                              |
| d Involves the ability to appropriately express and control your own thoughts, feelings and behaviours, supported by expressing a range of emotions in appropriate situations _____ |                              |

#### Question 2

Use the following list of key terms to match the name of a typical characteristic of a mentally healthy person and the aspects of that characteristic.

- |                              |                       |
|------------------------------|-----------------------|
| • High levels of functioning | • Emotional wellbeing |
| • Social wellbeing           | • Resilience          |

a _____	b _____	c _____	d _____
Appropriately regulates emotions	Has a strong support network	Can live independently	Can maintain positivity after a stressor is presented
Can empathise with others	Can communicate with others	Meets demands of everyday life	Can cope with the stressors of day to day life
Expresses emotions in appropriate situations	Respects others	Can use logic and make decisions	Maintains flexibility and adapts responses to different stressors



**Exam-style questions****Remember and understand****Question 3** (1 MARK)

A mentally healthy person can display social wellbeing by

- A** effectively achieving tasks.
- B** strengthening connections with others through strong communication.
- C** expressing a sense of positivity.
- D** being able to move on from challenges.

**Question 4** (1 MARK)

Which of the following best describes the characteristics of an individual displaying resilience?

- A** Low level of self-esteem, can perform daily tasks and avoid stressors.
- B** Experiences lower levels of stress, is respectful of others and cannot cope with the stressors they regularly face.
- C** Can return to the functioning state that occurred before the presence of a stressor, has high self-esteem and adapts to many types of stressors.
- D** Enjoys seeing family and friends, feels hopeless when they cannot cope with stress and has a high level of confidence.

**Question 5** (1 MARK)

The ability to be independent and effectively meet everyday demands within the environment is known as

- A** confidence.
- B** resilience.
- C** being a grown up.
- D** high levels of functioning.

**Question 6** (2 MARKS)

Using examples, explain one characteristic of a mentally healthy person and why this is an important aspect of a mentally healthy person.

**Apply and analyse****Question 7** (1 MARK)

After losing his job, Tom missed his work colleagues as well as his daily bike ride to work. He found it difficult to financially cope and had to move back in with his parents. Despite these challenges, he still maintained respectful relationships with his friends and family and kept in touch with his work colleagues. Two of his friends helped him move house and his mum encouraged him to start applying for new jobs.

Tom would be considered mentally healthy due to

- A** displaying strong social wellbeing.
- B** missing his bike rides.
- C** having weak emotional wellbeing.
- D** finding it hard when losing his job.

Adapted from VCAA 2017 exam MCQ39

**Question 8** (4 MARKS)

Jimmy got into a car accident where his amygdala was damaged. After this accident, he found it difficult to fall asleep, did not want to see his friends or family anymore, found it hard to cook dinner for himself, and showed less respect for his colleagues at work.

Using examples from the scenario, explain why Jimmy is not mentally healthy after his accident, with reference to two characteristics of a mentally healthy person.

Adapted from VCAA 2018 exam MCQ14

### Questions from multiple lessons

**Use the following information for questions 9 and 10.**

When Tina first left her home country in search of a better life and moved to Australia, she missed her family and found it hard to learn English. She felt as if she did not fit in with the people she met in Australia and spent most of her free time watching movies. Two months after moving to Australia, she decided to sign up for an English class which helped her to get a job that she enjoyed. After receiving help from her work friends and her neighbours, she was able to use public transport, has learned new meals to cook and has joined a netball team.

**Question 9** (1 MARK)

When Tina spent most of her free time watching movies, she was displaying

- A coping-specific effectiveness.
- B avoidance coping.
- C strong emotional wellbeing.
- D independence.

**Question 10** (1 MARK)

Which of the following most accurately describes the characteristics of a mentally healthy person that Tina displayed two months after moving to Australia?

Resilience	Social and emotional wellbeing	High levels of functioning
A Adapted to challenges in her environment	Regularly communicated with others in an effective manner	Independently completed tasks
B Immediately displayed flexibility to stressors	Had a strong support network	Unable to meet the demands of everyday life
C Solely focused on the cause of her stress	Was productive	Was sensitive to other people's emotions
D Forgot about her family	Regularly communicated with her friends and family back home	Was confident

**Question 11** (7 MARKS)

Ingrid is a new mother who is struggling with a lack of sleep since she gave birth to her daughter. She is starting to believe that she is incapable of looking after her daughter and has recently relied on eating pre-packaged food even though she loves cooking. Her sister Jessica realises that she is struggling and offers to look after the baby so that Ingrid can sleep, but Ingrid gets angry at her suggestion and responds that she is fine.

- a Identify a stressor Ingrid is exposed to in the scenario. (1 MARK)
- b According to Lazarus and Folkman's Transactional Model of Stress and Coping, outline how Ingrid is most likely interpreting the stressor during primary appraisal. Use examples to justify your response. (2 MARKS)
- c Using examples, refer to at least two characteristics to explain if Ingrid is a mentally healthy person in this scenario. (4 MARKS)

### Key science skills

**Question 12** (3 MARKS)

A researcher wants to investigate the relationship between the characteristics of a mentally healthy person at different ages across the lifespan and levels of stress. To investigate this, participants completed a survey about their levels of resilience, the different levels were:

- Level 1 – Low level of resilience.
- Level 2 – Medium level of resilience.
- Level 3 – High level of resilience.

Participants included in this study spanned across multiple age groups, ranging from the age of 10 to the age of 80. The results of the study were recorded at one particular point in time in order to make comparisons across the age groups.



The participants then played a video game for two hours which was meant to mimic the demands in day-to-day life; these demands included having to cook, going to work and interacting with their family at home. During the game, the participants were presented with a number of challenges meant to induce stress, such as traffic on the way to work, having to suddenly meet with their boss for an evaluation of their performance, fighting with their partner and having the dinner they were cooking burn. A quantitative measure of their ability to cope with and adapt to the stress experienced was measured on a scale of 1-20 based on the responses in the video game. It was shown that individuals with a Level 3 resilience level on the survey were more likely to have a lower score of stress compared to those with a Level 2 or 1 resilience. In particular, participants in lower age groups were more likely to have a lower measure of stress as outlined from the responses in the video game.

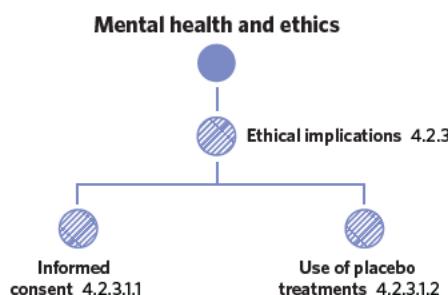
- a** Name the type of investigation used in this study. (1 MARK)
- b** Identify a limitation of using a self-report to measure resilience. Justify your response. (2 MARKS)

# 11C MENTAL HEALTH AND ETHICS

So far in this chapter, you have learned about the mental health continuum. Specifically, you have learned about the internal and external factors which contribute to the mental health of an individual and the characteristics of a mentally healthy person. Now, you will learn about the ethical implications involved in mental health research.

11A. Mental health continuum	11B. Characteristics of a mentally healthy person	11C. Mental health and ethics
<b>Study design dot point</b>		
<ul style="list-style-type: none"> <li>ethical implications in the study of, and research into, mental health, including informed consent and use of placebo treatments</li> </ul>		
<b>Key knowledge units</b>		
Informed consent (ethical implications)		4.2.3.1.1
Use of placebo treatments (ethical implications)		4.2.3.1.2

**In this lesson, you will be learning about the ethical implications involved in the research of mental health.** Specifically, you will focus on the **use of placebo treatments** and **informed consent**.



## Ethical implications 4.2.3.1

### OVERVIEW

Researchers need to ensure that they meet the ethical considerations of psychological research to prevent possible consequences. This is particularly important when conducting research on mental health due to its sensitive nature.

### THEORY DETAILS

During a study, researchers aim to meet the ethical considerations of psychological research in an attempt to minimise or prevent any harm that may come to participants. This ensures that the rights and safety of the participants are met.

It is even more important to meet the standards of these ethical considerations when conducting research into mental health. All research conducted around mental health disorders must keep in mind the need for sensitivity and confidentiality, especially because individuals with mental health disorders are a particularly vulnerable population.

### Informed consent 4.2.3.1.1

One vital ethical consideration to implement during any study, but particularly for research into mental health, is **informed consent**. This involves participants being made aware of the procedures involved in the research they are partaking in. This includes having a thorough understanding of the potential harms and risks they may encounter before consenting to participate. This is very important during research into mental health as there are often considerable risks which the participants may encounter. They may become sensitive or distressed during the research, especially if they are experiencing a mental health problem or a mental health disorder. For this reason, the researchers must ensure that every participant has given informed consent by agreeing to participate in mental health research.



If you need a refresher on the use of ethics in research, return to lesson **1E: Ethical considerations**.

**Informed consent** ensuring participants have a thorough understanding of the procedures involved in the research they are partaking in, including potential harm or risks, and still willingly agree to participate



Some mental health disorders are so severe that the individual experiencing them is unable to think logically, make decisions and understand and process information accurately. In these scenarios, the individual may not have full cognitive capacity to give consent for a study. Due to this, studies involving participants with severe mental health disorders are often subject to controversy over whether the individual can give informed consent. As such, it can be viewed as unethical to conduct these experiments.

In order to protect the rights and safety of participants with mental health disorders, legal guardians are often required to give consent on their behalf. This ensures that participants are free from harm and participate willingly, as their guardian can understand the nature of the research and decide on their behalf whether it is safe for them to participate. Although the legal guardian can provide consent for the participant, the researcher still needs to ensure that the participant understands the nature, purpose and risks of the study to the best of their ability.

#### Use of placebo treatments 4.2.3.1.2

##### The importance of placebos in mental health research:

Placebo treatments are commonly used in mental health research as they are able to test the effectiveness of new medications. This is implemented through the use of an experiment, in which an experimental group receives the new medication being tested and a control group receives a placebo. This is often easy to do through the use of an independent groups design. As placebos contain no active treatment, they can act as a control in determining the effectiveness of a new treatment or medication. The participant's responses to placebos provides a baseline for comparison in evaluating active treatments. In mental health research, this is important as it indicates whether results are due to the treatment being administered, or to the placebo effect.

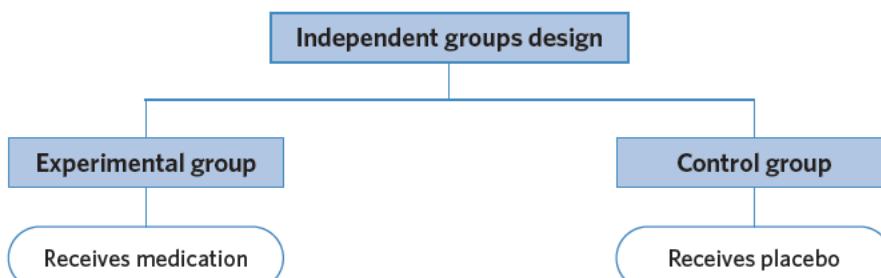


Figure 2 An example of how placebos can be used as a control condition in experimental designs

The use of a placebo involves administering a 'fake' treatment to participants, in which the participants are unaware that the treatment or medication being administered to them has no therapeutic effect. Despite not being a legitimate treatment, the physical and mental state of the participant may be influenced by the false beliefs and expectations about the placebo they have been administered. This is called the **placebo effect**. For this reason, placebo treatments are often used in studies in an attempt to minimise or control the expectations of the participants or experimenter.

Besides testing the effectiveness of new medications, placebos are also of interest in research on mental health in their own right. This is due to the placebo effect occasionally providing therapeutic benefits itself. This may involve participants experiencing improvements in their mental health purely because of their belief that they are receiving an effective and active treatment. With this in mind, a participant may experience improved mental health after receiving a placebo treatment which they believe to be a valid treatment. These improvements reflect the possible benefits the placebo effect can have on mental health.

##### Want to know more?

Research conducted by Michigan Medicine found that individuals who experienced the greatest mental health improvements from a placebo treatment were more likely to experience the greatest improvements from a legitimate procedure or medication. This emphasises the power of believing in a treatment.

If you would like to learn more about this, have a look at the University of Michigan's study *Placebo power: Depressed people who respond to fake drugs get the most help from real ones, U-M study finds* (Arbor, 2015).



Image: Retro67/Shutterstock.com

**Figure 1** Ensuring that participants consent to participate in a study with knowledge of the nature of the research is a vital ethical consideration for mental health research

**Placebo** a procedure or substance with no active treatment

**lesson link** The concepts of mental health problems and mental health disorders were first introduced to you in lesson 11A: *Mental health continuum*. Refer back to this lesson if you need to refresh your understanding of these concepts.

##### Want to know more?

For more information on the ethical guidelines which must be followed when conducting research with those that are vulnerable, refer to the National Statement on Ethical Conduct in Human Research. This can be found on the National Health and Medical Research Council (NHMRC) website. The guideline 4.5.1 and guidelines 4.5.5–4.5.10 are particularly relevant to the use of informed consent in mental health research. (NHMRC, 2018)

**The placebo effect** changes to an individual's mental or physical state as a result of a false belief in the effects of a placebo substance or procedure

### Negative ethical implications of placebo use in mental health research:

Although the use of placebos can often lead to benefits in mental health research, it can also present some negative implications. These include the use of deception, as researchers are sometimes unable to outline the use of a placebo prior to the research. This can result in the participants being unaware of the full details of the experiment, inhibiting their ability to give informed consent.

Due to the use of deception, it is extremely important that the researcher employs thorough debriefing at the study's conclusion. This ensures that participants will not experience ongoing distress or psychological harm after the conclusion of the study.

The use of placebo treatments for participants with mental health disorders can lead to many negative implications. These include:

- Prolonging and preventing recovery from a mental health disorder due to holding participants back from accessing other treatments.
- The use of deception on individuals who are already vulnerable due to a mental health disorder may exacerbate their sense of distress, potentially leading to them feeling betrayed, or creating a sense of paranoia.

For these reasons, providing participants with a placebo can be seen as unethical. Medical professionals have an obligation to provide individuals with the most beneficial and effective treatment. The purpose of using a placebo is to ensure participants are not exposed to an active substance which may interfere with the study's results. However, this also means that participants receiving a placebo treatment are denied access to other effective treatments. Similarly, although placebos can provide benefits in the short term, these often disappear over time or when participants are made aware of the use of a placebo in their treatment. This may jeopardise their mental health recovery.

### Theory summary

In this lesson, you have learned about the ethical implications involved when conducting research into mental health. More specifically, you have learned about the ethical implications of informed consent and the use of placebo treatments. You should be able to understand the importance of implementing ethical considerations when conducting research into mental health. In addition, you should also be able to understand the ethical implications of informed consent and use of placebo treatments, and how these impact participants.

Table 1 Comparison of informed consent and use of placebo treatments

Ethical consideration	Description	Implications in mental health research
<b>Informed consent</b>	Ensuring participants understand the procedures and risks involved in the research they are partaking in, and still willingly agree to participate	<ul style="list-style-type: none"> <li>• Some individuals who are experiencing mental health difficulties may not be able to give consent</li> <li>• Guardians may have to give consent on behalf of individuals who do not have full cognitive capacity due to mental health disorders</li> </ul>
<b>Use of placebo treatment</b>	A procedure or substance with no active treatment	<ul style="list-style-type: none"> <li>• Can prolong mental health disorders and prevents recovery</li> <li>• Use of deception may exacerbate participant's levels of distress</li> </ul>



Image: Plan-B/Shutterstock.com

**Figure 3 Placebo treatments**  
may involve administering a 'fake' medication to participants who are under the impression that it is 'real'

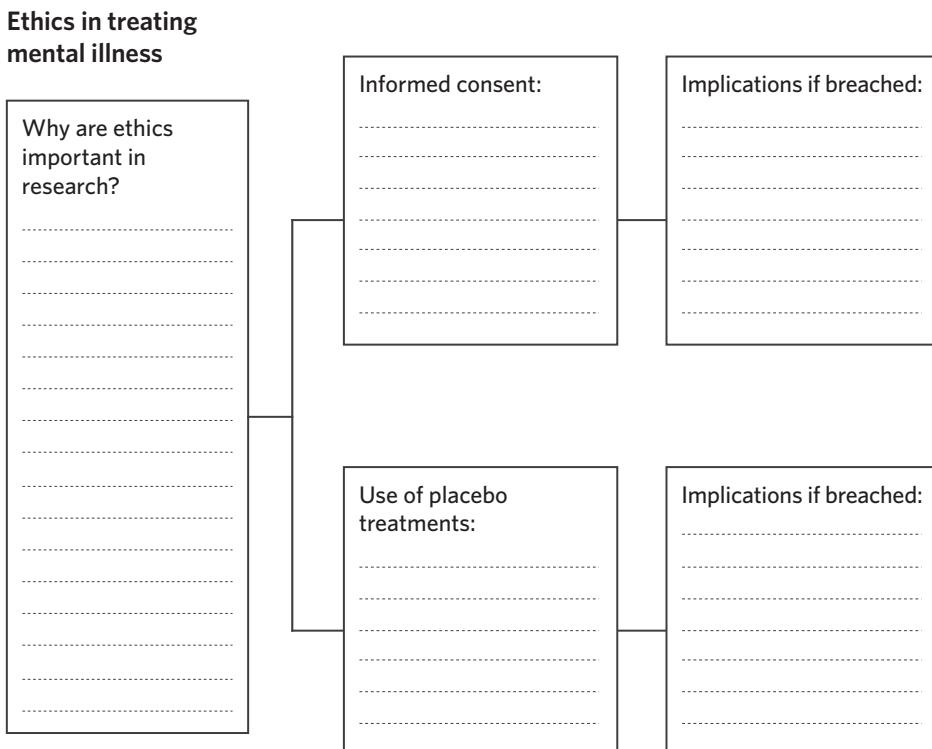
**lesson link** The use of debriefing was introduced to you in lesson **1E: Ethical considerations**. Turn back to this lesson if you need a refresher.

**lesson link** The use of placebo treatments in research often involves a single-blind or double-blind procedure. Turn back to lesson **1D: Sources of error and prevention** to refresh your memory on these concepts.



## 11C Activities

- 1 Complete the following mindmap using the knowledge you have learned in this lesson about mental health and ethics.



*Adapted from Edrolo and A.Muller, 2017.*

## 11C QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |           |                  |                    |
|-----------|------------------|--------------------|
| • Placebo | • Placebo effect | • Informed consent |
|-----------|------------------|--------------------|
- a Ensuring participants understand the procedures and risks involved in the research they are partaking in, and still willingly agree to participate \_\_\_\_\_
- b A procedure or substance with no active treatment \_\_\_\_\_
- c Changes to an individual's mental or physical state as a result of a false belief in the effect of a placebo substance or procedure \_\_\_\_\_

### Exam-style questions

#### Remember and understand

#### Question 2 (1 MARK)

When conducting research into mental health, an implication which may arise surrounding informed consent is that

- A participants with mental health disorders are never able to give informed consent.
- B all participants are unable to understand the nature of the study, and therefore are unable to give informed consent.
- C legal guardians are unable to provide consent on behalf of individuals with mental health disorders.
- D some individuals may be unable to give informed consent due to having an impaired cognitive capacity which has stemmed from their mental health disorder.

**Question 3** (2 MARKS)

Explain two reasons why the use of placebo treatments specifically for participants with mental health disorders is sometimes believed to be unethical.

**Apply and analyse****Use the following information for questions 4 and 5.**

Fletcher has recently been diagnosed with schizophrenia. His psychologist decided that Fletcher would be the perfect candidate to participate in a study assessing the use of a new type of therapy. The psychologist knew Fletcher would be unable to understand the nature, purpose and risks of the study so he didn't mention the new technique he would use with him during his therapy sessions.

**Question 4** (1 MARK)

Which ethical consideration is Fletcher's psychologist breaching?

- A Standardised testing
- B Informed consent
- C Use of placebo treatment
- D Withdrawal rights

**Question 5** (1 MARK)

In order to meet the necessary ethical considerations, which of the following situations would be the best for Fletcher's psychologist to implement?

- A Fletcher's psychologist should gain consent from Fletcher to participate in the study after explaining the nature, purpose and risks of the study.
- B Fletcher's psychologist should not conduct the study as it is unethical to conduct research on individuals with mental health disorders.
- C Fletcher's psychologist should gain consent from Fletcher's legal guardian to participate in the study, and ensure that Fletcher understands the nature, purpose and risks of the study to the best of his ability.
- D Fletcher's psychologist should not attempt to gain consent from any of the participants involved in the study to ensure standardised testing and procedures.

Adapted from VCAA 2017 exam MCQ49.

**Question 6** (2 MARKS)

Magnus was diagnosed with a mental health disorder five years ago. Due to the nature of his condition, he was able to give informed consent to participate in a research study which he was told may lead to improvements in treatment for his condition. As part of the study, Magnus was allocated to one of two conditions. The experimental group received the new medication being trialled, while the control group, which Magnus was in, received a placebo.

Is the use of a placebo treatment an ethical concern in relation to this study? Justify your response.

Adapted from VCAA 2017 sample exam SAQ6.

**Questions from multiple lessons****Use the following information for questions 7 and 8.**

Edwin signed up on a website to participate in a psychological study on mental health in adults. The study involved the experimental group receiving a newly developed medication, while the control group received a placebo pill. During the six month duration of the study, Edwin, who was in the control group, experienced panic attacks where he would hyperventilate and break down in tears at almost every check-in. The researchers were unable to calm him down when these panic attacks occurred and had to seek medical assistance. Edwin did not disclose any information about experiencing mental health difficulties when signing up to participate.



**Question 7** (1 MARK)

Which of the following is the most accurate description of Edwin's mental health during the study?

- A Edwin is likely to be placed at the mentally healthy end of the mental health continuum due to displaying an ability to regulate his emotions.
- B Edwin is likely to be experiencing a mental health disorder due to a prolonged period of significant distress.
- C Edwin's mental health cannot be determined from this scenario.
- D Edwin is likely to be experiencing a mental health problem as he has only experienced dysfunction for a temporary period.

**Question 8** (1 MARK)

The use of a placebo in this study may be viewed as unethical because

- A Edwin's legal guardian did not give consent for him to participate in this study.
- B it has tricked the participants in the experimental group.
- C deception was used, which may present risks as the participants may feel betrayed.
- D the researchers knowingly prevented Edwin from using his own medication to treat his mental health condition.

**Question 9** (5 MARKS)

Dr Lovell is a psychiatrist who often works with patients with Alzheimer's disease. One of her friends is a medical researcher who has recently claimed to have developed a drug which reverses the brain damage from Alzheimer's disease. She asked Dr Lovell to test it out for her. Dr Lovell wants to help out her friend and decided to run a study with her patients. This involved five of her patients continuing to use their usual medication, while Dr Lovell changed the medication of her other five patients to her friend's new drug without their knowledge.

- a Identify the main part of the brain which experiences damage due to Alzheimer's disease in its early stages. (1 MARK)
- b Identify the two structures which are abnormal in the brain of individuals with Alzheimer's disease. (2 MARKS)
- c Apart from voluntary participation, identify an ethical consideration Dr Lovell has violated during this study. Justify your response. (2 MARKS)

**Key science skills****Question 10** (5 MARKS)

Stefania was admitted to the local hospital for four months after experiencing a severe mental health disorder. She was placed on a medication which helped her daily functioning and reduced her levels of distress. After three months, she returned to the hospital for a checkup. At the checkup, her psychiatrist suggested that she participate in a study trialling new medication. Stefania was informed that she would be allocated to one of two groups, either the control or experimental group. She was unaware that she was placed in the control group, where a placebo rather than the new medication was administered to her. The researcher hired a research assistant to give the participants either the medication or placebo pill.

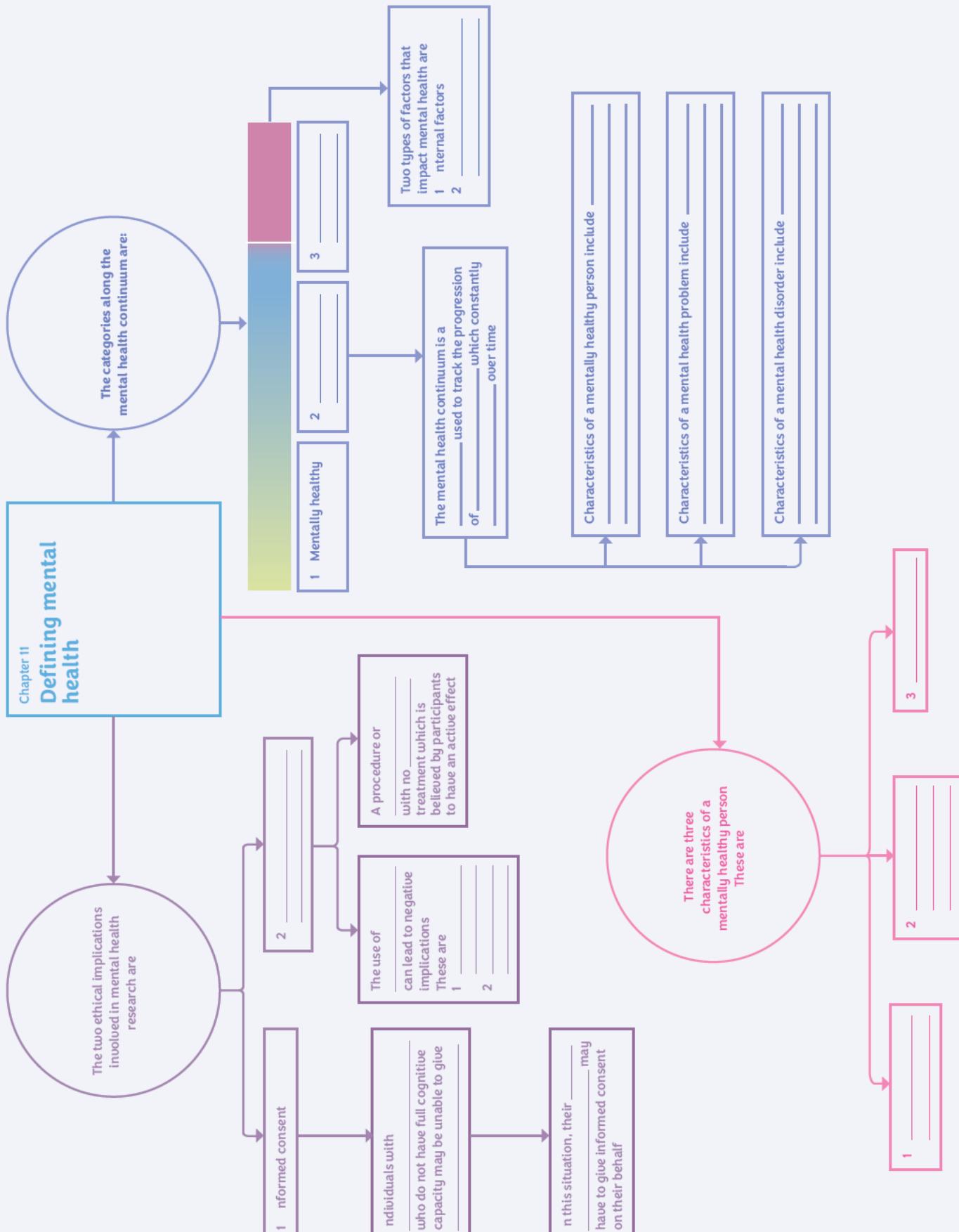
Adapted from VCAA 2014 exam SAQ11.

- a Name the experimental research design used in this study. (1 MARK)
- b Identify whether a single-blind or double-blind procedure was used in this scenario and justify your response. (2 MARKS)
- c Outline an advantage of using this procedure. (2 MARKS)

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own. This includes all concepts from the chapter.



**Review activity 2: Example bank**

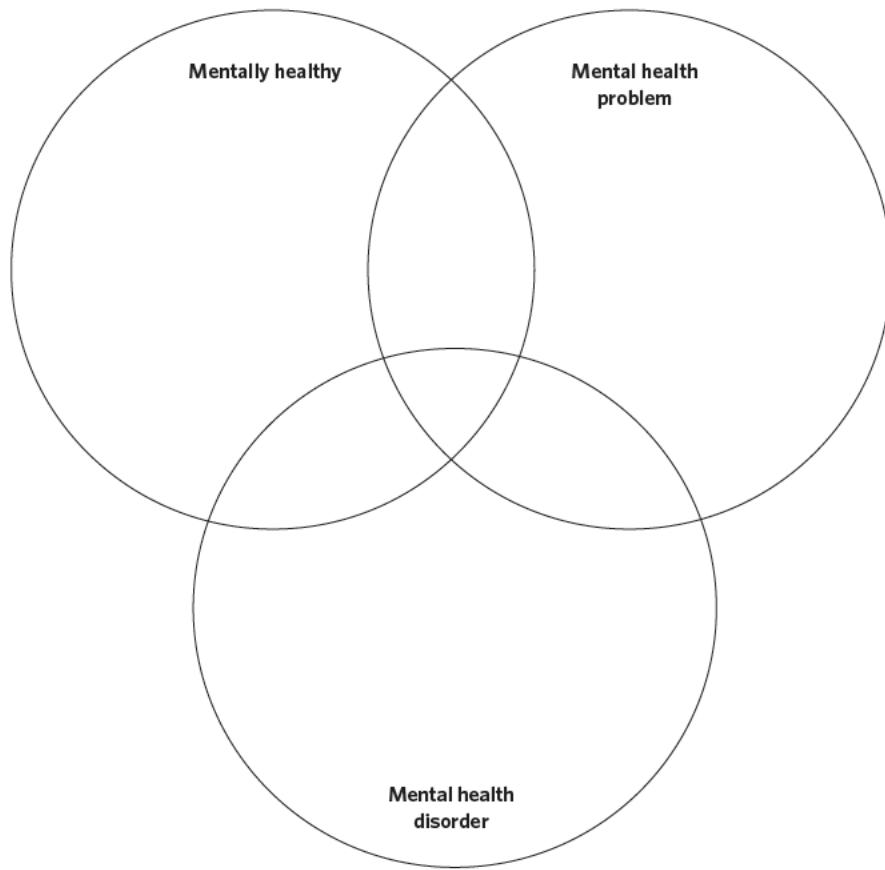
Fill in the table with your own notes.

Key terminology	Your own definition	Example
Mental health		
Mental health continuum		
Mentally healthy		
Mental health problems		
Mental health disorder		
Internal factors		
External factors		
High levels of functioning		
Social wellbeing		
Emotional wellbeing		
Resilience		
Informed consent		

Key terminology	Your own definition	Example
Placebo		
Placebo effect		

### Review activity 3: Venn diagram

Fill in the venn diagram, thinking of as many differences and similarities between the categories of being mentally healthy, having a mental health problem, and having a mental health disorder as possible.



## CHAPTER TEST

### Multiple choice questions

#### Question 1 (1 MARK)

A mentally healthy person needs to display the characteristics of

- A resilience, curiosity and intelligence.
- B neuroticism, social and emotional wellbeing and confidence.
- C high levels of functioning, strong social and emotional wellbeing and the ability to overcome stressors.
- D adapting to social norms, high levels of functioning and kindness.



**Question 2** (1 MARK)

Which of the following is the most accurate description of an individual who displays high levels of functioning?

- A Can carry out everyday tasks and has a strict schedule to follow which cannot be adapted.
- B Is able to set goals towards achieving tasks and is productive.
- C Has poor self-efficacy and can effectively communicate.
- D Has a wide range of emotions and is sensitive to the emotions of others.

**Question 3** (1 MARK)

The use of a placebo treatment when conducting mental health research can **not** lead to

- A the researcher being unable to use a single-blind procedure.
- B prolonged participant recovery from a mental health disorder.
- C preventing participants from accessing other medication and treatments.
- D heightened distress levels of individuals with mental health disorders due to the use of deception.

**Question 4** (1 MARK)

Which of the following best describes the difference between internal and external factors?

- A All internal factors stem from a psychological or biological source whereas external factors mainly stem from a social or environmental source.
- B Internal factors always stay the same from birth whereas external factors change over time.
- C Internal factors have a greater impact on an individual's mental health than external factors.
- D Internal factors arise from the environment whereas external factors directly arise from within an individual.

***Use the following information for questions 5–7.***

Dr Bailey works at the Paradise Bay hospital. He wanted to study the effect of different types of medication for adults with a mental health disorder. Some of the legal guardians gave consent on behalf of the participants.

Half of the participants were given a sugar pill, and the other half were given a GABA agonist medication made up of benzodiazepines.

*Adapted from VCAA 2017 exam MCQ49*

**Question 5** (1 MARK)

Which of the following best describes the reason as to why some legal guardians had to give informed consent for participants with mental health disorders?

- A All participants with mental health disorders are unable to give informed consent.
- B Some participants with mental health disorders do not have the cognitive capacity to give informed consent.
- C Some participants had their legal guardians give informed consent for them as they were under the age of eighteen.
- D Some studies on mental health disorders present so many risks that it was smart to have a legal guardian give consent.

**Question 6** (1 MARK)

The benzodiazepine medication is likely to have

- A an excitatory effect on communication between neurons.
- B a damaging effect on communication between neurons.
- C no effect on communication between neurons.
- D an inhibitory effect on communication between neurons.

**Question 7** (1 MARK)

The group of participants who received the sugar pill were allocated to

- A the control group.
- B a random sample.
- C the experimental group.
- D the experimental condition.

**Use the following information for questions 8–10.**

Last week, Blayne's dog Riley suddenly died. Blayne used to take Riley on a walk around his local creek every morning before starting work. Since Riley died, Blayne no longer goes for his morning walk and cannot go anywhere near the creek. He is also finding it difficult to sleep, often crying for hours at night.

**Question 8** (1 MARK)

Blayne is **not** displaying

- A the characteristics of a mental health problem.
- B distress.
- C the impact of external factors.
- D very high levels of resilience.

**Question 9** (1 MARK)

Blayne's poor sleep is an example of a/an

- A internal factor.
- B protective factor.
- C external factor.
- D characteristic of a mentally healthy person.

**Question 10** (1 MARK)

Which of the following best describes Blayne's current position on the mental health continuum?

- A Blayne is placed in the mentally healthy category on the continuum as he is displaying resilience.
- B Blayne does not fit on the mental health continuum as he is mentally unhealthy.
- C Blayne is placed in the mental health problem category on the continuum as he is experiencing temporary distress in response to an event.
- D Blayne has a mental health disorder as it is not normal to cry over a dog.

**Short answer questions****Question 11** (2 MARKS)

Describe high levels of functioning and explain why it is an important characteristic of a mentally healthy person.

**Question 12** (3 MARKS)

Outline a difference between the categories 'mentally healthy' and 'mental health problem' on the mental health continuum. Give an example of a characteristic of each category.

**Question 13** (5 MARKS)

Giovanni was the dux of his class when he graduated from high school. He was known to successfully accomplish tasks and was confident in himself. He was offered a scholarship at his dream university due to performing so well academically.

Three months into university, he was finding it difficult to maintain his grades and found himself losing many of his relationships. He rarely had time to see his friends or family anymore and decided to take a break from his friends during the semester.

- a Referring to the scenario, explain why Giovanni may be considered mentally healthy when he graduated from high school. (2 MARKS)
- b While at university, would Giovanni be considered mentally healthy? Justify your response by referring to a characteristic of a mentally healthy person. (3 MARKS)



**Question 14** (5 MARKS)

Ginger recently got married to her childhood sweetheart. A week before the wedding, she learnt that her grandmother had experienced a stroke. Upon hearing this news, she broke down into tears at work and was sent home early. Ginger's new husband has provided her with support and has been driving her to visit her grandma and the rest of her family every day.

- Identify whether the news of Ginger's grandmother's stroke is an external or internal factor. (1 MARK)
- Identify where Ginger would be placed along the mental health continuum after hearing the news of her grandmother's stroke. Justify your response. (2 MARKS)
- Explain whether Ginger is displaying social and emotional wellbeing or not. Justify your response. (2 MARKS)

**Key science skills questions****Question 15** (5 MARKS)

After class one day, a high school teacher, Ms Spase, thought about the relationship between strong personal skills and high levels of mental health. She decided to carry out a study, sourcing 30 participants (15 females and 15 males), all of whom were aged 18. These participants were all students of Ms Spase.

The students in the study all completed a questionnaire before the study began. This questionnaire allocated the students to a level of mental health based on their responses. Students were either allocated to being mentally healthy, having a mental health problem, or having a mental health disorder.

Ms Spase contacted the parents of the students who were allocated to having a mental health disorder, in order to gain consent on their behalf before continuing with the experiment. These students were unaware of the study and were unaware that their parents were contacted by Ms Spase. The students who were allocated as being mentally healthy or having a mental health problem were able to provide informed consent themselves.

The study involved recording the number of social interactions each student participated in while in the class through Ms Spase's direct observation and recording. Every time Ms Spase viewed an interaction between two or more students, she quickly recorded it in her notebook.

*Adapted from VCAA 2017 exam MCQ30*

- Identify the sampling procedure Ms Spase used in her study. (1 MARK)
- Discuss whether Ms Spase's recording of the number of social interactions may be a confounding variable in this study. Justify your response. (2 MARKS)
- Explain whether Ms Spase appropriately met the ethical consideration of informed consent or not. Justify your response. (2 MARKS)

**Extended response****Question 16** (10 MARKS)

Ziggy has a very stressful, high-pressure job as a CEO. The ongoing demands of his career have led him to experience high levels of distress and he has recently been diagnosed with sleep-onset insomnia. He has begun to isolate himself from his friends and family and is not sure if he can meet the expectations of his employees.

Due to getting inadequate sleep, he has been experiencing great difficulties concentrating and making decisions at work, which has heightened the pressure he is feeling at work. Due to his struggle with sleep, he has recently started treatment in an attempt to minimise and treat his insomnia.

At one of his psychology appointments, his psychologist suggested that he partake in a study trialling a new medication believed to help induce sleep. He would be able to continue his current treatment for insomnia as part of this study. Ziggy decided to take up his psychologist's advice and signed up for the study.

In the study, he was allocated to the control group. This involved him being administered a placebo pill without his knowledge. The study involved participants rating the quality of their sleep each morning after waking up, on a scale of one to ten. The participants also kept a journal in which they recorded how long they believed it took them to fall asleep each night.

With reference to Ziggy's situation, write a detailed analysis of his mental health experience, the impact of sleep-onset insomnia on his daily functioning, procedures involved in an experimental study and the implications of the use of placebo treatment in mental health research. In your answer, refer to a possible treatment Ziggy may have started to treat his insomnia, whether he is displaying characteristics of a mentally healthy person and the internal and external factors which may have impacted his mental health.



UNIT 4 AOS 2, CHAPTER 12

# 12

## Mental health disorders and risk factors

### 12A Four P model

- the distinction between predisposing risk factors (increase susceptibility), precipitating risk factors (increase susceptibility and contribute to occurrence), perpetuating risk factors (inhibit recovery) and protective factors (prevent occurrence or re-occurrence)

### 12B Biological risk factors

- the influence of biological risk factors including genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and substance use

### 12C Psychological risk factors

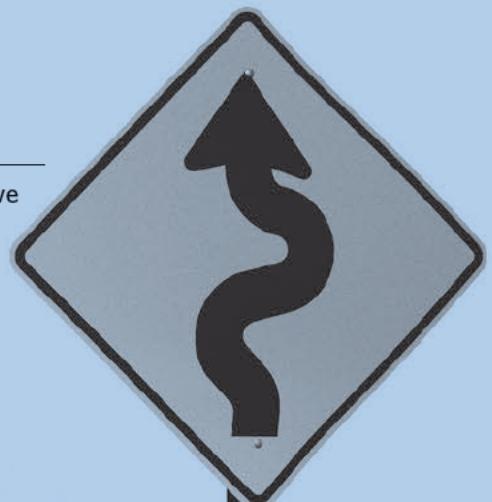
- the influence of psychological risk factors including rumination, impaired reasoning and memory, stress and poor self-efficacy

### 12D Social risk factors

- the influence of social risk factors including disorganised attachment, loss of a significant relationship and the role of stigma as a barrier to accessing treatment

### 12E Cumulative risk

- the concept of cumulative risk

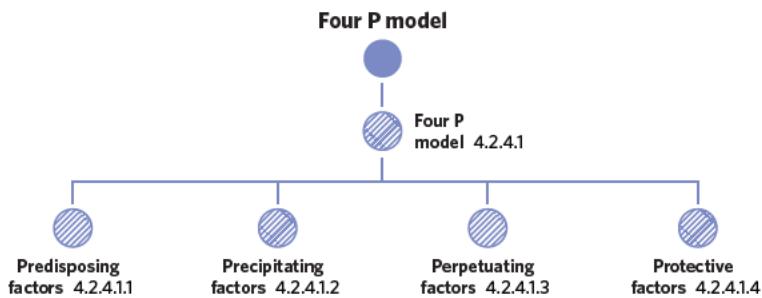


# 12A FOUR P MODEL

In the previous chapter, you learned how to define mental health. In this chapter, you will further develop your understanding of mental health through learning about the factors that contribute to the development and progression of mental health disorders, including the Four P model. All risk factors examined in this chapter will be assessed from the perspective of the Four P model and the biopsychosocial framework.

12A. Four P model	12B. Biological risk factors	12C. Psychological risk factors	12D. Social risk factors	12E. Cumulative risk
<b>Study design dot point</b>				
<ul style="list-style-type: none"> <li>the distinction between predisposing risk factors (increase susceptibility), precipitating risk factors (increase susceptibility and contribute to occurrence), perpetuating risk factors (inhibit recovery) and protective factors (prevent occurrence or re-occurrence).</li> </ul>				
<b>Key knowledge units</b>				
Predisposing factors (Four P model)				4.2.4.1.1
Precipitating factors (Four P model)				4.2.4.1.2
Perpetuating factors (Four P model)				4.2.4.1.3
Protective factors (Four P model)				4.2.4.1.4

**In this lesson, you will be learning about factors that contribute to the development and progression of mental health disorders.** This involves learning about the **Four P model**, where the factors that can influence the development and progression of mental health disorders are broken up into **predisposing, precipitating, perpetuating** and **protective factors**. The Four P model will also be explored in the following lessons as it can be applied in the context of biological, psychological and social risk factors.



## Four P model 4.2.4.1

### OVERVIEW

The Four P model is a method used to categorise the different factors that contribute to the development and progression of a mental health disorder.

### THEORY DETAILS

The **Four P model** categorises the different factors that contribute to the development and progression of a mental health disorder as either predisposing, precipitating or perpetuating risk factors or protective factors. The three risk factors increase the likelihood of developing a mental health disorder, whereas the protective factor decreases the likelihood of developing a mental health disorder.

Table 1 describes each of the factors according to the Four P model. These will be explored in greater detail throughout the duration of this lesson.

**The Four P model** a framework to understand the impact of different factors on the development and progression of a mental health disorder

**lesson link** The relationship between risk factors and protective factors will be further explored in lesson **12E: Cumulative risk**.

**Table 1** Summary of the Four P model

<b>Predisposing risk factors</b>	Increase the susceptibility to developing a mental health disorder.
<b>Precipitating risk factors</b>	Increase the susceptibility to and contribute to the occurrence of developing a mental health disorder.
<b>Perpetuating risk factors</b>	Inhibit a person's ability to recover from a mental health disorder.
<b>Protective factors</b>	Prevent the occurrence or re-occurrence of mental health disorders.

### Predisposing factors 4.2.4.1.1

**Predisposing risk factors** increase the likelihood of developing a mental health disorder. An example of a predisposing risk factor is genetic vulnerability. A person's biological characteristics have the ability to make them more likely to develop a mental health disorder. This can include a family history of mental health disorders, which consequently means that a person has a higher chance of developing a mental health disorder than if there was no history of mental health disorders in their family. Predisposing risk factors such as genetic vulnerability are therefore considered to be outside of the control of the individual who is experiencing them.

Other examples of predisposing risk factors may include:

- Personality traits (e.g. poor self-efficacy)
- Disorganised attachment

### Precipitating factors 4.2.4.2

**Precipitating risk factors** are stimuli or events that a person faces in their life that both increase the chance of developing a mental health disorder and directly lead to its occurrence. The fact that they can directly lead to the occurrence of a mental health disorder is important as this is what distinguishes a precipitating risk factor from a predisposing risk factor. A predisposing risk factor only increases the chances of developing a mental health disorder, but does not at any stage directly lead to its occurrence.

For example, if somebody has a genetic predisposition, this does not mean that they are guaranteed to develop a mental health disorder and immediately experience its effects. They are more likely to develop a mental health disorder which could occur at any given stage in their life. In contrast, a precipitating risk factor explicitly causes the mental health disorder.

An example of a precipitating risk factor is the loss of a significant relationship. When somebody separates from their partner it can be extraordinarily distressing. As a result, it can increase the chances of somebody developing a mental health disorder in this state of vulnerability, directly triggering its occurrence.

Other examples of precipitating risk factors may include:

- Poor sleep
- Substance use
- Stress

### Perpetuating factors 4.2.4.1.3

**Perpetuating risk factors** are stimuli or events that a person faces in their life that limit their ability to recover from a mental health disorder.

For example, a person could have poor response to medication that was prescribed to them by a doctor or psychiatrist due to genetic factors. As a result, the medication does not work effectively for them, and they are not able to recover from a mental health disorder as planned.

Other examples of perpetuating risk factors may include:

- Rumination
- Impaired reasoning and memory
- The role of stigma as a barrier to accessing treatment

**Predisposing risk factor** a risk factor that increases an individual's susceptibility to developing a mental health disorder



Genetic vulnerability as a biological and predisposing risk factor will be further explored in lesson

#### 12B: Biological risk factors

The other specific examples of predisposing risk factors (poor self-efficacy and disorganised attachment) will be covered in lesson 12C: Psychological risk factors and lesson 12D: Social risk factors.

**Precipitating risk factor** a risk factor that increases the susceptibility to and contributes to the occurrence of developing a mental health disorder



The loss of a significant relationship as a social and precipitating risk factor will be further explored in lesson

#### 12D: Social risk factors

The other specific examples of precipitating risk factors (poor sleep, substance use and stress) will be covered in lesson 12B: Biological risk factors and 12C: Psychological risk factors.

**Perpetuating risk factor** a risk factor that inhibits a person's ability to recover from a mental health disorder



To remember the distinction between predisposing risk factors and precipitating risk factors you can think of precipitating risk factors as a 'trigger' because they 'trigger' the occurrence of developing a mental health disorder. There are 't's' for 'trigger' in precipitating, but not in predisposing as predisposing risk factors only increase the possibility of developing a mental health disorder.



Poor response to medication due to genetic factors as a biological and precipitating risk factor will be further explored in lesson 12B: Biological risk factors. The other specific examples of perpetuating risk factors (rumination, impaired reasoning and memory and the role of stigma as a barrier to accessing treatment) will be covered in lesson 12C: Psychological risk factors and 12D: Social risk factors.



### Protective factors 4.2.4.1.4

Protective factors are characteristics in a person's life that enable them to maintain mental health, and hence avoid developing a mental health disorder. Protective factors can prevent people from developing a mental disorder, or prevent the re-occurrence of a mental disorder.

For example, if somebody has adequate sleep, they are more likely to have the biological resources to build resilience and avoid developing a mental health disorder.

Other examples of protective factors may include:

- Adequate diet
- Cognitive behavioural strategies
- Support from family, friends and community

**Protective factor** a factor that prevents the occurrence or re-occurrence of mental health disorders



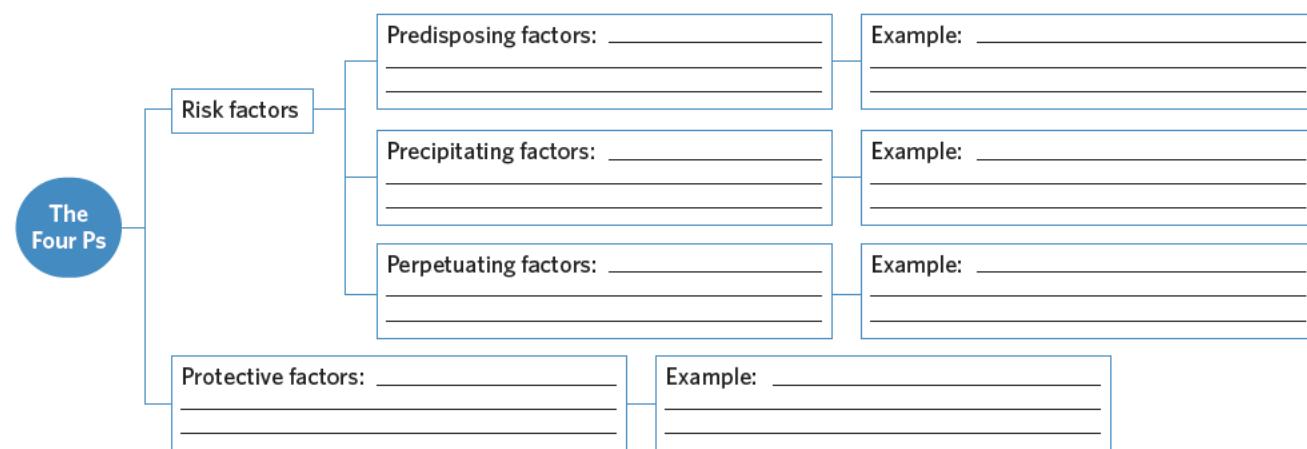
You will be learning about specific examples of protective factors in lesson **14A: Resilience**.

### Theory summary

In this lesson, you have learned about factors that contribute to the development and progression of mental health disorders. You should now have a thorough understanding of the Four P model, specifically the distinction between predisposing, precipitating, perpetuating and protective factors, and their effects on mental health.

## 12A Activities

- 1 Fill in the blanks with definitions or examples to complete this mind map of the Four Ps.



Adapted from Edrolo and A. Muller, 2017.

## 12A QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |                            |                             |                     |
|----------------------------|-----------------------------|---------------------|
| • The Four P model         | • Precipitating risk factor | • Protective factor |
| • Predisposing risk factor | • Perpetuating risk factor  |                     |
- a Factors in someone's life that prevent them from being able to recover from a mental health disorder \_\_\_\_\_
- b Factors in someone's life that makes them more likely to develop a mental health disorder in the future \_\_\_\_\_
- c Stimuli or events that make someone more likely to develop a mental health disorder and directly lead to its occurrence \_\_\_\_\_
- d Any factor that decreases the likelihood of someone developing a mental health disorder for the first time, or again, after previously having a mental health disorder \_\_\_\_\_
- e A framework for characterising the different factors that contribute to the development or progression of mental illness \_\_\_\_\_

**Exam-style questions*****Remember and understand*****Question 2** (1 MARK)

A predisposing risk factor

- A** increases the likelihood of somebody developing a mental health disorder.
- B** increases the likelihood of a mental health disorder progressing.
- C** increases the likelihood of the development and progression of a mental health disorder.
- D** decreases the likelihood of somebody developing a mental health disorder.

**Question 3** (1 MARK)

A perpetuating risk factor relates to the

- A** development of a mental health disorder, whereas a precipitating risk factor is about progression.
- B** progression of a mental health disorder, whereas a precipitating risk factor is about the development.
- C** development of a mental health disorder, whereas a precipitating risk factor is about recovery.
- D** progression of a mental health disorder, whereas a precipitating risk factor is about recovery.

**Question 4** (1 MARK)

Explain what is meant by protective factors.

**Question 5** (1 MARK)

Identify a difference between predisposing and precipitating risk factors.

***Apply and analyse******Use the following information for questions 6 and 7.***

Cameron has been in a healthy relationship for the past 3 years. However, his partner has recently taken up a job overseas and since he cannot join them, he has decided to end the relationship. As a result, Cameron has been incredibly upset. He saw a psychologist who said that he may now be more vulnerable to developing a mental health disorder and that this event could directly result in its occurrence.

**Question 6** (1 MARK)

Cameron's loss of a significant relationship is a

- A** perpetuating risk factor.
- B** precipitating risk factor.
- C** protective factor.
- D** predisposing risk factor.

**Question 7** (1 MARK)

If Cameron was prescribed medication to cope with a mental health disorder, but it did not work due to genetic factors, this would be considered a

- A** protective factor because it prevents the occurrence or recurrence of their mental health disorder.
- B** precipitating risk factor because it increases their susceptibility to and contributes to the occurrence of their mental health disorder.
- C** perpetuating risk factor because it inhibits recovery from their mental health disorder.
- D** predisposing risk factor because it increases their susceptibility to developing a mental health disorder.

**Question 8** (3 MARKS)

Zeynep was recently diagnosed with a mental health disorder. When being diagnosed, her psychologist asked her if she had a history of mental health disorders in her family. When Zeynep said that she did, her psychologist said that this increased her chances of developing a mental health disorder.

- a** Identify a protective factor that could prevent the re-occurrence of Zeynep's mental health disorder when she recovers. (1 MARK)
- b** Define predisposing risk factors and identify an example that applies to Zeynep. (2 MARKS)



**Questions from multiple lessons****Question 9** (3 MARKS)

Hakan has just recovered from a mental health disorder. With reference to the restoration theory of sleep, explain why getting adequate sleep would act as a protective factor for Hakan.

**Question 10** (6 MARKS)

Enes is a healthy adult who works long hours as a doctor. Despite always being busy, Enes is still able to carry out everyday tasks such as cooking himself a dinner each night without assistance from others. Enes also has a strong support network and maintains healthy relationships with his friends and family. However, his psychologist is worried that he would be at greater risk of developing a mental health disorder if he were to suddenly lose his job or some of his close friends.

- a What type of risk factor is Enes' psychologist concerned will affect his mental health? Justify your response. (2 MARKS)
- b With reference to the scenario, identify two characteristics of a mentally healthy person that Enes displays. (4 MARKS)

**Key science skills****Question 11** (6 MARKS)

Dr Abara was interested in studying the effectiveness of adequate diet as a protective factor. Dr Abara randomly allocated people who had just recovered from a mental health disorder into one of two groups. Group one were assigned a healthy diet across the period of four months, while group two received no treatment. At the end of the experiment, Dr Abara assessed if any participants had been re-diagnosed with a mental health disorder.

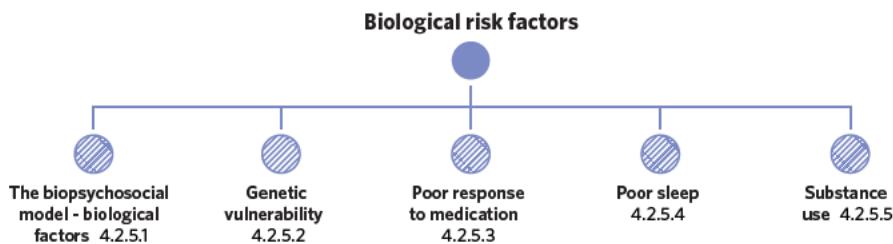
- a Identify the experimental research design that Dr Abara used. Justify your response. (2 MARKS)
- b Which group is the control group in Dr Abara's experiment? Justify your response. (2 MARKS)
- c Identify a relevant extraneous variable and explain how it could impact Dr Abara's results. (2 MARKS)

# 12B BIOLOGICAL RISK FACTORS

In the previous lesson, you learned about the Four P model as a way of defining the different factors that contribute to the development and progression of mental health disorders. This lesson focuses specifically on biological factors that contribute to developing mental health disorders. The biological risk factors covered in this lesson will also be examined using the Four P model as each risk factor impacts mental health in different ways.

12A. Four P model	12B. Biological risk factors	12C. Psychological risk factors	12D. Social risk factors	12E. Cumulative risk
<b>Study design dot point</b>				
▪ the influence of biological risk factors including genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and substance use				
<b>Key knowledge units</b>				
The biopsychosocial model - biological factors				4.2.5.1
Genetic vulnerability				4.2.5.2
Poor response to medication due to genetic factors				4.2.5.3
Poor sleep				4.2.5.4
Substance use				4.2.5.5

In this lesson, you will be learning about **biological risk factors**. Specifically, you will be learning about **genetic vulnerability**, **poor response to medication**, **poor sleep** and **substance use**. You will also be looking at each of these biological risk factors from the perspective of the Four P model.



## The biopsychosocial model - biological factors 4.2.5.1

### OVERVIEW

The biopsychosocial model is a framework that can be used to categorise the factors that contribute to the development and progression of mental illness. It proposes that biological, psychological and social risk factors all interact and contribute to the development of a mental disorder, where biological risk factors relate specifically to the body.

### THEORY DETAILS

In the last lesson, you learned about the Four P model which is one way of categorising and understanding the different factors that contribute to the development and progression of a mental health disorder. In the rest of this chapter, you will be introduced to the biopsychosocial model, which is another perspective for understanding these risk factors. The **biopsychosocial model** proposes that biological, psychological and social factors all interact together to influence your mental health.

In this lesson you will start by examining the biological risk factors and learn about them through both the Four P and biopsychosocial model.

**Biological risk factors** are one group of risk factors that can impact your mental health. Biological risk factors refer to risk factors relating to physiological functioning. In this lesson you will be looking at the influence of genetic vulnerability, poor response

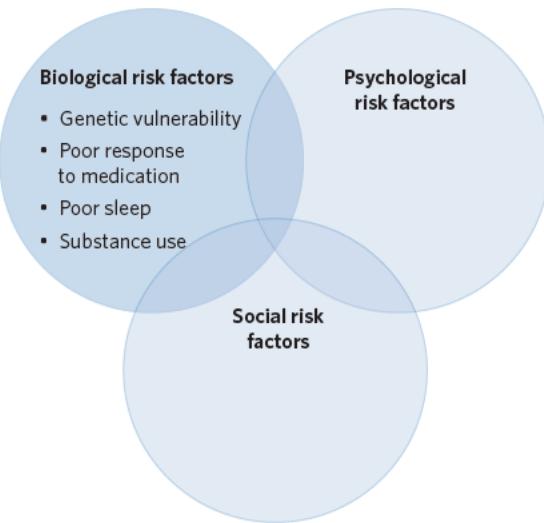
**The biopsychosocial model** a framework for approaching mental health that suggests that biological, psychological and social factors all interact and contribute to the development of mental illness

**Biological risk factors** factors relating to the body that increase the risk of developing a mental health disorder

**lesson link** As you learned in lesson 11A: Mental health continuum, biological risk factors are an example of an internal factor.



to medication, poor sleep and substance use. As highlighted in figure 1, this lesson specifically covers biological risk factors, which forms a part of the overall framework of the biopsychosocial model.



**Figure 1** Biological risk factors as part of the biopsychosocial framework

## Genetic vulnerability 4.2.5.2

### OVERVIEW

Genetic vulnerability to specific mental disorders is a biological risk factor because it describes genetic or inherited factors that contribute to mental health disorders. These factors affect an individual's physical makeup and are outside of a person's control. Genetic vulnerability increases susceptibility to developing a mental health disorder.

### THEORY DETAILS

Genetic vulnerability to specific mental disorders is a biological risk factor because it involves a person's genetic makeup that is outside of their control. It occurs when there is a family history of a particular mental health disorder. For example, if many people in a person's family have had schizophrenia, then that person is more likely to develop schizophrenia themselves as they may also have a genetic predisposition.

In terms of the Four P model, genetic vulnerability is often considered a predisposing risk factor. If somebody has a genetic vulnerability to a specific mental health disorder, they are not guaranteed to develop that mental health disorder themselves. Rather, it increases their susceptibility to developing this mental health disorder, therefore acting as a predisposing risk factor.

## Poor response to medication due to genetic factors 4.2.5.3

### OVERVIEW

Poor response to medication is a biological risk factor because it involves genetic factors that limit the effectiveness of medication. As a result, it limits a person's ability to recover from a mental health disorder.

### THEORY DETAILS

The effectiveness of a particular medication prescribed by a doctor or psychiatrist relies on the biological condition of the person who is taking the medication. This is because the medication has an active ingredient that reacts in different ways depending on the individual consuming it. While medication is widely effective in the population, there are some people who have **poor response to medication** if their biology is resistant to the effect of particular drugs.

In terms of the Four P model, poor response to medication is often considered to be a perpetuating risk factor. Taking medication is often part of the process of recovering from a mental health disorder. A psychiatrist or other doctor may prescribe medication to someone as it will address the symptoms that the person is experiencing and as a result manage their mental health. Therefore, if a person experiences a poor response to

**Genetic vulnerability** a person's genetic predisposition that increases their susceptibility to developing a mental health disorder

**Poor response to medication** when medication is not effective due to genetic factors

a medication that was prescribed to manage their mental health disorder, it inhibits their recovery and acts as a perpetuating risk factor.

#### **Want to know more?**

It is important to understand that genetic vulnerability occurs for specific disorders and that it does not guarantee that the individual will develop the disorder. Rather, it only increases their susceptibility to developing a certain disorder.

You may remember from Unit 1 psychology that the development of disorders such as schizophrenia are due to the interaction between genetic factors and environmental triggers such as harmful alcohol or drug use, based on the 'two-hit' hypothesis. A person may have a genetic vulnerability to schizophrenia, but the disorder may not develop if the individual does not experience an environmental trigger.

## **Poor sleep** 4.2.5.4

### **OVERVIEW**

Poor sleep has biological consequences that make a person more vulnerable to developing a mental health disorder and can directly lead to its occurrence.

### **THEORY DETAILS**

**Poor sleep** is a common consequence of the struggles and demands of everyday life. Unfortunately, poor sleep also has biological consequences that can contribute to the development of mental health disorders. Biological consequences of sleep deprivation that can lead to the development of a mental health disorder include:

- An inability to restore adequate neurotransmitter levels
- An inability to maintain neural pathways through lack of stimulation
- Greater difficulty with learning
- Inadequate memory consolidation
- An inability to recover from general fatigue

In terms of the Four P model, poor sleep is often considered to be a precipitating risk factor. When someone experiences poor sleep, they no longer have the biological resources to cope with the pressures of everyday life. This increases a person's susceptibility to developing a mental health disorder as they are more vulnerable to being unable to function in society without these biological resources. If it is specifically poor sleep that caused this vulnerability, then it can also act as the specific 'trigger' to the onset of a mental health disorder.

#### **Useful tip**

Despite sleep having both biological and psychological benefits, it is important to focus on the biological effects when discussing poor sleep as a biological risk factor for mental health, as this is the way that it is characterised on the study design.

**Poor sleep** inadequate sleep quality or quantity

**lesson link** To help understand the biological impacts of poor sleep, it is important to remember the restorative effects of sleep according to the restoration theory that you learned in lesson **9B: The purpose and function of sleep**.

**lesson link** The opposite of poor sleep, being adequate sleep, will also be explored as a biological protective factor in lesson **14A: Resilience**.

**lesson link** When used as prescribed and with caution, benzodiazepines can also be an effective intervention for specific mental health disorders such as phobias. This will be further explored in lesson **13C: Interventions for Phobia**.

## **Substance use** 4.2.5.5

### **OVERVIEW**

Substance use is a biological risk factor because the active ingredients in substances can harm the body when used. As a result, substance use increases the chances of somebody developing a mental health disorder and can directly lead to its occurrence.

### **THEORY DETAILS**

**Substance use** refers to the use of drugs, either legal or illegal. Some common legal substances that can increase the likelihood of developing a mental disorder include:

**Substance use** use of either legal or illegal drugs

- Alcohol
- Tobacco
- Sleep medications
- Barbiturates
- Benzodiazepines
- Codeine



- Morphine
- Methadone
- Fentanyl & analogs

(Centre of addiction, 2017)

Some common illegal substances that can increase the likelihood of developing a mental health disorder include:

- Cannabis (marijuana)
- Heroin
- Amphetamines (speed)
- Cocaine
- LSD
- MDMA (ecstasy)

(Victoria legal aid, 2018)

When people become biologically dependent on a particular substance, it compromises their ability to function in everyday life without using that drug. Therefore, when people try to stop using a drug or have to function in a context where they cannot consume the drug, they often cannot deal with the demands of everyday life. This therefore may lead to the development of mental health disorders. Sometimes, using particular drugs like hallucinogens even once or twice can cause someone to develop a mental health disorder. This can happen if someone has a particularly bad experience, or if they have a genetic predisposition to developing disorders. An example of this is schizophrenia, which can be triggered by the use of certain drugs, even from using substances only once or rarely.

In terms of the Four P model, substance use can often be considered to be a precipitating risk factor. As discussed, the biological dependence on a particular substance can increase someone's susceptibility to developing a mental health disorder. When that person attempts to stop using the drug, perhaps because they can no longer financially afford the habit or because the situation they are in (such as work or school) does not allow for it, that person may struggle to function effectively in society. If substance use is specifically the cause of this biological vulnerability, then it also directly leads to the occurrence of a mental health disorder.

#### **Useful tip**

Risk factors such as substance use can be more than one 'P' factor based on the Four P model. For example, although substance use can be understood as a precipitating risk, in other instances it can also be predisposing or perpetuating, and for some people it could be all three risk factors.

In a given scenario, it is important to understand how the risk factor is either precipitating, predisposing or perpetuating specific to the scenario.

## **Theory summary**

In this lesson, you have learned about biological risk factors. You should now be able to describe genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and substance use and understand why they are considered to be biological risk factors. In addition, you should also be able to apply each of these biological risk factors to the Four P model, an example of how these models relate is summarised in table 1.

**Table 1** Four P model and biological risk factors

Four P model	Biological risk factors
Predisposing risk factor	<ul style="list-style-type: none"> <li>• Genetic vulnerability</li> </ul>
Precipitating risk factor	<ul style="list-style-type: none"> <li>• Poor sleep</li> <li>• Substance use</li> </ul>
Perpetuating risk factor	<ul style="list-style-type: none"> <li>• Poor response to medication</li> </ul>



Your understanding of stimulants and depressants from lesson **8D: Alertness, brain wave patterns and drug-induced ASCs** helps you to understand the biological effects of drug consumption.

#### **Want to know more?**

If you or somebody you know is suffering from substance use, some places to seek help include:

- Your doctor
- Harm Reduction Victoria Tel. (03) 9329 1500
- DirectLine Tel. 1800 888 236
- DrugInfo Tel. 1300 85 85 84

#### **Useful tip**

When a question asks you to identify a biological risk factor that is present in an example, it is important not to select any biological factor from this lesson as being involved hypothetically. Instead, only select a biological risk factor that is explicitly relevant to the scenario.

## 12B Activities

1 In the table below, read through each item and decide if it is true or false, and remember to justify your choices.

Statement	True/false	Justification
Having a mental disorder is the main cause of poor sleep.		
All mental disorders are solely caused by biological changes within the person.		
Individuals who have family members with a mental health disorder are more likely to develop that disorder.		

Adapted from Edrolo and A.Muller, 2017.

## 12B QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- |  |                 |
|--|-----------------|
| • Genetic vulnerability  | • Poor sleep    |
| • Poor response to medication  | • Substance use |
| a Sleep that is not sufficient in terms of quality or quantity _____                                       |                 |
| b When prescribed medication is not effective due to genetic factors _____                                 |                 |
| c Use of a drug that is harmful and/or excessive _____   |                 |
| d Having genetic characteristics that increase the likelihood of developing a mental health disorder _____ |                 |

#### Question 2

Which of the following options most correctly matches the blanks?

Four P model	Biological risk factors
Predisposing risk factor	• X
Precipitating risk factor	• Poor sleep • Y
Z	• Poor response to medication

	X	Y	Z
A	Substance use	Genetic vulnerability	Perpetuating risk factor
B	Genetic vulnerability	Substance use	Perpetuating risk factor
C	Perpetuating risk factor	Perpetuating risk factor	Substance use
D	Perpetuating risk factor	Genetic vulnerability	Substance use

### Exam-style questions

#### Remember and understand

#### Question 3 (1 MARK)

A biological risk factor that could contribute to the development of a mental illness is

- A stress.
- B living alone.
- C poor sleep.
- D having few friends.

Adapted from VCAA 2015 exam MCQ5



**Question 4** (1 MARK)

A biological risk factor that is also a predisposing risk factor is

- A** increased heart rate.
- B** catastrophic thinking.
- C** ruminating.
- D** genetic vulnerability.

**Question 5** (1 MARK)

Poor response to medication is considered to be a biological factor and a

- A** perpetuating risk factor, because it inhibits the individual's ability to recover.
- B** predisposing risk factor, because it inhibits the individual's ability to recover.
- C** precipitating risk factor, because it supports the individual's ability to recover.
- D** protective factor, because it supports the individual's ability to recover.

**Question 6** (1 MARK)

Which of the following incorrectly pairs a risk factor of the Four P model with a corresponding biological risk factor?

	<b>Four P model</b>	<b>Biological risk factor</b>
<b>A</b>	Predisposing risk factor	Substance use and poor sleep
<b>B</b>	Predisposing risk factor	Poor sleep
<b>C</b>	Precipitating risk factor	Substance use and poor sleep
<b>D</b>	Precipitating risk factor	Exercise

**Question 7** (1 MARK)

Identify a similarity between poor sleep and substance use.

**Question 8** (2 MARKS)

Explain what is meant by poor response to medication as a biological risk factor and explain why it is considered a perpetuating risk factor.

**Apply and analyse****Use the following information for questions 9 and 10.**

Mehmet was prescribed medication by his psychiatrist to treat his mental health disorder. Despite taking the medication as prescribed, Mehmet still experienced the same symptoms of his mental health disorder. However, eventually, Mehmet was prescribed a medication which was effective, removing the symptoms of the mental health disorder which allowed him to function effectively in everyday life. Years later, Mehmet started abusing alcohol and began to again experience the same symptoms of mental illness.

**Question 9** (1 MARK)

Which of the following is a biological risk factor that contributed to Mehmet's response to the initial treatment?

- A** genetic factors influencing the effectiveness of the medication
- B** genetic vulnerability
- C** substance use
- D** stress

Adapted from VCAA 2017 exam MCQ33

**Question 10** (1 MARK)

Which biological risk factor was responsible for Mehmet experiencing the symptoms of mental illness after previously having recovered?

- A poor sleep
- B poor response to medication
- C substance use
- D genetic vulnerability

**Use the following information for questions 11 and 12.**

Ava recently got fired from her job and cannot find any opportunities for new employment. Consequently, she has been having difficulty sleeping, has stopped seeing her friends and has started to drink alcohol frequently each day.

**Question 11** (1 MARK)

Which of the following identifies the biological risk factors experienced by Ava after losing her job?

- A loss of employment and poor sleep
- B substance use and poor sleep
- C not seeing her friends and substance use
- D loss of employment and not seeing her friends

*Adapted from VCAA 2018 exam MCQ13*

**Question 12** (1 MARK)

In terms of the development of mental health disorders, Ava's sleep deprivation could be considered a

- A social predisposing risk factor.
- B social precipitating risk factor.
- C biological protective risk factor.
- D biological precipitating risk factor.

*Adapted from VCAA 2017 sample exam MCQ45*

**Question 13** (4 MARKS)

Finton has a family history of mental health disorders. Recently, Finton has been unable to cope with the pressures of his everyday life and has been unable to function effectively. Upon visiting a psychologist, he was told that he has a mental illness.

In relation to this scenario, explain what is meant by 'biological risk factor' and 'predisposing' risk factor'.

*Adapted from VCAA 2017 sample exam SAQ6b*

**Questions from multiple lessons****Question 14** (1 MARK)

Ethan is a healthy teenager who had only been sleeping for 5 hours each night. After a few months, he saw a psychologist who diagnosed him with a mental illness. The type of sleep deprivation and risk factor that Ethan was experiencing were

- A partial sleep deprivation; protective risk factor.
- B total sleep deprivation; precipitating risk factor.
- C partial sleep deprivation; precipitating risk factor.
- D total sleep deprivation; predisposing risk factor.

**Question 15** (2 MARKS)

With reference to the restoration theory of sleep, explain why poor sleep is considered to be a biological risk factor.

**Question 16** (2 MARKS)

Define stimulants and explain how their excessive use could be considered a biological risk factor.



**Key science skills****Question 17** (9 MARKS)

Dr Craig is interested in studying the impact of poor sleep as a biological risk factor. In order to determine how significant of a factor it is in developing a mental health disorder compared to having adequate sleep, Dr Craig recruited patients from his hospital with no prior history of mental health disorders and randomly allocated them into two groups. **Group 1** were made to use an alarm which woke them up throughout different stages of their regular sleep to disrupt sleep quality and quantity. **Group 2** were told to sleep for as long as they would usually. At the end of a three month period, all participants were made to see a psychologist who could diagnose any potential mental illness. The percentage of diagnosed mental illness for each group was compared.

- a What is the dependent variable in Dr Craig's experiment? (1 MARK)
- b Identify the sampling technique used by Dr Craig. Justify your response. (2 MARKS)
- c Identify the experimental research design that Dr Craig used in his experiment. Justify your response. (2 MARKS)
- d Explain how two extraneous variables could have impacted the results of Dr Craig's experiment. (4 MARKS)

# 12C PSYCHOLOGICAL RISK FACTORS

So far in this chapter, you have learned about the Four P model as a way of defining the different factors that contribute to the development and progression of a mental health disorder. You have also applied this concept to specific biological risk factors as part of the biopsychosocial framework. This lesson will further your understanding of factors that influence mental health by looking at the specific psychological risk factors that contribute to the development and progression of mental illness.

12A. Four P model	12B. Biological risk factors	12C. Psychological risk factors	12D. Social risk factors	12E. Cumulative risk
<b>Study design dot point</b>				
<ul style="list-style-type: none"> <li>the influence of psychological risk factors including rumination, impaired reasoning and memory, stress and poor self-efficacy</li> </ul>				
<b>Key knowledge units</b>				
The biopsychosocial model - psychological factors				4.2.6.1
Rumination				4.2.6.2
Impaired reasoning and memory				4.2.6.3
Stress				4.2.6.4
Poor self-efficacy				4.2.6.5

In this lesson, you will be learning about **psychological risk factors**. Specifically, you will be learning about **rumination, impaired reasoning and memory, stress, and poor self-efficacy**. You will also be looking at each of these psychological risk factors from the perspective of the Four P model.



## The biopsychosocial model - psychological factors 4.2.6.1

### OVERVIEW

Psychological factors make up part of the broader biopsychosocial model. Psychological factors relate to cognitive and affective processes such as thought patterns and memory and can contribute to the development and progression of mental illness.

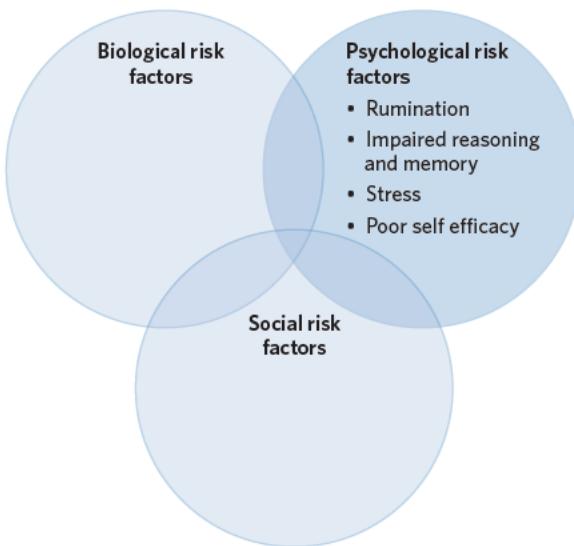
### THEORY DETAILS

**Psychological risk factors** are another group of risk factors that can impact your mental health. Psychological risk factors refer to risk factors relating to cognitive and affective functioning, such as the process of learning and memory, thought patterns and emotional states. When there are issues with these processes, the risk of developing a mental health disorder may increase. In this lesson, you will be looking at the influence of rumination, impaired reasoning and memory, stress, and poor self-efficacy. As highlighted in figure 1, this lesson specifically covers psychological risk factors, which forms a part of the overall framework of the biopsychosocial model.

**Psychological risk factors** factors relating to cognitive and affective functioning that increase the risk of developing a mental health disorder

 As you learned in lesson 11A: **Mental health continuum**, psychological risk factors are an example of an internal factor.





**Figure 1** Psychological risk factors as part of the biopsychosocial framework

### Rumination 4.2.6.2

#### OVERVIEW

Rumination is a psychological risk factor that involves negative thought patterns whereby an individual repeatedly focuses on negative emotional experiences.

#### THEORY DETAILS

Have you ever fixated on something bad that happened to you and found yourself thinking about it over and over again? **Rumination** involves repeatedly thinking negative emotional thoughts and remembering unfavourable experiences. Instead of being able to overcome a negative experience, ruminating means that an individual will keep thinking about a negative situation until it becomes overwhelming and distressing. It is the cognition involved in developing the negative thought processes of rumination that make it a psychological risk factor for developing a mental health disorder.

In terms of the Four P model, rumination is often a perpetuating risk factor. Rumination is perpetuating when it compromises an individual's ability to overcome distressing thoughts and experiences. As a result, rumination also limits an individual's ability to overcome symptoms of mental illness and ultimately inhibits a person's ability to recover from a mental health disorder. Rumination can also be predisposing and precipitating depending on the individual's circumstance.

### Impaired reasoning and memory 4.2.6.3

#### OVERVIEW

Impaired reasoning and memory is a psychological risk factor because it involves cognitive biases that limit an individual's ability to think rationally and remember events accurately.

#### THEORY DETAILS

**Impaired reasoning and memory** involves not being able to make rational decisions or remember a situation accurately. Impaired reasoning and memory is caused by cognitive bias, which is when an individual's subjective beliefs distort their ability to process and accurately recall the objective truth of an experience.

Impaired reasoning and memory can act as a perpetuating risk factor. Often, overcoming the symptoms of a mental health disorder requires the ability to think rationally. For example, holding the belief that seeing a psychologist will realistically help you to recover from a mental illness. If an individual experiences impaired reasoning and memory, they may instead not believe that seeing a psychologist will help them recover from a mental illness. Impaired reasoning and memory, therefore, acts as a perpetuating risk factor due to limiting an individual's ability to think rationally, which is required to overcome the symptoms of a mental illness.

**Rumination** repeatedly focusing on negative psychological thoughts and experiences

**Impaired reasoning and memory** cognitive biases that limit a person's ability to think about an event in a rational, constructive way and to remember it accurately

Furthermore, impaired reasoning and memory may act as predisposing risk factors. Having memory impairments such as long-term memory loss for example may increase a person's susceptibility to developing a mental health disorder if the frustrations this brings significantly impacts on their lifestyle.

On the other hand, impaired reasoning and memory may act as precipitating risk factors if a person makes consistent and systematic errors of judgement. For example, a person who believes that everyone around them has a problem with them may experience constant worry and therefore be more likely to develop a mental health disorder like anxiety.

#### **Useful tip**

*Impaired reasoning and memory* is one psychological risk factor. In your responses, you should therefore not separate impaired reasoning from impaired memory and talk about only one of these aspects without the other.



Specific cognitive biases are examined in lesson **13B: Contributing factors to phobia** in terms of how they can cause someone to develop a phobia.

## **Stress** 4.2.6.4

### **OVERVIEW**

Stress can be considered a psychological risk factor because it involves cognitive and affective processes, such as an individual's subjective appraisal of a stressor.

### **THEORY DETAILS**

Stress involves psychological processes, such as an individual's subjective appraisal of a stressor. This can result in the individual not coping and consequently contribute to mental illness. An individual's appraisal of a stressor is psychological given that it involves cognitive processes. Simply put, if an individual appraises a stimulus to exceed their ability to cope they will consequently experience a stress response. This then, in turn, increases their risk of developing a mental health disorder.

In terms of the Four P model, stress is also often considered to be a precipitating, predisposing and/or a perpetuating risk factor, dependent on the situation. Stress may be precipitating, for example, if an individual regularly experiences stress and uses poor coping strategies. This may result in the individual becoming less equipped to deal with the pressures of everyday life and their stress could accumulate to an extent that it is no longer manageable, leading to the symptoms of, or even directly resulting in a mental health disorder. More generally, stress can result in anxious thought patterns. These anxious thought patterns can disrupt an individual's ability to process information effectively and operate at a high level of functioning, therefore increasing susceptibility to, contributing to or maintaining mental health disorders.

**Stress** psychological and biological process that occurs when an individual does not feel as though they have adequate resources to cope with a stressor



The role of the stress response is also considered to be a biological contributing factor for phobia, which you will learn in lesson **13B: Contributing factors to phobia**.

#### **Useful tip**

Although stress has both biological and psychological processes, when talking about stress as a risk factor for mental health broadly, only refer to the psychological aspects of stress, such as an individual's subjective appraisal of a stressor. This is because stress is only listed under psychological risk factors for mental health on the study design.



In lesson **3C: Psychological processes of stress** you looked at Lazarus and Folkman's transactional model of stress and coping. This model provides a useful insight into the processes that are involved when an individual feels as though they cannot cope with a stressor, consequently increasing their susceptibility to and eventuating in the occurrence of a mental health disorder.

## **Poor self-efficacy** 4.2.6.5

### **OVERVIEW**

Self-efficacy is a psychological factor that relates to an individual's confidence in their ability to complete tasks and meet goals in their everyday life. Poor self-efficacy is a risk factor as it increases susceptibility to, directly causes, and in some cases limits an individual's ability to recover from a mental health disorder.

### **THEORY DETAILS**

Poor self-efficacy occurs when an individual does not believe in their capacity to complete a task or meet their goals. Poor self-efficacy is a psychological risk factor because it involves aspects of cognitive functioning such as thought patterns.

An individual with poor self-efficacy will have negative thought patterns that discourage them from completing tasks. For example, if a student with poor self-efficacy had a

**Self-efficacy** a person's confidence in their ability to complete tasks and meet goals



series of homework tasks due they may think that they cannot complete the homework, discouraging them from being able to meet the deadline. This limits an individual's ability to cope with the demands of everyday life, therefore contributing to the development of a mental health disorder.

In terms of the Four P model, poor self-efficacy is often also considered to be a predisposing risk factor. A person who has low self-efficacy will have a consistent lack of confidence in their abilities. It can, therefore, reduce the ability to complete daily tasks such as going to school or work as a lack of confidence may prevent them from functioning effectively.

It is important to note, depending on the scenario, self-efficacy can also be:

- A precipitating risk factor:
  - If a specific event occurs that challenges an individual's ability to cope, then poor self-efficacy could be the direct cause of the development of a mental health disorder.
  - For example, if someone was given demanding deadlines for a work project and they had poor self-efficacy, they may not feel confident in their ability to complete the task and as a result, fail to make the deadline. The consequences for this, such as being fired, could cause the individual to feel incredibly distressed and challenge their ability to continue to function effectively, thereby increasing their susceptibility to and directly causing mental illness.
- A perpetuating risk factor:
  - If an individual is trying strategies to overcome a mental health disorder, then poor-self efficacy can limit their capacity to complete these strategies and recover.
  - For example, if an individual was seeing a psychologist and given strategies to overcome mental illness, such as to exercise regularly, then poor self-efficacy could result in them not believing in their capacity to achieve the goals set by the psychologist, consequently inhibiting recovery.

#### **Useful tip**

The context of a scenario is important in being able to classify what type of risk factor poor self-efficacy is in relation to the Four P model. Make sure that you read the scenario carefully to be able to determine how poor self-efficacy is impacting an individual's mental health in a specific context.

## **Theory summary**

In this lesson, you have learned about psychological risk factors. You should now be able to describe rumination, impaired reasoning and memory, stress, and poor self-efficacy and understand why they are considered to be psychological risk factors. You should also be able to apply each of these psychological risk factors to the Four P model. These are summarised in table 1.

**Table 1** Four P model and psychological risk factors

Four P model	Psychological risk factors
Predisposing risk factor	<ul style="list-style-type: none"> <li>• Poor self-efficacy</li> </ul>
Precipitating risk factor	<ul style="list-style-type: none"> <li>• Impaired reasoning and memory</li> <li>• Stress</li> </ul>
Perpetuating risk factor	<ul style="list-style-type: none"> <li>• Rumination</li> </ul>

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## **12C Activities**

- 1 In the table below, read through each item and decide if it is true or false, remembering to justify your choices.

Statement	True/false	Justification
Impaired reasoning and memory is a biological risk factor.		
Self-efficacy refers to obsessive thinking and worrying about the negative aspects of a situation.		
Rumination has the potential to negatively affect mental health if an individual is not able to break the cycle of obsessing about the negative aspects of their lives.		

# 12C QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- |   |                      |
|---|----------------------|
| • Rumination  | • Stress             |
| • Impaired reasoning and memory   | • Poor self-efficacy |
| <b>a</b> A psychological and physiological process that occurs when an individual feels as though an event exceeds their capacity to cope _____ |                      |
| <b>b</b> Repeatedly focusing on a negative situation instead of how to overcome it _____  |                      |
| <b>c</b> When an individual does not believe in their ability to complete tasks and meet goals _____  |                      |
| <b>d</b> Disruptions to the ability to process information rationally and remember how an event occurred accurately _____                       |                      |

### Question 2

Which of the following options correctly matches the blanks?

Four P model	Psychological factors
<b>X</b>	• Poor self-efficacy
Precipitating risk factor	• <b>Y</b> • Stress
Perpetuating risk factor	• <b>Z</b>

	X	Y	Z
<b>A</b>	Impaired reasoning and memory	Predisposing risk factor	Rumination
<b>B</b>	Protective factor	Rumination	Impaired reasoning and memory
<b>C</b>	Predisposing risk factor	Impaired reasoning and memory	Rumination
<b>D</b>	Rumination	Impaired reasoning and memory	Predisposing risk factor

## Exam-style questions

### Remember and understand

#### Question 3 (1 MARK)

According to the biopsychosocial model, which of the following is a psychological risk factor?

- A** Impaired reasoning and memory
- B** Genetic vulnerability
- C** Cumulative risk
- D** Poor response to medication

Adapted from VCAA 2017 exam MCQ19

#### Question 4 (1 MARK)

The tendency to fixate on negative emotional experiences without thinking about a way to overcome the problem best matches the definition of

- A** poor self-efficacy.
- B** stress.
- C** rumination.
- D** impaired reasoning and memory.



**Question 5** (2 MARKS)

Describe poor self-efficacy and explain how it could act as a predisposing risk factor.

**Question 6** (2 MARKS)

Explain how stress can be considered as a psychological and precipitating risk factor.

**Apply and analyse****Question 7** (1 MARK)

Sam is a high school student who has been diagnosed with a mental illness. Sam has been recovering from her mental illness effectively, but was recently told by her teacher at school that she was not working hard enough. Sam has not been able to move on from this event, thinking about the scenario over and over again to the extent that she has become overwhelmed. Sam's recovery from her mental illness has been inhibited as a result and her symptoms persist.

Which psychological risk factor, involving Sam thinking about the event over and over, played a role in inhibiting Sam's recovery from her mental illness?

- A stress
- B poor self-efficacy
- C rumination
- D impaired reasoning and memory

**Question 8** (1 MARK)

Bronson's partner of 20 years died following a long illness. Bronson felt stressed and anxious to the extent that he forgot to complete many tasks that he would usually remember. For example, paying bills on time and going shopping. Bronson also had a distorted judgement about what his future was going to look like, thinking that he would now be forever alone and miserable.

Which of the following is a psychological risk factor that perpetuated Bronson's symptoms of anxiety?

- A Stigma
- B Impaired reasoning and memory
- C Loss of a significant relationship
- D Poor sleep

*Adapted from VCAA 2018 exam MCQ30*

**Question 9** (1 MARK)

Daniel is auditioning for the lead role in the school play. Although Daniel knows that he is a talented singer, he is feeling overwhelmed by the level of competition for a place in the play and is concerned that he is not good enough to get the lead role.

Identify one example of Daniel's poor self-efficacy.

*Adapted from VCAA 2017 sample exam SAQ5a*

**Question 10** (2 MARKS)

George was incredibly stressed about an upcoming formal where he had to bring a date. He spent hours each day trying to think of someone he could take, but kept thinking that it was not worth it because they would all say no to him. George was so worried about who to take and what people would think of him if he goes alone that he could not bear going to school.

Explain how stress could precipitate a mental health disorder for George.

**Questions from multiple lessons****Question 11** (1 MARK)

Benjamin has poor self-efficacy. Whenever he is given a deadline for a task at work he does not think that he will be able to do it. His heart rate increases as he panics about his capacity to complete the task on time.

Which division of the nervous system is dominant when Benjamin is experiencing poor self-efficacy at work?

- A Central nervous system
- B Somatic nervous system
- C Sympathetic nervous system
- D Parasympathetic nervous system

**Question 12** (8 MARKS)

Adem works at an incredibly demanding law firm. Recently, Adem has been given a major assignment to complete by his boss. As the date that the assignment is due gets closer, Adem becomes incredibly worried that he won't have time to be able to finish it and that his boss will fire him as a result. Experiencing regular symptoms of distress, Adem saw a psychologist who diagnosed him with a mental illness.

- a Identify the type of stress that Adem is experiencing. (1 MARK)
- b What source of stress is Adem experiencing? Justify your response. (2 MARKS)
- c With reference to the primary and secondary appraisal stages of Lazarus and Folkman's transactional model of stress and coping, explain how stress acted as a precipitating risk factor. (5 MARKS)

**Key science skills****Question 13** (6 MARKS)

Dr Quina was interested in studying the extent to which rumination perpetuates a mental health disorder. Dr Quina created two groups, one with participants who had an existing mental health disorder and who ruminated and the other with participants who had an existing mental health disorder but did not ruminate. A month later, Dr Quina recorded if participants still had a mental health disorder.

- a Identify the independent variable in Dr Quina's experiment. (1 MARK)
- b Identify the dependent variable in Dr Quina's experiment. (1 MARK)
- c What experimental research design did Dr Quina use in her experiment? Justify your response. (2 MARKS)
- d Explain how an extraneous variable could have impacted the results to Dr Quina's experiment. (2 MARKS)

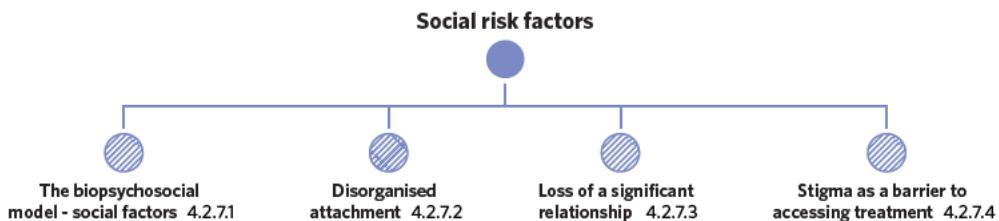


# 12D SOCIAL RISK FACTORS

So far in this chapter, you have learned about the biological and psychological risk factors which partly make up the biopsychosocial framework for mental health. In this lesson you will learn about the social risk factors, which make up the final component of this model. You have also learned about the Four P model as another way of defining the factors that can contribute to the development and progression of mental illness.

12A. Four P model	12B. Biological risk factors	12C. Psychological risk factors	12D. Social risk factors	12E. Cumulative risk
<b>Study design dot point</b>				
<ul style="list-style-type: none"> <li>the influence of social risk factors including disorganised attachment, loss of a significant relationship and the role of stigma as a barrier to accessing treatment</li> </ul>				
<b>Key knowledge units</b>				
The biopsychosocial model - social factors				4.2.7.1
Disorganised attachment				4.2.7.2
Loss of a significant relationship				4.2.7.3
Stigma as a barrier to accessing treatment				4.2.7.4

In this lesson, you will be learning about **social risk factors**. Specifically, you will be learning about **disorganised attachment**, **loss of a significant relationship** and **stigma as a barrier to accessing treatment**. You will also be looking at these factors from the perspective of the Four P model.



## The biopsychosocial model - social factors 4.2.7.1

### OVERVIEW

Social factors make up part of the overall biopsychosocial framework. Social risk factors relate to aspects of an individual's environment and interactions that can contribute to the development of a mental illness.

### THEORY DETAILS

**Social risk factors** are another group of risk factors that can impact your mental health. Social risk factors arise from an individual's interaction with their external environment, such as their relationships with their family and friends. When there are disruptions to these relationships, it can increase an individual's risk of developing a mental illness. In this lesson, you will be looking at the influence of disorganised attachment, the loss of a significant relationship and the role of stigma as a barrier to accessing treatment. As highlighted in figure 1, this lesson specifically covers social risk factors, which complete the overall framework of the biopsychosocial model.

**Social risk factors** factors relating to an individual's interaction with their external environment and other people that increase the risk of developing a mental health disorder



As you learned in lesson **11A: Mental health continuum**, social risk factors are an example of an external factor.

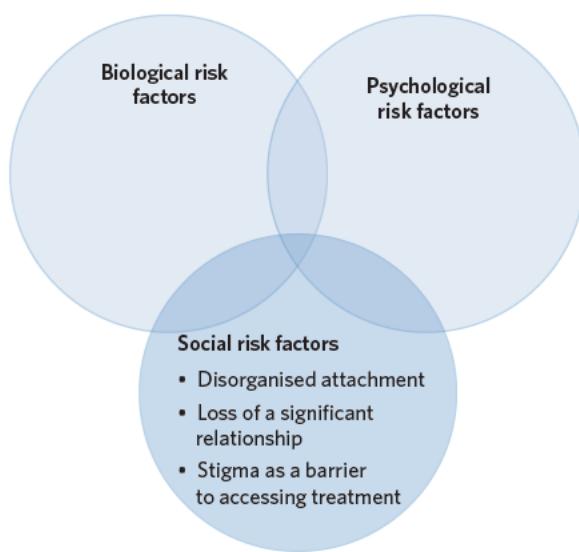


Figure 1 Social risk factors as part of the biopsychosocial framework

## Disorganised attachment 4.2.7.2

### OVERVIEW

Disorganised attachment occurs during infancy when the primary caregiver does not provide consistent support and security. This has many implications for the infant later in life which may increase their risk of developing a mental illness.

### THEORY DETAILS

Disorganised attachment involves an infant displaying inconsistent behaviour in the presence of their primary caregiver when not provided with consistent or adequate care. The main caregiver does not need to be the infant's biological parent, but rather, whoever is most responsible for caring for them each day, such as another family member or a nanny. Inconsistent support can come in many forms, including not providing regular love, food, emotional support, or affection.

Inconsistent support can cause the infant to believe they are unable to rely on important people in their lives, leading to the development of trust issues later in life. As an adult, this infant may experience difficulty forming and maintaining relationships with others as a result. Disorganised attachment may also occur simply because the child has not developed adequate social skills due to a lack of early childhood socialisation, demonstrating that parental behaviour is not the only factor that can contribute to the development of disorganised attachment.

In terms of the Four P model, disorganised attachment is often a predisposing risk factor. Disorganised attachment is predisposing when the effects of disorganised attachment, such as finding it difficult to trust others, continue to affect an individual throughout their life. This continued impact can increase their susceptibility to developing a mental health disorder, but does not directly contribute to its onset. Disorganised attachment can also be precipitating and perpetuating depending on the individual's circumstance.

**Disorganised attachment** the inconsistent behaviour displayed by an infant towards their main caregiver when they are not provided with consistent and adequate support

## Loss of a significant relationship 4.2.7.3

### OVERVIEW

Losing a relationship which involved significant emotional attachment can be highly distressing. The loss of a significant relationship can therefore act as a specific event that causes the onset of a mental illness.

### THEORY DETAILS

The loss of a significant relationship can be incredibly stressful and often involves adapting to new situations that you have not had to deal with before. For example, if an individual separates with their partner after living with them for a long time, they would have to find a new place to live and adapt to living alone, in addition to coping with the loss of this emotional connection. As in this example, the loss of a significant relationship can be incredibly distressing, as it requires an individual to adapt to new, and sometimes uncomfortable situations.

**Loss of a significant relationship** losing a relationship that involved considerable emotional attachment



The loss of a significant relationship is therefore a social risk factor because it involves an individual's relationships with those who are important to them. The loss of a significant relationship applies not only to romantic relationships, but also to friendships, relationships between family members or even relationships with a pet. Moreover, loss of a significant relationship can be defined by more than the event of death. It can also occur through separating from someone important in another way, such as breaking up with a partner, or having someone close to you move to another country.

In terms of the Four P model, the loss of a significant relationship is often a precipitating risk factor. It acts as a specific event that may cause the onset of a mental illness. When somebody loses a significant relationship, they may experience reduced resilience and therefore become more vulnerable in their state of emotional distress to developing a mental illness. In this way, the loss of a significant relationship both increases susceptibility and directly contributes to the occurrence of a mental health disorder. The loss of a significant relationship can also be a predisposing or perpetuating risk factor depending on the individual's circumstance.

### **Stigma as a barrier to accessing treatment** 4.2.7.4

#### **OVERVIEW**

Stigma is a social risk factor that involves feeling ashamed about a characteristic that sets you apart from others. Stigma has the role of acting as a barrier to seeking treatment, therefore perpetuating a mental health disorder.

#### **THEORY DETAILS**

Stigma refers to the feeling of embarrassment or shame experienced by an individual when they perceive that society has a negative view of the particular characteristic that distinguishes them from other people. Although stigma can be experienced at a psychological level when an individual internalises these views, it is a social risk factor because it is caused by the views that society holds, whether these are real or imagined by the person experiencing stigma. These views may negatively affect the relationships and interactions people with a mental disorder have with others, causing feelings of isolation and societal exclusion. Importantly, when someone with a mental health disorder feels ashamed, they are unlikely to seek the help they need to overcome their condition. For example, it may be less likely that they will talk to family or friends about how they are feeling or see a psychologist. In this way, stigma acts as a barrier to accessing treatment for people with a mental health disorder.

Some common examples of stigma that are misconceived include:

- having a mental illness is a sign of weakness
- men need to be strong and should not have to seek help when experiencing mental illness
- women are too emotional and lack resilience
- having a mental illness means that you are always unstable and are unable to think logically
- people with a mental illness should not be trusted

The shame that occurs as a result of stigma can also perpetuate mental health disorders in other ways. People with a mental illness may be excluded from certain jobs, medical appointments or sports due to the stigma held by society. This occurs when individuals or institutions directly exclude people because of their mental illness, or because the sufferer believes they will be excluded, discouraging them from seeking such opportunities in the first place. This perpetuates their mental illness, exacerbating its effects on the individual to make them feel worse. This further illustrates how stigma is a social risk factor, through highlighting its impact on an individual's ability to interact with their external environment.

In terms of the Four P model, stigma is a perpetuating risk factor and acts as a barrier to accessing treatment. For example, if an individual is experiencing symptoms of a mental illness, they may feel too embarrassed to reach out for help or tell people what they are experiencing due to the perceived societal view that mental illness is a sign of weakness or instability. Consequently, the individual will not receive the treatment and support they need to recover from their symptoms, inhibiting their recovery and perpetuating their mental illness.



The loss of a significant relationship is also an example of a life event, which you learned about in lesson **3A: Stress**.

**Stigma** a mark of shame or disgrace experienced by an individual for a characteristic that distinguishes them from others



Further information about stigma is presented in lesson **13B: Contributing factors to phobia**, where you learn about stigma in the context of the development of phobia.

#### **Want to know more?**

SANE Australia is a national mental health charity working to support four million Australians affected by complex mental disorders. SANE's work includes mental health awareness, online peer support and information, stigma reduction, specialist helpline support, research and advocacy.

You can find out more at their website: [www.sane.org](http://www.sane.org)

**SANE**  
AUSTRALIA

## Theory summary

In this lesson, you have learned about social risk factors. You should now be able to describe disorganised attachment, the loss of a significant relationship and stigma as a barrier to accessing treatment, and understand why they are considered to be a social risk factor. In addition, you should also be able to apply the Four P model to each of these social risk factors, which is summarised in table 1.

Table 1 Four P model and social risk factors.

Four P model	Social risk factors
Predisposing risk factor	• Disorganised attachment
Precipitating risk factor	• Loss of a significant relationship
Perpetuating risk factor	• Stigma as a barrier to accessing treatment

## 12D Activities

- 1 In the table below, describe each social risk factor, describe the impact it may have on mental health, and provide an example.

Risk factor	Description	Impact on mental health	Example
Disorganised attachment			
Loss of a significant relationship			
Stigma as a barrier to accessing treatment			

Adapted from Edrolo and A.Muller, 2017.

## 12D QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- Social risk factors
  - Disorganised attachment
- a Societal views about a characteristic that sets someone apart from others and acts as a barrier to them accessing treatment \_\_\_\_\_
- b Losing a relationship of emotional significance \_\_\_\_\_
- c The inconsistent behaviour displayed by an infant towards their main caregiver when they are not provided with consistent and adequate support \_\_\_\_\_
- d Risk factors that increase the risk of developing a mental health disorder originating from an individual's external social environment \_\_\_\_\_

#### Question 2

Which of the following options correctly matches the blanks?

Four P model	Social risk factors
Predisposing risk factor	• X
Y	• Loss of a significant relationship
Perpetuating risk factor	• Z

	X	Y	Z
A	Disorganised attachment	Stigma as a barrier to accessing treatment	Precipitating risk factors
B	Stigma as a barrier to accessing treatment	Disorganised attachment	Precipitating risk factors
C	Precipitating risk factors	Disorganised attachment	Stigma as a barrier to accessing treatment
D	Disorganised attachment	Precipitating risk factors	Stigma as a barrier to accessing treatment



**Exam-style questions****Remember and understand****Question 3** (1 MARK)

According to the biopsychosocial model, which of the following is a social risk factor?

- A stigma as a barrier to accessing treatment
- B rumination
- C genetic vulnerability
- D substance use

**Question 4** (1 MARK)

A risk factor for developing a mental disorder due to the distress of losing an important relationship is referred to as

- A disorganised attachment.
- B the loss of a significant relationship.
- C poor self-efficacy.
- D rumination.

**Question 5** (2 MARKS)

Describe disorganised attachment and explain how it could act as a predisposing risk factor.

**Question 6** (2 MARKS)

Explain how stigma as a barrier to accessing treatment can be considered a social and perpetuating risk factor.

**Apply and analyse****Use the following information for questions 7 and 8.**

Frenkie works as a life saver at his local beach. Recently, Frenkie broke up with his partner of four years and has been feeling incredibly distressed. Due to struggling to get out of bed, he has been unreliable at work and is worried he will be fired. Frenkie feels embarrassed to tell his boss about his feelings because he thinks they will perceive him as weak.

**Question 7** (1 MARK)

A precipitating risk factor that directly lead to Frenkie's symptoms is

- A the loss of a significant relationship.
- B genetic vulnerability.
- C stigma as a barrier to accessing treatment.
- D substance use.

**Question 8** (1 MARK)

A perpetuating risk factor that restricted Frenkie from communicating his feelings to his boss is

- A poor self-efficacy.
- B stigma as a barrier to access treatment.
- C poor response to medication.
- D disorganised attachment.

**Question 9** (4 MARKS)

Phillip's parents had very demanding jobs when he was growing up and as a result were not a consistent part of his infancy. He never felt he could rely on them being home to look after him or provide support when he was upset as they were too busy. Phillip now finds it difficult to trust his friends and struggles to form supportive and meaningful relationships with others. Phillip wants to seek help from a psychologist to overcome these issues but is worried they will think he is overreacting and needs to toughen up.

- a Describe disorganised attachment and explain how it has increased Phillip's susceptibility to developing a mental health disorder. (2 MARKS)
- b Identify one possible source of stigma and explain how this stigma could act as a barrier to Phillip accessing treatment. (2 MARKS)

Adapted from VCAA 2017 exam SAQ6d

### Questions from multiple lessons

**Use the following information for questions 10 and 11.**

Lionel has a series of upcoming exams. He is so worried about them he has not left the house for weeks. He wants to see a psychologist to ask if his feelings are normal but is too embarrassed. Lionel spends hours trying to fall asleep as he keeps worrying about his exams.

#### Question 10 (1 MARK)

What social risk factor restricted Lionel from seeing a psychologist?

- A loss of a significant relationship
- B disorganised attachment
- C rumination
- D stigma as a barrier to accessing treatment

#### Question 11 (1 MARK)

Lionel is likely suffering from

- A a dyssomnia.
- B a parasomnia.
- C a phobia.
- D microsleeps.

#### Question 12 (4 MARKS)

Matthais' partner of 45 years died following a long illness. Matthais felt stressed, overwhelmed, had difficulty sleeping and struggled finding motivation to leave the house and go shopping. Matthais saw a psychologist who diagnosed him with a mental health disorder.

- a Identify the source of stress that Matthais experienced. Justify your response. (2 MARKS)
- b Describe how the loss of a significant relationship acted as a precipitating risk factor for Matthais' development of a mental health disorder. (2 MARKS)

### Key science skills

#### Question 13 (5 MARKS)

Dr Begis was interested in studying the extent to which disorganised attachment increases the risk of developing a mental health disorder. He decided to set up an experiment with one group of participants who had experienced disorganised attachment and another group of participants who had never experienced disorganised attachment. Dr Begis had all participants regularly see a psychologist and compared how many participants from each group were diagnosed with a mental illness. When Dr Begis published the results, the names of each participant were included without their knowledge.

- a Identify the experimental research design that Dr Begis used. (1 MARK)
- b What ethical consideration did Dr Begis compromise? Justify your response. (2 MARKS)
- c State whether Dr Begis' experiment demonstrates internal validity. Justify your response. (2 MARKS)



# 12E CUMULATIVE RISK

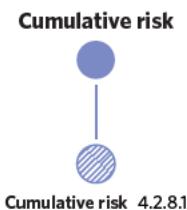
So far in this chapter, you have learned about biological, psychological and social risk factors as part of the biopsychosocial approach to mental health and have also applied these risk factors to the Four P model. This lesson will further your understanding of the development and progression of mental health disorders through learning about what happens when an individual experiences multiple risk factors at once. This concept is known as cumulative risk.

12A. Four P model	12B. Biological risk factors	12C. Psychological risk factors	12D. Social risk factors	12E. Cumulative risk
<b>Study design dot point</b>				
• the concept of cumulative risk				

<b>Key knowledge units</b>	
Cumulative risk	4.2.8.1

In this lesson, you will be learning about **cumulative risk**, which refers to the overall effect of experiencing multiple risk factors at once on an individual's mental health.



## Cumulative risk 4.2.8.1

### OVERVIEW

Cumulative risk refers to the increased risk of developing a mental health disorder that occurs when an individual experiences multiple risk factors at the same time. The effect of experiencing multiple risk factors is greater in impact than experiencing just one risk factor alone, and therefore increases the likelihood of developing mental illness.

### THEORY DETAILS

In this chapter you have been learning about different types of risk factors. The accumulation of multiple predisposing, precipitating and perpetuating risk factors has a greater effect on mental health than any individual risk factor alone. When an individual experiences all of these risk factors, they can compound together, meaning that they combine and interact in such a way that intensifies the risk of developing a mental health disorder. This is called **cumulative risk**, and it significantly increases the risk of developing a mental health disorder.

The concept of factors accumulating also applies to protective factors. The more protective factors that are present in an individual's life, the more likely they are to be able to display resilience. Therefore, the presence of multiple protective factors significantly decreases the risk of developing a mental health disorder. The presence of protective factors can, therefore, outweigh a risk factor and allow an individual to display resilience and maintain mental health. For example, if an individual has poor self-efficacy, but has an adequate diet, adequate sleep and support from family, friends and their community, they are less likely to develop a mental health disorder than someone else who also has poor self-efficacy but lacks these protective factors.

**Cumulative risk** the significantly increased risk of developing a mental health disorder that occurs when an individual has multiple risk factors present in their lives at the same time

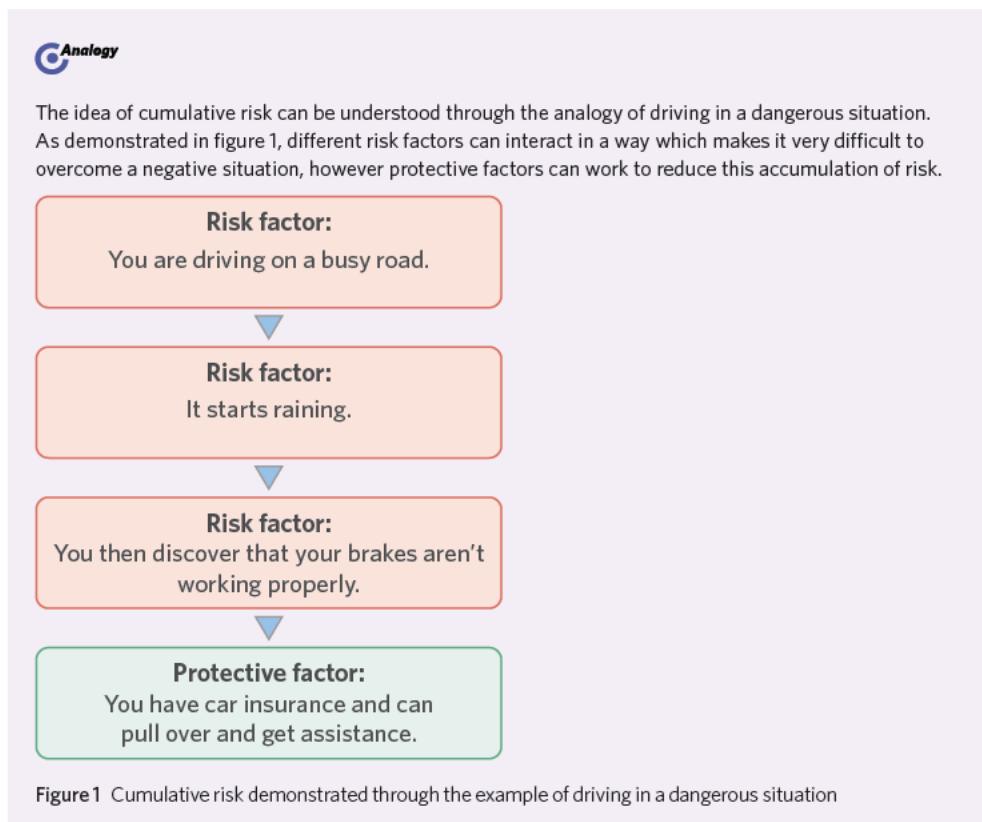


Figure 1 Cumulative risk demonstrated through the example of driving in a dangerous situation

**lesson link** You will learn more about protective factors and their role in preventing the occurrence or reoccurrence of a mental health disorder in lesson **14A: Resilience**.

The concept of cumulative risk also demonstrates the importance of a biopsychosocial approach to mental health. It is not only individual biological, psychological or social risk factors that contribute to the development of a mental health disorder, but rather the interaction between all of these different factors together. As demonstrated in figure 2, it is this interplay between multiple biological, psychological and social risk factors that poses the greatest risk to your mental health.

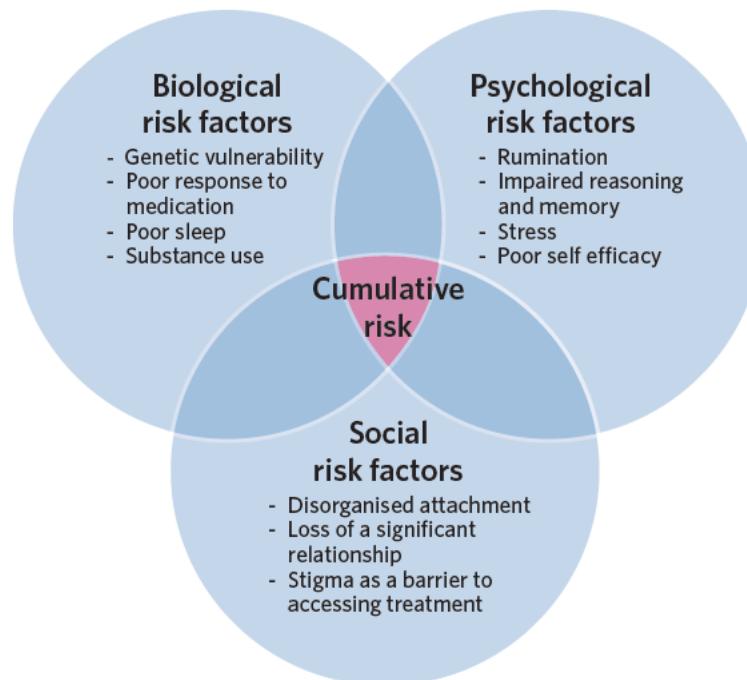


Figure 2 The biopsychosocial approach to mental health and cumulative risk



**Useful tip**

For extended response questions that incorporate mental health, it is often helpful to mention cumulative risk in your answer. Although not always explicitly mentioned in the question, students are often awarded more marks for applying the concept of cumulative risk to an extended response scenario, as it shows a greater understanding of the effect of multiple risk factors on the development of a mental health disorder.

## Theory summary

In this lesson, you learned about cumulative risk, which is the overall effect of multiple risk factors or protective factors on mental health. You should now understand that the effect of multiple risk factors at once exceeds the impact of an individual risk factor and therefore significantly contributes to the development of mental illness.

## 12E Activities

- 1 Identify whether each of the following scenarios is an example of cumulative risk or not. The first one has been completed for you.

Scenario	Y/N
Feeling stressed about exams.	N
Experiencing a break up.	
Not being able to sleep due to the stress experienced from work demands.	
Experiencing poor self-efficacy, struggling to meet the demands of a full-time job and experiencing high amounts of stress.	

## 12E QUESTIONS

### Theory review questions

#### Question 1

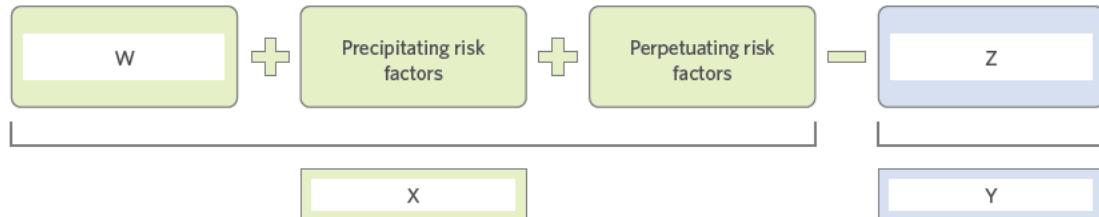
Use the vocabulary list to fill in the blanks and complete the definition of cumulative risk.

- increased
- risk factors
- multiple

The \_\_\_\_\_ risk of developing a mental health disorder that occurs when an individual has \_\_\_\_\_ present in their lives at the same time.

#### Question 2

Which of the following options correctly fills in the blanks?



	W	X	Y	Z
A	Protective factor	Increases risk	Decreases risk	Predisposing risk factor
B	Predisposing risk factor	Increases risk	Decreases risk	Protective factor
C	Protective factor	Decreases risk	Increases risk	Predisposing risk factor
D	Predisposing risk factor	Decreases risk	Increases risk	Protective factor

## Exam-style questions

### Remember and understand

#### Question 3 (1 MARK)

Cumulative risk refers to the

- A added effect of multiple risk factors only.
- B added effect of multiple protective factors only.
- C interaction between multiple risk factors and/or protective factors on mental health.
- D development of multiple mental health disorders.

#### Question 4 (2 MARKS)

Describe cumulative risk and explain how it can contribute to the development of a mental health disorder.

### Apply and analyse

#### Question 5 (1 MARK)

Alfred works long hours as a lawyer for a demanding law firm. Alfred has been stressed about all the work that he has to complete and finds that he drinks excessive amounts of alcohol each night in an attempt to forget about how much work he has to do. During this time, his friend passed away, after which Alfred decided to see a psychologist who diagnosed him with a mental health disorder.

It is likely that Alfred developed a mental health disorder due to having

- A multiple psychological and biological risk factors.
- B psychological risk factors only.
- C social risk factors only.
- D cumulative risk.

#### Question 6 (2 MARKS)

Four months ago, Vincent's partner of 30 years separated from him. Vincent's family has a history of depression, so Vincent has been seeing a psychologist for support. Vincent's psychologist was concerned that Vincent was displaying rumination by thinking the break-up over all the time and referred him to a doctor so that he could get medication. However, when Vincent started using the medication he reported that it had no effect.

With reference to cumulative risk, comment on the likelihood of Vincent developing a mental health disorder.

Adapted from VCAA 2017 sample exam SAQ2

### Questions from multiple lessons

#### Use the following information for questions 7–9.

Adrian has recently discovered that he sleepwalks. Adrian's partner has been finding him walking to the kitchen in the middle of the night and when he wakes up he does not know how he got there. Adrian has been feeling tired at work as a result of his sleepwalking and has been relying on his partner to cook, do the shopping and clean the house. As a result of all this pressure, Adrian's partner has broken up with him.

#### Question 7 (1 MARK)

Adrian's sleepwalking is an example of

- A parasomnia.
- B dyssomnia.
- C circadian phase disorder.
- D insomnia.



**Question 8** (1 MARK)

Adrian's partner separating from him is an example of

- A a biological risk factor.
- B a social risk factor.
- C a psychological risk factor.
- D disorganised attachment.

**Question 9** (1 MARK)

Adrian's increased susceptibility to developing a mental health disorder due to the presence of multiple risk factors demonstrates

- A a mental health disorder.
- B internal risk factors.
- C cumulative risk.
- D external risk factors.

**Question 10** (3 MARKS)

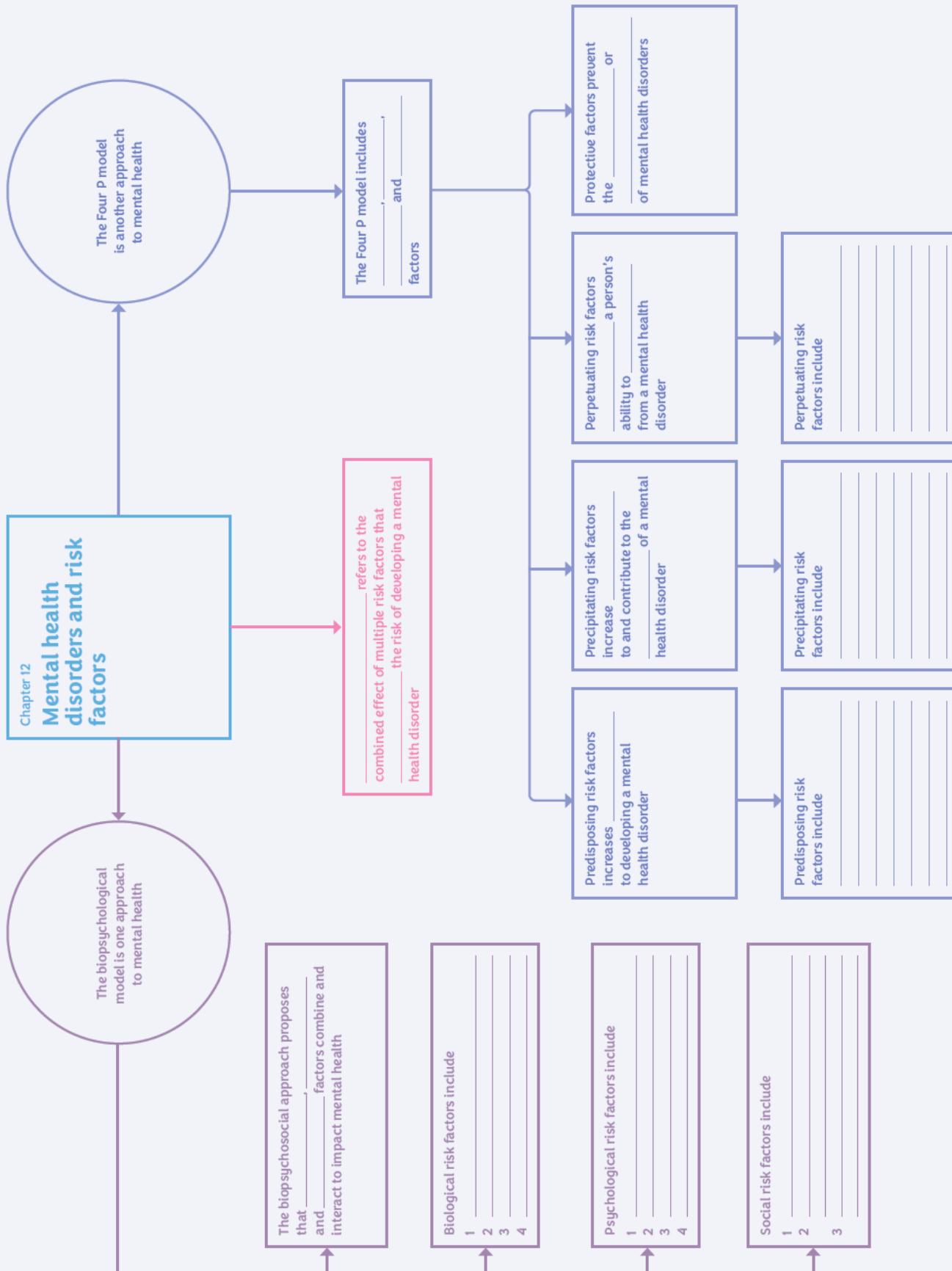
Shahid has been studying for his end of year exams. Shahid is incredibly stressed and has only been sleeping for five hours each night as a result. He has a family history of mental health disorders, so he decided to see a psychologist as he was worried about his mental health. Shahid's psychologist diagnosed him with a mental health disorder.

- a Identify the type of sleep deprivation that Shahid is experiencing. (1 MARK)
- b Describe how cumulative risk contributed to Shahid's development of a mental health disorder. (2 MARKS)

# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own.  
This includes all concepts from the chapter.



**Review activity 2: Example bank**

Fill in the table with your own notes.

Key terminology	Your own definition	Example
The Four P model		
Predisposing risk factor		
Precipitating risk factor		
Perpetuating risk factor		
Protective factor		
The biopsychosocial model		
Biological risk factors		
Genetic vulnerability		
Poor response to medication		
Poor sleep		
Substance use		
Psychological risk factor		

Key terminology	Your own definition	Example
Rumination		
Impaired reasoning and memory		
Stress		
Self-efficacy		
Social risk factors		
Disorganised attachment		
Loss of a significant relationship		
Stigma		
Cumulative risk		

**Review activity 3: Categorising factors from chapter 12 according to the Four P model and the biopsychosocial approach**

Fill in the table by listing all of the risk factors covered in chapter 12 where they fit in terms of the biopsychosocial approach and Four P model.

Four P model	Biopsychosocial approach		
	Biological risk factors	Psychological risk factors	Social risk factors
Predisposing risk factors			
Precipitating risk factors			
Perpetuating risk factors			



#### **Review activity 4: Create your own memory device for the biopsychosocial approach and Four P model**

In this chapter, you have learned memory devices to help you remember the biopsychosocial approach and Four P model. For example, that the letter 'T' in 'precipitating risk factors' can remind you that they 'trigger' the onset of a mental health disorder.

Try to come up with other ways to remember the concepts covered in this chapter, such as mnemonics or analogies. You can create an acronym, analogy, narrative or any other mnemonic device to help you remember the biopsychosocial approach and four P model.

Things to turn into a mnemonic:	Your mnemonics:
<ul style="list-style-type: none"> <li>• The list of biological, psychological and social risk factors</li> <li>• The list of predisposing, precipitating and perpetuating risk factors</li> </ul>	

## **CHAPTER TEST**

### **Multiple choice questions**

#### **Question 1** (1 MARK)

The difference between predisposing and precipitating risk factors is that

- A predisposing risk factors only increase the susceptibility to developing a mental health disorder, whereas precipitating risk factors can also directly contribute to their occurrence.
- B precipitating risk factors only increase the susceptibility to developing a mental health disorder, whereas predisposing risk factors can also directly contribute to their occurrence.
- C predisposing risk factors directly contribute to the occurrence of a mental health disorder, whereas precipitating risk factors inhibit recovery.
- D precipitating risk factors directly contribute to the occurrence of a mental health disorder, whereas predisposing risk factors inhibit recovery.

#### **Question 2** (1 MARK)

Rumination is

- A a social risk factor that also increases the susceptibility of developing a mental health disorder.
- B a social risk factor that inhibits the recovery from a mental health disorder.
- C a psychological risk factor that decreases the susceptibility of developing a mental health disorder.
- D a psychological risk factor that inhibits the recovery from a mental health disorder.

#### **Question 3** (1 MARK)

Perpetuating risk factors

- A increase the susceptibility to developing a mental health disorder.
- B contribute to the occurrence of a mental health disorder.
- C inhibit the ability to recover from a mental health disorder.
- D prevent the occurrence or reoccurrence of a mental health disorder.

#### **Question 4** (1 MARK)

Stigma is considered to be a social risk factor because

- A it is experienced by all of society.
- B it involves views held by society.
- C it causes significant personal distress.
- D it involves cognitive processes.

**Use the following information for questions 5-8.**

Corentin has a family history of mental health disorders. After a busy exam period for school and his partner breaking up with him, Corentin has been finding it difficult to find the motivation to leave the house and look after himself. He wants to go and see a psychologist about his current situation, but is too embarrassed about having to tell friends or family that he needs help.

**Question 5** (1 MARK)

A social and perpetuating risk factor that Corentin is experiencing is

- A the loss of a significant relationship.
- B stigma as a barrier to accessing treatment.
- C stress.
- D genetic vulnerability.

**Question 6** (1 MARK)

A biological risk factor that Corentin is experiencing is

- A genetic vulnerability, which also acts as a precipitating risk factor.
- B stress, which also acts as a precipitating risk factor.
- C genetic vulnerability, which also acts as a predisposing risk factor.
- D stress, which also acts as a predisposing risk factor.

**Question 7** (1 MARK)

What are the precipitating risk factors that are impacting Corentin's mental health?

- A genetic vulnerability and stigma
- B the loss of a significant relationship and genetic vulnerability
- C stress and stigma
- D stress and the loss of a significant relationship

**Question 8** (1 MARK)

Corentin's increased risk of developing a mental health disorder is due to

- A biological and psychological risk factors.
- B biological and social risk factors.
- C cumulative risk.
- D psychological and social risk factors.

**Question 9** (1 MARK)

Poor self-efficacy refers to

- A when an individual experiences difficulty believing in their capacity to complete a task.
- B an individual's ability to believe in their capacity to complete a task.
- C thinking about the negative aspects of a situation over and over again.
- D an individual failing to seek help.

**Question 10** (1 MARK)

Disorganised attachment is a

- A psychological risk factor that occurs due to a difficulty trusting others.
- B social risk factor that occurs due to the inconsistent care and support for an infant by a caregiver.
- C biological risk factor that occurs due to a difficulty trusting others.
- D psychological risk factor that occurs due to the inconsistent care and support for an infant by a caregiver.

**Short answer questions****Question 11** (4 MARKS)

Tia was recently diagnosed with a mental health disorder. Tia's psychologist said that she needed to overcome her tendency to ruminate in order to recover from her mental health disorder. Tia was also prescribed medication to help her recover, but found that the medication had no impact on her mental health. Her psychologist found that this poor response was due to genetic factors.



- a** Describe how rumination acted as a perpetuating risk factor for Tia's mental health. (2 MARKS)
- b** Explain how poor response to medication due to genetic factors acted as a biological risk factor for Tia's mental health. (2 MARKS)

**Question 12** (1 MARK)

---

Beatrice has a tendency to think about the negative aspects of a situation over and over again in her head. Recently, she was five minutes late for work and her boss told her to make sure that she comes to work on time in the future. Beatrice cannot stop thinking about being told off, causing her significant amounts of stress.

Describe how Beatrice displayed rumination.

**Question 13** (3 MARKS)

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Define poor self-efficacy and explain how it can act as both a psychological and predisposing risk factor.

**Question 14** (8 MARKS)

---

Angus' parents were not very present during his early childhood. He did not feel as though he could rely on them to provide him with affection and support. As an adult, Angus now feels as though he cannot rely on anyone but himself, making it difficult for him to form meaningful relationships. Angus did end up making a very close friend, but after a period of being incredibly stressed at work and not believing in his ability to complete work in time to meet deadlines, he ended up losing this relationship over conflict. Angus now feels incredibly upset and worried that he will never develop any meaningful relationships.

- a** With the use of examples, identify two social risk factors that influenced Angus' mental health. (4 MARKS)
- b** Define cumulative risk and explain how it could lead to Angus developing a mental health disorder. (2 MARKS)
- c** Explain how disorganised attachment acted as a predisposing risk factor for Angus. (2 MARKS)

### Key science skills questions

**Question 15** (4 MARKS)

---

Dr Visser is interested in studying the effectiveness of medication for common mental health disorders at the psychology practice that he works for. He is also interested in how common it is for people to have a poor response to medication due to genetic factors. To work this out, he gathered participants from his psychology practice by putting the names of all patients with a mental health disorder into a hat and pulling out 30 names. These 30 patients were put into one of two groups. Group one were given a common medicine for mental health disorders and group two were given a sugar pill containing no active ingredient.

- a** Explain the sampling procedure that Dr Visser used in their experiment. (2 MARKS)
- b** Identify how Dr Visser used a placebo treatment and describe how it controlled for participant expectations as an extraneous variable. (2 MARKS)

### Extended response

**Question 16** (10 MARKS)

---

Petra is in high school and is approaching her final exams. She is incredibly stressed about the need to perform well on her exams and get into university. Petra worries that she is not good enough to pass the exams and that failing them will ruin her future. These thoughts have led to many sleepless nights for Petra. Petra also has a family history of mental health disorders. As a result, she is worried that she is going to develop a mental health disorder herself. Petra wants to go and see the school psychologist but is worried that someone will see her and think that she is sensitive and weak. However, she eventually does see the school psychologist, who diagnoses Petra as having a mental health disorder due to the presence of multiple risk factors. Petra's psychologist is worried that her recovery will be inhibited by her embarrassment in seeking help.

As Petra's psychologist, write a report about the risk factors that Petra experienced that contributed to the development and progression of her mental health disorder. In your response refer to:

- The biopsychosocial approach to mental health, including the biological, psychological and social risk factors
- Predisposing, precipitating and perpetuating risk factors
- The concept of cumulative risk



UNIT 4 AOS 2, CHAPTER 13

# 13

## Biopsychosocial approach and specific phobia

### 13A Stress, phobia and anxiety

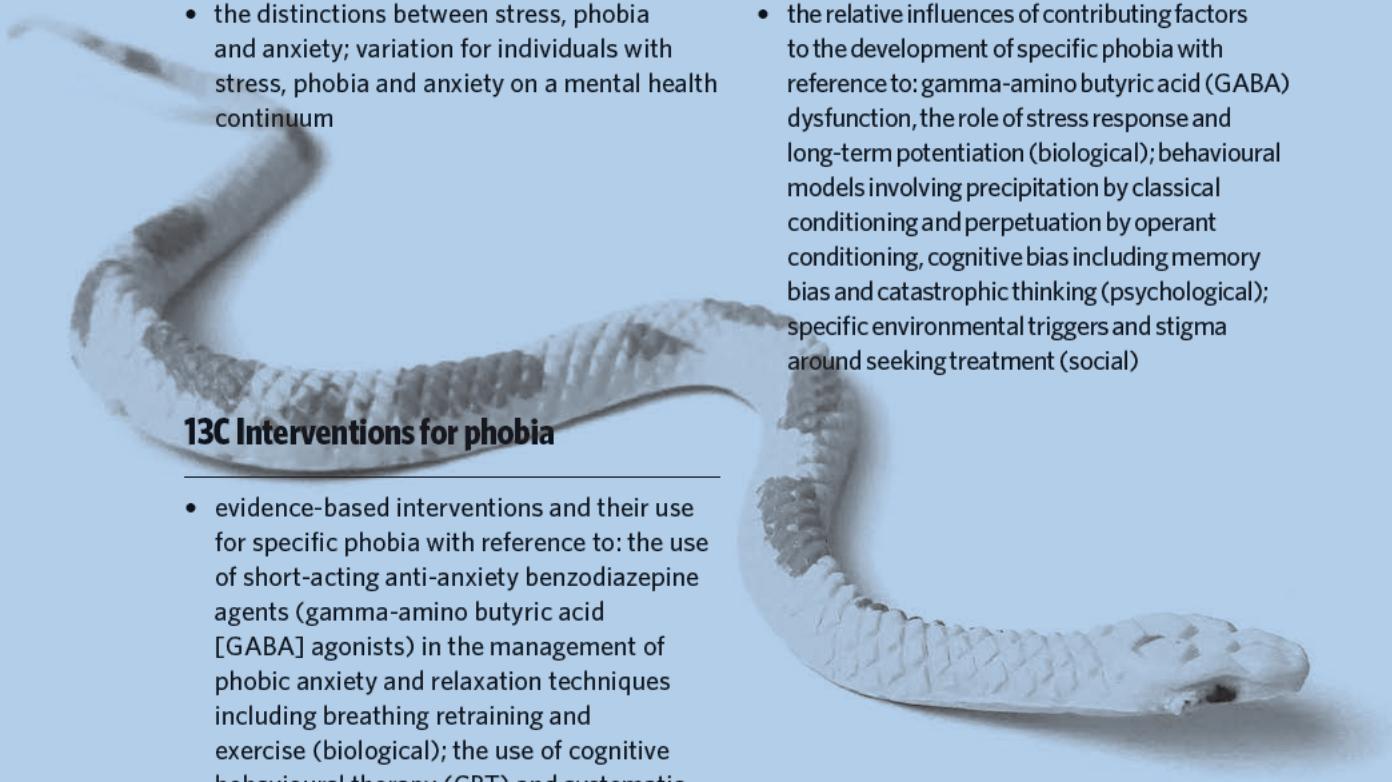
- the distinctions between stress, phobia and anxiety; variation for individuals with stress, phobia and anxiety on a mental health continuum

### 13B Contributing factors to phobia

- the relative influences of contributing factors to the development of specific phobia with reference to: gamma-amino butyric acid (GABA) dysfunction, the role of stress response and long-term potentiation (biological); behavioural models involving precipitation by classical conditioning and perpetuation by operant conditioning, cognitive bias including memory bias and catastrophic thinking (psychological); specific environmental triggers and stigma around seeking treatment (social)

### 13C Interventions for phobia

- evidence-based interventions and their use for specific phobia with reference to: the use of short-acting anti-anxiety benzodiazepine agents (gamma-amino butyric acid [GABA] agonists) in the management of phobic anxiety and relaxation techniques including breathing retraining and exercise (biological); the use of cognitive behavioural therapy (CBT) and systematic desensitisation as psychotherapeutic treatments of phobia (psychological); psychoeducation for families/supporters with reference to challenging unrealistic or anxious thoughts and not encouraging avoidance behaviours (social)

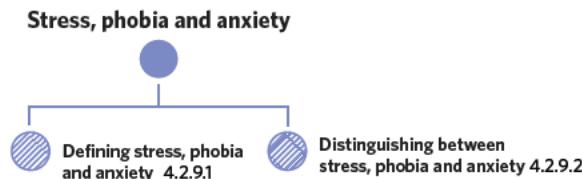


# 13A STRESS, PHOBIA AND ANXIETY

In this chapter, you are learning all about phobias. The symptoms of stress, phobia and anxiety are very similar. In this lesson, you will learn how to distinguish between these before exploring how specific phobias are developed and treated in the rest of this chapter.

13A Stress, phobia and anxiety	13B Contributing factors to phobia	13C Interventions for phobia
<b>Study design dot point</b>		
<ul style="list-style-type: none"> <li>the distinctions between stress, phobia and anxiety; variation for individuals with stress, phobia and anxiety on a mental health continuum</li> </ul>		
<b>Key knowledge units</b>		
Defining stress, phobia and anxiety		4.2.9.1
Distinguishing between stress, phobia and anxiety		4.2.9.2

**In this lesson, you will be learning about specific phobia**, how you can distinguish this from **stress and anxiety**, and how each of these can be understood along **the mental health continuum**.



## Defining stress, phobia and anxiety 4.2.9.1

### OVERVIEW

Stress, phobia and anxiety are psychological constructs that you must be able to define in regards to their specific characteristics.

### THEORY DETAILS

Stress, phobia and anxiety are psychological constructs that have many similarities, and as such, it can be difficult to distinguish between them. In order to do this, you must first have a clear understanding of each of these concepts, starting with their definitions.

As explored in chapter 3, **stress** is a response to a known stressor, and is a psychological and physiological response. Commonly, distress occurs when an individual does not feel as though they have adequate resources to cope with a stressor. In comparison, anxiety is broader and might not be in response to a known stressor. **Anxiety** involves feelings of worry, apprehension and unease, usually directed towards something in the future. It can involve cautiousness regarding a potential threat, danger or other negative events. While stress can involve both positive (eustress) and negative (distress) feelings, anxiety is typically only negative feelings (distress).

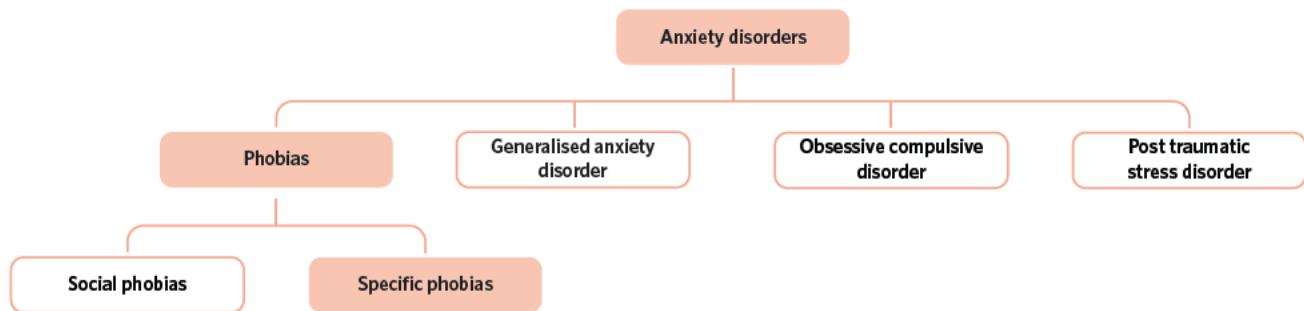
Both stress and anxiety are on the ‘normal functioning’ part of the mental health continuum. That is, people will experience stress and anxiety from time to time and it is an expected part of daily life. These usually don’t interrupt daily functioning. In fact, some stress and anxiety can be adaptive for functioning as they can motivate people to take action, such as preparing for a SAC instead of avoiding it.

When anxiety is excessive, persistent over a long period of time and disrupts aspects of daily functioning, it can become a mental health disorder, falling under the mental illness part of the continuum. These disorders are categorised under the umbrella term of anxiety disorders.

Phobias are a subset of anxiety disorders. In this regard, people with a diagnosed phobia have amplified anxiety responses. Specific phobia is a further subset of phobias. This is illustrated in figure 1.

**Stress** a psychological and biological process that occurs when an individual encounters a stressor

**Anxiety** a psychological and physiological response that involves feelings of worry and apprehension



**Figure 1** Specific phobia is a type of anxiety disorder

**Specific phobia** (sometimes just referred to as phobia) is defined as excessive, distressing, and persistent fear or anxiety in response to a specific object or situation (such as animals, enclosed spaces, elevators, or flying) (American Psychiatric Association, 2013).

**Specific phobia** a type of anxiety disorder that is categorised by excessive and disproportionate fear when encountering a particular stimulus

#### Useful tip

As you learned in lesson **11A: Mental health continuum**, an individual's normal level of functioning might vary along the mental health continuum. Disorders are classified when symptoms are persistent and impact functioning in a number of areas, and this might look different for each individual.

People who have a specific phobia are often aware that their level of fear and anxiety is disproportionate to the phobic stimulus but are unable to control these feelings. They may go to great lengths to avoid their phobic stimulus. Although people may have varying levels of fear, in order for a person's fear of a specific stimulus to be categorised as a phobia disorder, it must significantly disrupt their daily functioning either at work, home, in their social life or with family (American Psychiatric Association, 2013).

#### Want to know more?

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (American Psychiatric Association, 2013) uses the following criteria for diagnosis of specific phobia:

1. Unreasonable, excessive fear or anxiety about a specific object or situation
2. Phobic stimulus provokes an immediate anxiety response
3. The fear or anxiety is out of proportion to the actual danger posed by the phobic stimulus
4. Avoidance or extreme distress
5. Life-limiting in that it impacts daily functioning
6. At least six month duration
7. Not caused by another disorder

There are five subtypes of specific phobia:

- Animals, such as fear of dogs, cats, birds, spiders
- Natural environment, such as fear of water, heights, lightning
- Situational, such as fear of small confined spaces
- Blood/injection/injury, which includes fear of needles, injections and medical procedures
- Other, such as fear of clowns or costumed characters



**Want to know more?** —

**Table 1** Examples of specific phobias

Specific phobia	Phobic stimulus
Acrophobia	heights
Aerophobia	flying
Claustrophobia	enclosed spaces
Arachnophobia	spiders
Hematophobia	blood
Omphalophobia	belly buttons
Sesquipedalophobia	long words
Siderophobia	stars
Xanthophobia	the colour yellow

### Normal range of functioning                          Diagnosed disorders



**Figure 2** Stress and anxiety are within the normal range of functioning on the mental health continuum, whereas phobia is a mental health disorder

## Distinguishing between stress, phobia and anxiety 4.2.9.2

### OVERVIEW

Although stress, phobia and anxiety have similar physiological and psychological characteristics, it is important to be able to clearly identify the differences between them.

### THEORY DETAILS

Both the physiological and psychological responses of stress, phobia and anxiety are similar and as such, it can be difficult to distinguish between them.

Stress, phobia and anxiety have the same physiological markers, as when a person experiences either stress or anxiety, their sympathetic nervous system is activated. These physiological markers include:

- Increased heart rate
- Rapid breathing
- Increased perspiration
- Dilated pupils

A key difference between specific phobia and anxiety is that phobias are in response to a specific phobic stimulus, whereas anxiety is often more generalised.

**Table 2** Summary of key similarities and differences between stress, phobia and anxiety

Stress	Anxiety	Specific phobia
The sympathetic nervous system becomes dominant	The sympathetic nervous system becomes dominant	The sympathetic nervous system becomes dominant
The response is to a known stimulus	The response might be to an unknown stimulus, or generalised	The response is to a known stimulus
Feelings can be either positive (excitement) or negative (apprehension, nervousness)	Feelings of apprehension, unease, worry	The feeling of fear is predominant
Can be either eustress or distress	Distress only	Distress only
Some stress can be adaptive	Some anxiety can be adaptive	Phobia is maladaptive
May contribute to the development or progression of mental health disorders	May contribute to the development or progression of mental health disorders	Is a diagnosed mental health disorder



In lesson 3B: **Biological processes of stress**, you learned about the fight-flight-freeze response which also involves the activation of the sympathetic nervous system. When a person experiences stress, anxiety or phobia, they experience the same physiological symptoms as the fight-flight-freeze response.

## Theory summary

In this lesson, you have learned how to define and distinguish between stress, phobia and anxiety. In the following lessons, you will use the biopsychosocial approach and the Four P model to explore the development of specific phobias and evidence-based interventions.

## 13A Activities

- 1 For each of the following scenarios, identify if the individual is more likely to be suffering from anxiety or a phobia

Scenario	Anxiety	Phobia
Ana is terrified of cats. She avoids anywhere there might be cats present, even giving up working at a pet shop because there is a chance she will see a cat.		
The night before Kate starts a new job, she has trouble falling asleep because her heart won't stop pounding and she has a dry mouth.		
Jarrod is starting at a new school. On the bus, he worries about not making any friends.		
As a child, Stephanie had many painful dental treatments. As an adult, Stephanie refuses to go to the dentist despite having intense tooth pain. Stephanie will even turn off the TV if she sees a dentist on the screen.		
Amanda's son is sick with the flu. At work, Amanda finds it difficult to concentrate because she can't stop worrying.		

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## 13A QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition.

- Stress              • Phobia              • Anxiety
  
- a A psychological and physiological response to a stressor \_\_\_\_\_
- b A feeling of unease, apprehension and worry \_\_\_\_\_
- c A type of anxiety disorder that is characterised by disproportionate and irrational fear \_\_\_\_\_

#### Question 2

Place the following psychological constructs along the mental health continuum.

- Eustress              • Specific phobia              • Anxiety disorder              • Anxiety              • Distress

The mental health continuum



**Question 3**

Identify which of the following characteristics apply to stress, anxiety and specific phobia by placing a tick or cross in each box. The first characteristic has been completed for you.

Characteristic	Stress	Anxiety	Specific phobia
The sympathetic nervous system becomes dominant	✓	✓	✓
The response is to a known stimulus			
Some amount can be adaptive			
Distress is always prominent			
Within the 'normal' range of functioning on the mental health continuum			
A diagnosable mental health disorder			
May contribute to the development or progression of mental health disorders			

**Exam-style questions***Remember and understand***Question 4** (1 MARK)

One similarity between stress and anxiety is that

- A** both stress and anxiety can involve distress.
- B** both stress and anxiety are chronic.
- C** both stress and anxiety involve eustress.
- D** both stress and anxiety are marked by feelings of fear.

**Question 5** (1 MARK)

Which of the following statements is correct?

- A** Stress can be an adaptive response to a stimulus, whereas phobia is maladaptive.
- B** Stress can be an adaptive response to a stimulus, whereas anxiety is always maladaptive.
- C** Phobia is an adaptive response to a stimulus, whereas stress is maladaptive.
- D** Phobia is an adaptive response to a stimulus, whereas anxiety is always maladaptive.

**Question 6** (1 MARK)

Outline one difference between stress and anxiety.

**Question 7** (1 MARK)

Outline one similarity between stress and anxiety.

**Apply and analyse****Question 8** (1 MARK)

Jodie has been diagnosed with a general anxiety disorder and constantly feels like she has butterflies in her stomach. Today she is going to an appointment but is running late which is causing her mum to feel stressed. For both Jodie and her mum, which nervous system is likely to be activated?

- A** The parasympathetic nervous system
- B** The autonomic nervous system
- C** The somatic nervous system
- D** The sympathetic nervous system

**Question 9** (2 MARKS)

Renata has not been feeling like herself recently. Her mood is often down, and she feels uneasy thinking about her school year ahead. She often feels worried about school, but when her parents ask her why she is unable to tell them what exactly she is worried about. Her parents decide to take her to a psychologist to seek support for her. Is the psychologist likely to say that Renata is experiencing stress, anxiety or phobia? Justify your response.

**Question 10** (3 MARKS)

With reference to eustress and distress, explain why excessive anxiety can be maladaptive, whereas some stress can be adaptive.

**Questions from multiple lessons****Question 11** (1 MARK)

Alan has a SAC tomorrow. He is feeling worried that he won't do well and so he has decided to stay up to cram as much as possible before the morning.

Alan is likely experiencing

- A stress, and is demonstrating avoidance coping.
- B eustress, and is demonstrating approach coping.
- C anxiety, and is demonstrating avoidance coping.
- D anxiety, and is demonstrating approach coping.

**Question 12** (4 MARKS)

When Rowan was five years old, he was bitten by a swan when trying to feed it. Ever since, he has been afraid of birds. He will try to avoid being outside as much as possible in order to not be swooped by birds. Last week, he decided not to go to his niece's birthday party as she was having it in the park. He believes that if he is exposed to birds, they will swoop him and peck out his eyes. Whenever he encounters any type of bird, he breaks out into a cold sweat and feels like he is going to faint.

- a Identify the process of classical conditioning that has caused Rowan to be scared of all birds, rather than just swans. (1 MARK)
- b Referring to the characteristics of specific phobia, explain why Rowan is likely to have a specific phobia of birds. (3 MARKS)

**Key science skills****Question 13** (7 MARKS)

Maia wanted to test why some people developed phobias, and others didn't. She tested her hypothesis on her two younger siblings by repeatedly leaving bugs in their room and recording each time she could see they were scared. Her younger brother seemed to be scared of the bugs, so much so that he didn't want to go out into the garden anymore because he was afraid there were bugs there. However, her younger sister didn't seem to be scared by the bugs at all and when she found them in her room, she would pick them up and put them back outside.

- a Write a possible hypothesis for Maia's experiment. (2 MARKS)
- b Outline one ethical consideration that Maia did not take into account. (2 MARKS)
- c Outline three characteristics of specific phobia. (3 MARKS)



# 13B CONTRIBUTING FACTORS TO PHOBIA

In this chapter, you are learning about specific phobia and its unique characteristics. In the last lesson, you learned that specific phobia is a classifiable mental disorder. Now, you will learn about a range of factors that contribute to the development of a specific phobia.

## 13A. Stress, phobia and anxiety

## 13B. Contributing factors to phobia

## 13C. Interventions for phobia

### Study design dot point

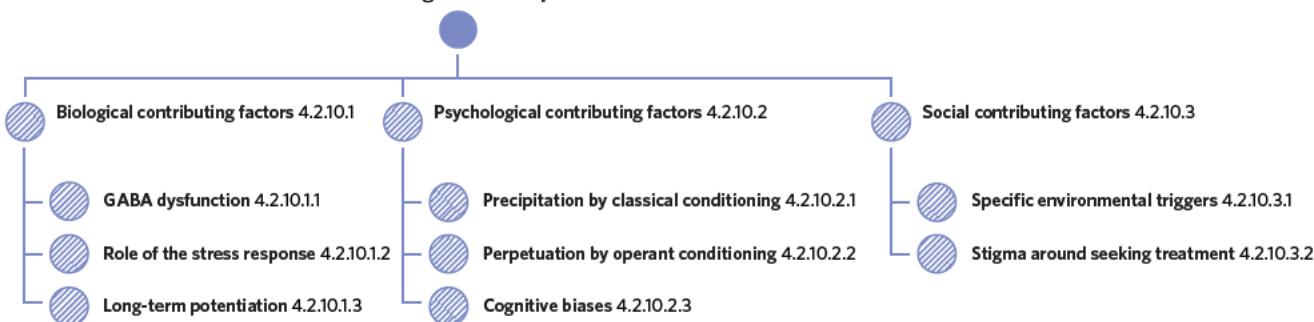
- the relative influences of contributing factors to the development of specific phobia with reference to: gamma-amino butyric acid (GABA) dysfunction, the role of stress response and long-term potentiation (biological); behavioural models involving precipitation by classical conditioning and perpetuation by operant conditioning, cognitive bias including memory bias and catastrophic thinking (psychological); specific environmental triggers and stigma around seeking treatment (social)

### Key knowledge units

GABA dysfunction (Biological contributing factors)	4.2.10.1.1
Role of the stress response (Biological contributing factors)	4.2.10.1.2
Long-term potentiation (Biological contributing factors)	4.2.10.1.3
Precipitation by classical conditioning (Psychological contributing factors)	4.2.10.2.1
Perpetuation by operant conditioning (Psychological contributing factors)	4.2.10.2.2
Cognitive biases (Psychological contributing factors)	4.2.10.2.3
Specific environmental triggers (Social contributing factors)	4.2.10.3.1
Stigma around seeking treatment (Social contributing factors)	4.2.10.3.2

In this lesson, you will apply the biopsychosocial model to understand a range of biological, psychological and social factors that contribute to the development of specific phobia.

### Contributing factors to phobia



### Biological contributing factors 4.2.10.1

#### OVERVIEW

There are three important biological contributing factors to phobia you should know. These are GABA dysfunction, the role of the stress response and long-term potentiation.

#### THEORY DETAILS

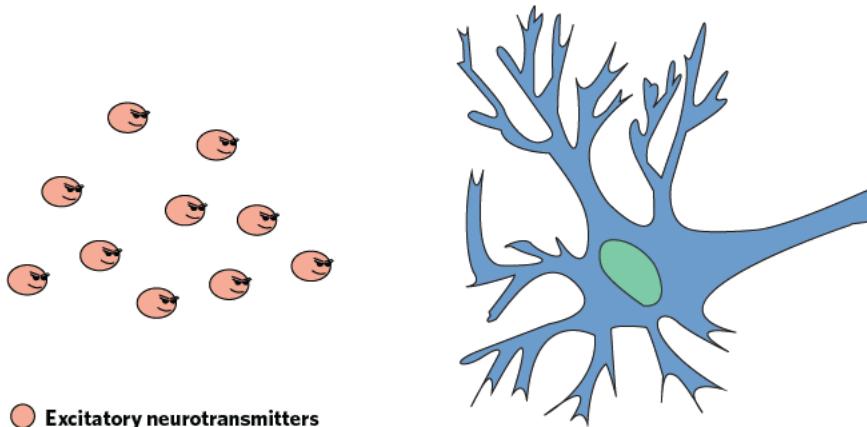
When looking at phobia through the frame of the biopsychosocial model, it is important to understand how all three components interact to contribute to a phobia's development. Biological contributing factors are those factors which might lead to the development of a phobia because of a physiological factor in an individual's brain and/or body.

There are three main biological factors that you will examine in this lesson that contribute to the development and maintenance of specific phobia. These include abnormalities in neurotransmitter function (GABA dysfunction), the physiological stress response, and the role of long term potentiation.

### GABA dysfunction 4.2.10.1.1

As you've learned, GABA is the main inhibitory neurotransmitter in the human nervous system. It plays an important role in regulating postsynaptic activation in neural pathways, preventing over-excitation and uncontrolled firing. This is important in regulating the fight-flight-freeze response and anxiety, as GABA acts to slow or halt the excitatory neural transmission responsible for these reactions.

Research suggests that there is often a positive correlation between GABA dysfunction and the development of anxiety disorders. GABA dysfunction is the insufficient neural transmission of GABA. This can be due to a low level or production of GABA, or an insufficient reception or transmission of it across the synapse.



**Excitatory neurotransmitters**

**Figure 1** A visual representation of excitatory neurotransmitters about to activate a neuron. Uncontrolled excitatory activation can create neurological conditions that increase the likelihood of the development of a specific phobia.

GABA dysfunction may cause someone's fight-flight-freeze or anxiety response to be activated more easily than someone with adequate GABA levels. This means that for some people, the stress response is more easily triggered by certain stimuli. Recurrent stress responses to specific stimuli can lead to the development of a phobia.

### Role of the stress response 4.2.10.1.2

As you've learned, the **biological stress response** involves the activation of the autonomic nervous system responses, such as the fight-flight-freeze response. A person who is afraid of certain stimuli sees them as threatening in some way, and this leads to the biological stress response. This is a biological contributing factor to phobia, as the physiological experience of fear comes to be associated with a certain stimulus.



Often, the development of a phobia comes from a particularly traumatic experience with certain stimuli in childhood. As you've learned, in times of heightened emotional arousal, the amygdala and hippocampus work together to consolidate the experience in long-term memory. This is another biological mechanism involved in the development of phobias, which might be useful to keep in mind. For a refresher on these mechanisms, head to lesson **6B: Memory and the brain**.



**Figure 2** Brain regions involved in memory are also important to the development of phobias.

### Long-term potentiation 4.2.10.1.3

In learning and memory, you learned about the role of long-term potentiation. **Long-term potentiation** is a form of neural plasticity that causes a strengthening of neural connections that are repeatedly coactivated. This contributes to the development of phobias by strengthening the association between neural signals involved in perceiving a stimulus, and neural signals involved in activating the fear response. Through their repeated coactivation, the signals involved in perceiving a phobic stimulus more readily trigger the activation of the neural signals responsible for the fear response.

For example, when a person fears a spider, two neural signals are coactivated: these are the neural signals involved in perceiving the spider, as well as the neural signals responsible for activating the stress response. The repeated activation of both these neural signals together can lead to the development of a phobia, as the stress response is associated with and activated at the same time as the perception of a certain phobic stimulus. The more this occurs, the stronger the association becomes. This coactivation is represented in figure 3.

**GABA dysfunction** an insufficient neural transmission or reception of GABA in the body



For a refresher on the importance of neurotransmitter balance in optimal functioning, head to **lesson 2D: Neurotransmitters**.

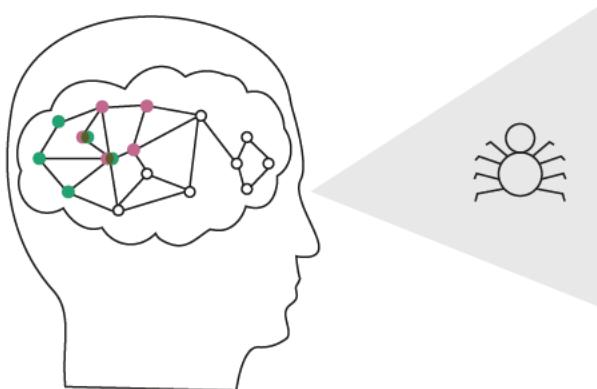
**Biological stress response** the activation of autonomic nervous system responses in the face of a stressor



For a refresher on the processes of the fight-flight-freeze response, head to **lesson 3B: Biological processes of stress**. For examples of sympathetic nervous system responses, head to **lesson 2A: Central and peripheral nervous systems**.

**Long-term potentiation** the long-lasting and experience-dependent strengthening of synaptic connections





**Figure 3** A visual representation of two neural pathways being activated by the perception of a spider, which for this person, is a phobic stimulus. Through their repeated coactivation, long-term potentiation makes the fear response quickly activated in the presence of a spider.



For a refresher on the role of long-term potentiation in learning and memory, head to lesson **4A: Long-term potentiation and long-term depression**.



In terms of the Four P model outlined in lesson **12A: Four P model**, long-term potentiation could be considered a perpetuating factor as it inhibits recovery. This is because it is more difficult to eliminate a response when it is hard-wired in the brain neuronally.

#### Useful tip

The saying 'neurons that fire together, wire together' helps to remember the role of long-term potentiation in the development of phobias. The more a stress response to a certain stimulus is activated, the more easily that stress response is activated in future interactions with that same stimulus.

## Psychological contributing factors 4.2.10.2

### OVERVIEW

There are also some important psychological contributing factors to phobia you should be familiar with. These are the role of behavioural models including precipitation by classical conditioning and perpetuation by operant conditioning, as well as the role of cognitive biases including memory bias and catastrophic thinking.

### THEORY DETAILS

It is also important to look at psychological contributing factors to specific phobia to gain a full picture of the interactions within the biopsychosocial model. Psychological contributing factors are thoughts and mental processes that lead to the development of a phobia.



The Four P model which you explored in lesson **12A: Four P model** is used to classify some of the psychological contributing factors to phobia. Specifically, it is used to describe the ways the behavioural models of classical and operant conditioning contribute to phobia.

### Precipitation by classical conditioning 4.2.10.2.1

You have learned about the processes involved in classical conditioning earlier in the course, as well as precipitating factors in the previous chapter. **Precipitation by classical conditioning** can contribute to the development of phobias by increasing susceptibility to and contributing to their occurrence. This is because phobias can be learned through classical conditioning.

In terms of classical conditioning, what becomes a phobic stimulus would start out as the neutral stimulus (NS). Through repeated association with an unconditioned stimulus (UCS) that naturally induces fear, the NS becomes the conditioned stimulus (CS) or phobic stimulus, producing the conditioned response (CR) or phobic response. In this way, a phobic response can be acquired through the processes of classical conditioning.

**Precipitating risk factor** a risk factor that increases the susceptibility to and contributes to the occurrence of developing a mental health disorder

**Classical conditioning** a model of learning in which organisms learn through the involuntary association of two or more stimuli



The role of precipitation through classical conditioning is best illustrated through the example of Little Albert, which you learned about in lesson **5B: The Little Albert experiment**. In this scenario, Little Albert formed a phobia of white rats. The processes involved included:

- The NS of a white rat initially induced no phobic/fear response in Little Albert.
- The UCS of a loud noise initially induced the unconditioned fear response (UCR) in Little Albert
- Repeated association of the NS and UCS occurred
- After this association, the NS white rat became the conditioned stimulus (CS), which produced the conditioned response (CR) of fear to the white rat

This classically conditioned fear of the white rat is considered a phobic response. This demonstrates the role of classical conditioning in precipitating phobias. It is also an example of how traumatic experiences in childhood can lead to the development of phobias.



### Perpetuation by operant conditioning 4.2.10.2.2

Another behavioural model which can be applied to phobias is operant conditioning. **Perpetuation by operant conditioning** contributes to phobias by preventing the ability to overcome them.

The role of operant conditioning in phobias can be thought about largely in terms of the consequence stage. A person with a phobia will generally avoid contact with their phobic stimulus at all costs. By avoiding confrontation with the phobic stimulus, a person is negatively reinforced through this avoidance in not having to deal with their fear response. Over time, this reinforcement strengthens or maintains the phobic response, making avoidant behaviours more likely to be repeated, and preventing recovery through this cycle.

### Cognitive biases 4.2.10.2.3

A **cognitive bias** is a predisposition to think about and process information in a certain way. This can bias or cause errors in people's judgements and thoughts. Cognitive biases contribute to phobias because some people consider certain stimuli as particularly harmful, dangerous or scary. There are two cognitive biases you should be familiar with:

- **Memory bias** is a kind of cognitive bias caused by inaccurate or exaggerated memory. As phobias are often caused by traumatic events, people may remember the trauma as extremely significant or harmful, and this impacts their present cognitions about related stimuli. For example, people with arachnophobia (fear of spiders) may recall the size of a spider they encountered as much bigger than it was in reality. This inaccurate memory of the spider's size may serve to justify their extreme fear of spiders and the threat they pose after the encounter. This in turn allows their phobic fears to persist over time in their mind.
- **Catastrophic thinking** is a kind of cognitive bias in which a stimulus or event is predicted to be far worse than it is. A person will often imagine the worst case scenario possible when imagining an interaction with their phobic stimulus. This contributes to phobia, making stimuli seem worthy of extreme fear and anxiety.

### Social contributing factors 4.2.10.3

#### OVERVIEW

There are two important social contributing factors to phobia you should know. These are specific environmental triggers and stigma around seeking treatment.

#### THEORY DETAILS

To complete your understanding of the biopsychosocial approach to phobias, you need to look at social contributing factors. Social factors are those which involve some sort of interaction with other people or the environment.

#### Specific environmental triggers 4.2.10.3.1

There are a range of interactions a person can have that lead to the development of a specific phobia. **Specific environmental triggers** refer to stimuli or experiences in a person's environment that prompt an extreme stress response, leading to the development of a phobia. There are a few different types of environmental triggers including:

**Perpetuating risk factor** a risk factor that inhibits a person's ability to recover from a mental health disorder

**Operant conditioning** learning through the association of a behaviour and the consequence it receives

**Cognitive bias** a predisposition to think about and process information in a certain way

**Memory bias** a form of cognitive bias caused by inaccuracy or exaggeration in the recall of an event

**Catastrophic thinking** a kind of cognitive bias in which a stimulus or event is predicted to be far worse than it is likely to be in reality

**Specific environmental triggers** stimuli or experiences in a person's environment that prompt an extreme stress response



For a refresher on the processes of operant conditioning, head to lesson **5C: Operant conditioning**.



In terms of the Four P model outlined in lesson **12A: Four P model**, specific environmental triggers could be considered precipitating as they increase susceptibility to and contribute to the occurrence of a phobia.



- Direct confrontation with a traumatic stimulus or event e.g. being bitten by a snake
- Observing another person having a direct confrontation with a traumatic stimulus or event e.g. watching someone be threatened with a weapon
- Learning about a potentially dangerous or traumatic stimulus or event indirectly, e.g. by watching a movie about motorcycle gangs or reading about the danger of snakes

### Stigma around seeking treatment 4.2.10.3.2

Leaving one's phobia untreated also contributes to the development and maintenance of specific phobia. Often, people will not seek help due to embarrassment, worry or fear. **Stigma around seeking treatment** refers to the sense of shame a person might feel about getting professional help for their phobia. They might feel as though their phobia is too embarrassing or insignificant to seek professional help, or as though they are unusual and isolated from society in some way for doing so. As phobias are based on at least somewhat irrational fears, seeking help can be very difficult.



In terms of the Four P model outlined in lesson **12A: Four P model**, stigma around seeking treatment could be considered perpetuating as it inhibits recovery from a phobia.

**Stigma around seeking treatment**  
the sense of shame a person might feel about getting professional help



You have already learned about the role of stigma as a barrier to accessing treatment in lesson **12B: Social risk factors**.

### Theory summary

In this lesson, you have learned about a range of contributing factors to phobia through the lens of the biopsychosocial model. You should now be familiar with all the contributing factors under biological, psychological and social categories, and be able to explain what each of them involve. Keep in mind that some or all of these factors may interact with each other to cause phobia, as the biopsychosocial model suggests. Figure 4 summarises the factors you should know.

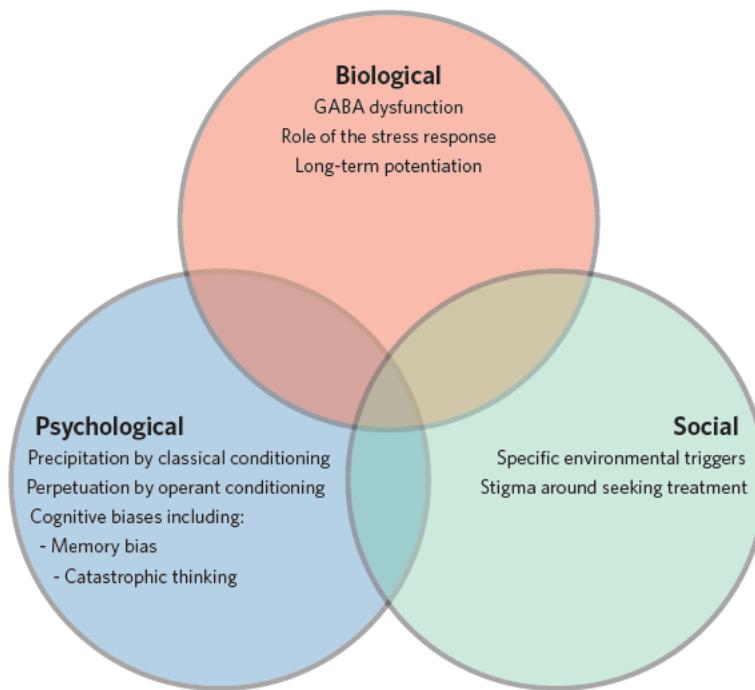
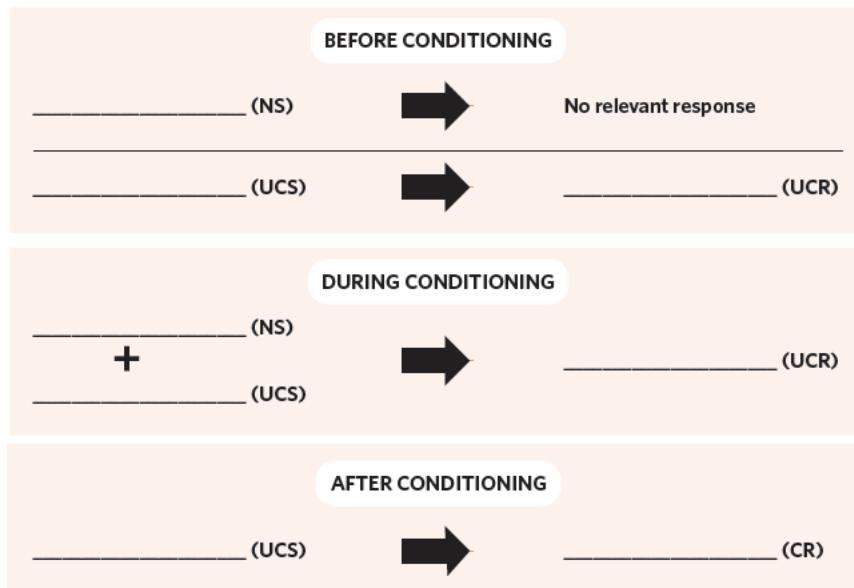


Figure 4 Summary of the contributing factors to phobia

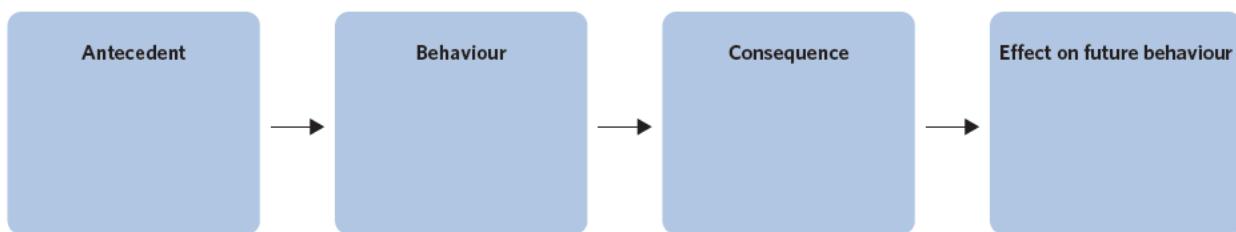
### 13B Activities

- 1 Warren has a phobia of water. As a small child, he went swimming at the beach. When he was in the water, he was caught by a rip and almost drowned. As an adult, Warren prefers not to go in large bodies of water as it makes him feel too anxious. He even avoids taking baths, as it reminds him of the incident.

- a Fill in this model by outlining how Warren developed his fear of water using the language of classical conditioning:



- b Fill in the boxes to discuss how Warren maintained his fear of water with reference to the three-phase model of operant conditioning:



Adapted from Edrolo and A.Muller, 2017.

## 13B QUESTIONS

### Theory review questions

#### Question 1

Match the key term from the lesson to the corresponding definition and indicate next to the definition which category of contributing factors it belongs to by marking either:

**B** for biological contributing factors

**P** for psychological contributing factors

**S** for social contributing factors

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>▪ Memory bias</li> <li>▪ Biological stress response</li> <li>▪ Specific environmental triggers</li> <li>▪ Long term potentiation</li> <li>▪ Perpetuation by operant conditioning</li> </ul> | <ul style="list-style-type: none"> <li>▪ Cognitive bias</li> <li>▪ Catastrophic thinking</li> <li>▪ GABA dysfunction</li> <li>▪ Stigma around seeking help</li> <li>▪ Precipitation by classical conditioning</li> </ul> |
|--|--|



Definition	Key term	Category
The increase in susceptibility and contribution to phobia caused by a type of passive learning through association		
The inhibiting of recovery from phobia caused by a kind of learning through the consequences of an action		
The activation of the sympathetic nervous system in the face of a perceived threat		
A kind of cognitive bias caused by inaccurate or exaggerated memory		
The feeling of shame associated with receiving professional help		
An inadequate neural transmission of GABA		
A predisposition to think about and process information in a certain way		
Events or stimuli in a person's surroundings that induce the stress response		
The strengthening of synaptic connections due to repeated coactivation		
A kind of cognitive bias in which stimulus or event is thought to be far worse than it is		

### Exam-style questions

#### Remember and understand

##### Question 2 (1 MARK)

Gamma-amino butyric acid (GABA) dysfunction can be a biological contributing factor to specific phobia when

- A there is an excess of this inhibitory neurotransmitter.
- B there is a deficiency of this inhibitory neurotransmitter.
- C there is an excess of this excitatory neurotransmitter.
- D there is a deficiency of this excitatory neurotransmitter.

Adapted from VCAA 2017 Exam MCQ15

##### Question 3 (1 MARK)

In terms of psychological contributing factors to phobia, behavioural models suggest that

- A classical conditioning perpetuates phobia while operant conditioning precipitates phobia.
- B classical conditioning precipitates phobia while operant conditioning perpetuates phobia.
- C classical conditioning prolongs phobia while operant conditioning prevents phobia.
- D classical conditioning prevents phobia while operant conditioning prolongs phobia.

##### Question 4 (2 MARKS)

In terms of psychological contributing factors, describe the role of operant conditioning in the development of specific phobia.

##### Question 5 (2 MARKS)

Describe the role of long-term potentiation in the development of specific phobia.

### Apply and analyse

#### Use the following information for questions 6 and 7.

Kabir is enormously afraid of grapes and has been since he was a small child. He feels extremely discomforted by their texture and the noise they make when bitten. He refuses to see a psychologist about it, as he feels his fear is embarrassing and not important enough to ask for help.

##### Question 6 (1 MARK)

In terms of social contributing factors to phobia, Kabir's embarrassment is an example of

- A a specific environmental trigger.
- B perpetuation.
- C stigma around seeking treatment.
- D precipitation.

Adapted from VCAA sample exam 2017 MCQ21

**Question 7** (1 MARK)

In terms of neural plasticity, Kabir's stress response to grapes may have been developed by

- A long-term depression.
- B gamma-amino butyric acid dysfunction.
- C long-term potentiation.
- D glutamate dysfunction.

**Question 8** (4 MARKS)

Carson has a phobia of crowds and will always avoid places where he knows that there will be lots of people. Even when he shuts his eyes and imagines being in a crowd, Carson feels anxiety and his heart begins to beat faster.

- a Describe how gamma-amino butyric acid (GABA) dysfunction might contribute to Carson's phobic response. (2 MARKS)
- b Outline one possible social contributing factor that may have contributed to the development of Carson's phobia of crowds. (2 MARKS)

**Question 9** (4 MARKS)

Flynn has a phobia of repeated patterns of hexagonal shapes. As a child, he walked past a construction site and saw a metal fence with hundreds of hexagons all in a row. He remembers them making him feel nauseous and uneasy, recalling it to be the most horrific experience he ever had. Now, if Flynn sees a metal fence in the distance, he will not walk near it out of fear that it will have hexagon shapes and that these will set off an embarrassing public breakdown.

In terms of psychological contributing factors to phobia, identify and describe the cognitive biases Flynn is presenting and how they contribute to his phobia of repeated patterns of hexagons.

**Questions from multiple lessons****Question 10** (1 MARK)

The division of the nervous system activated by a phobic stress response would be

- A the sympathetic nervous system.
- B the parasympathetic nervous system.
- C the somatic nervous system.
- D the autonomic nervous system.

**Question 11** (6 MARKS)

Ali has had a phobia of spiders since he was a child because he witnessed his brother get bitten by one and have to go to the hospital. Whenever Ali sees a spider, he has to leave the room it is in and sometimes even the house. He is currently at a party and has had several alcoholic drinks. Later that night, some people noticed a spider in the corner of the room. Ali noticed the spider too and moved to a couch further away from that corner of the room.

- a Alcohol is considered a depressant. Describe the likely effects of alcohol on Ali's brain wave patterns. (2 MARKS)
- b Describe the role of specific environmental triggers in terms of the development of Ali's phobia of spiders. (2 MARKS)
- c In terms of levels of alertness, explain why Ali may have had a less severe phobic reaction to the spider than he normally would. (2 MARKS)

**Question 12** (8 MARKS)

Grace's mother has a phobia of dogs. Since she was little, whenever they walked past a dog together, Grace's mother would walk to one side of the footpath, start breathing heavily and grab Grace protectively. From watching her mother, Grace has developed a phobia of dogs too.

*Adapted from VCAA 2018 Exam SAQ2*

- a Name the type of learning responsible for Grace's fear of dogs. (1 MARK)
- b Discuss two different ways in which reinforcement might contribute to both Grace and her mother's phobia of dogs. (4 MARKS)
- c In terms of biological contributing factors to phobia, name and describe what Grace's mother's heavy breathing is an example of. (2 MARKS)
- d Grace's mother is not afraid of wolves. In terms of processes of conditioning, what is this an example of? (1 MARK)

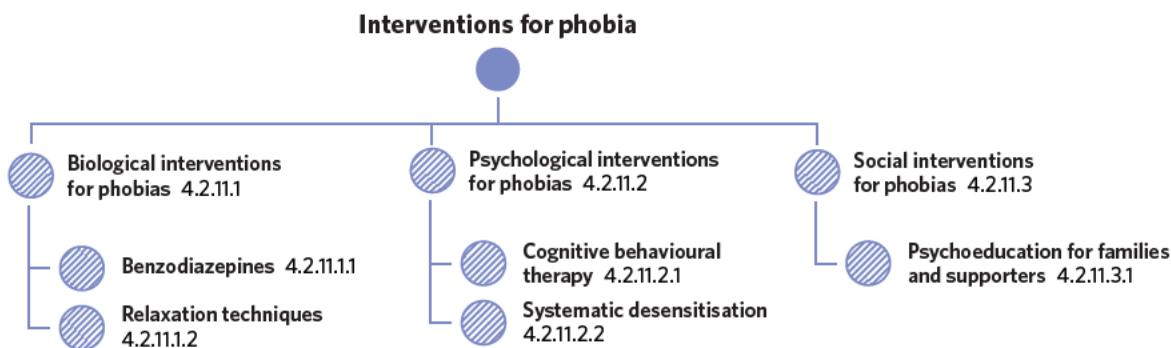


# 13C INTERVENTIONS FOR PHOBIA

So far in this chapter, you have been learning about phobia and its contributing factors, as well as where phobia fits in as a mental health disorder. You will now learn about the interventions used to treat and deal with phobia.

13A. Stress, phobia and anxiety	13B. Contributing factors to phobia	13C. Interventions for phobia										
<b>Study design dot point</b>												
<ul style="list-style-type: none"> <li>evidence-based interventions and their use for specific phobia with reference to: the use of short-acting anti-anxiety benzodiazepine agents (gamma-amino butyric acid [GABA] agonists) in the management of phobic anxiety and relaxation techniques including breathing retraining and exercise (biological); the use of cognitive behavioural therapy (CBT) and systematic desensitisation as psychotherapeutic treatments of phobia (psychological); psychoeducation for families/supporters with reference to challenging unrealistic or anxious thoughts and not encouraging avoidance behaviours (social).</li> </ul>												
<b>Key knowledge units</b>												
<table> <tr> <td>Benzodiazepines (Biological interventions for phobias)</td> <td>4.2.11.1</td> </tr> <tr> <td>Relaxation techniques (Biological interventions for phobias)</td> <td>4.2.11.2</td> </tr> <tr> <td>Cognitive behavioural therapy (Psychological interventions for phobias)</td> <td>4.2.11.2.1</td> </tr> <tr> <td>Systematic desensitisation (Psychological interventions for phobias)</td> <td>4.2.11.2.2</td> </tr> <tr> <td>Psychoeducation for families and supporters (Social interventions for phobias)</td> <td>4.2.11.3.1</td> </tr> </table>			Benzodiazepines (Biological interventions for phobias)	4.2.11.1	Relaxation techniques (Biological interventions for phobias)	4.2.11.2	Cognitive behavioural therapy (Psychological interventions for phobias)	4.2.11.2.1	Systematic desensitisation (Psychological interventions for phobias)	4.2.11.2.2	Psychoeducation for families and supporters (Social interventions for phobias)	4.2.11.3.1
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Systematic desensitisation (Psychological interventions for phobias)	4.2.11.2.2											
Psychoeducation for families and supporters (Social interventions for phobias)	4.2.11.3.1											

In this lesson, you will be learning how to apply the biopsychosocial model to understand the different evidence-based interventions used to treat specific phobia.



## Biological interventions for phobias 4.2.11.1

### OVERVIEW

There are two biological interventions for phobias you should be familiar with: the use of benzodiazepines as short-acting anti-anxiety medication and the use of relaxation techniques.

### THEORY DETAILS

As the causes of phobias can be understood in terms of the biopsychosocial model, so too can their interventions. This helps to create a holistic method for treatment by addressing each different component. Biological interventions for phobias are those treatments which involve acting on the physiological elements of phobias.

#### Benzodiazepines 4.2.11.1.1

As you learned in the previous lesson, GABA dysfunction is one of the biological contributing factors to specific phobia. This is due to the lack of inhibitory neural transmission in the body, leading to over-excitation at the synapses. A decreased ability to regulate neural firing like this can lead to feelings of anxiety.

Benzodiazepines are a type of short-acting, anti-anxiety medication that act in response

**Benzodiazepines** a type of short-acting anti-anxiety medication that works to reduce anxiety

to control the over-excitation of neural pathways characteristic of a phobic fear response. They work by amplifying the inhibitory role of GABA at the synapse. This helps to temporarily counter the effects of GABA dysfunction.

Drugs that mimic a neurotransmitter by binding to and activating the receptor site of a neuron are called **agonists**. Benzodiazepines are agonists because when they bind to a GABA receptor site, they increase the efficiency of the inhibitory effects of GABA. By inducing inhibitory responses, the rapid excitatory communication between neurons in the fear response is reduced, relieving the anxiety it causes. The ability of agonists to bind to a receptor site of a neurotransmitter depends on the mechanisms of the lock-and-key process. Here, the agonist acts as the 'key', with the same molecular structure as a neurotransmitter, and works to bind to the same 'lock' or receptor site as a neurotransmitter would.

### In summary:

1. Benzodiazepines bind to a GABA receptor site on a postsynaptic neuron.
2. The benzodiazepines increase the effectiveness of GABA when it later binds to the same receptor sites.
3. GABA is able to then have its inhibitory effect, reducing the likelihood that the neuron will fire. This acts temporarily to reduce neural communication, in turn reducing anxiety.

**Agonists** a type of drug that imitates neurotransmitters and works to initiate a neural response (excitatory or inhibitory) when it binds to the receptor sites of a neuron

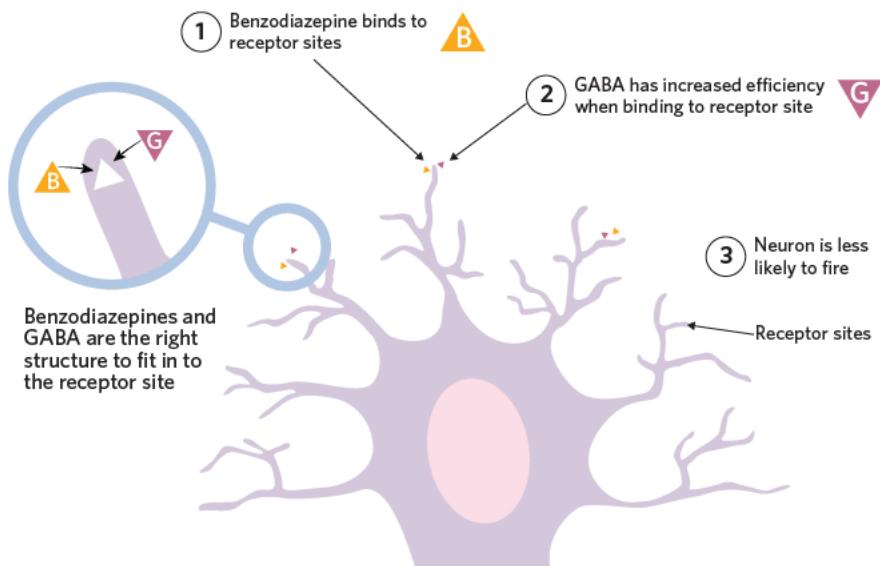


Figure 1 A diagram depicting how benzodiazepines operate in the lock-and-key process to initiate a short-acting, anti-anxiety response

### Useful tip

One important thing to remember is that benzodiazepines don't actually produce the inhibitory effects of GABA by themselves, but rather act to increase the efficiency of GABA when it reaches the receptor sites of the postsynaptic neuron.

There are also drugs called **antagonists**, which work by preventing an action at the receptor site by blocking the effect of a neurotransmitter. Like agonists, antagonists similarly operate using the mechanisms of the lock-and-key process. However, rather than initiating a response once bound to the 'lock', antagonists work to prevent a response occurring at the synapse.

### Relaxation techniques 4.2.11.2

There are two relaxation techniques which both rely on engaging the parasympathetic nervous system to counter the biological stress response.

### Breathing retraining

**Breathing retraining** is a method used to teach someone with a specific phobia how to control their breathing when in the presence of their phobic stimulus. When someone with specific phobia is facing their phobic stimulus, they often experience fast, shallow breathing. This can lead to hyperventilation, the engagement of other sympathetic nervous system responses, and in turn, increased anxiety.

**Antagonist** a type of drug that works to prevent a neural response (excitatory or inhibitory) by blocking the receptor sites of a neuron

**Breathing retraining** a method used to teach someone breathing control techniques that they can apply when facing their phobic stimulus



Both agonists and antagonists work as 'keys', but while agonists cause an effect (excitatory or inhibitory), antagonists prevent one (excitatory or inhibitory). It is important to note that agonists can initiate both excitatory and inhibitory responses at the synapse.

To understand the relationship between agonists and antagonists, it is helpful to understand how they work in relation to the lock-and-key process which you learned about in lesson **2D: Neurotransmitters**.



There are two main steps that are involved in breathing retraining:

Step	Techniques	Demonstration
1. A therapist or doctor will teach a person with a specific phobia how to consciously control their breathing.	<ul style="list-style-type: none"> <li>Slow and deep inhalations, followed by slow and controlled exhalations</li> <li>Counting slowly when breathing in, and on breathing out</li> <li>Breathing slowly in through the nose, and focusing on breathing out slowly from the diaphragm</li> </ul>	<p style="text-align: center;">IN Breath                    OUT Breath</p>
2. The learner applies the learned breathing techniques when in the presence of a phobic stimulus. This restores the amount of oxygen in the body to an optimal level through parasympathetic responses, in turn reducing sympathetic responses and anxiety.	Using and applying the breathing techniques learned in step 1. For example, by counting aloud or in your head, or imagining the therapist saying the instructions to you when in the presence of the phobic stimulus.	<p style="text-align: center;">Image: Visual Generation /Shutterstock.com</p>

Figure 2 A type of breathing technique involving breathing in through the nose and out through the mouth.

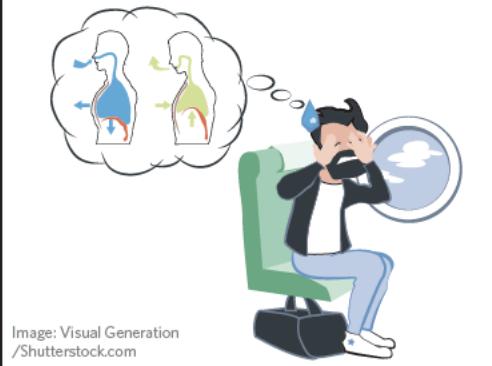


Figure 3 A person employing breathing techniques when faced by their phobia of flying

#### Useful tip

When answering questions about how to apply breathing retraining or explaining how it works, it is important that you include both these steps as well as an incorporation of the relevant nervous system responses involved.

#### Exercise

Exercise can also reduce an individual's experience of psychological and physiological stress. As you've learned in previous lessons, exercise in VCE psychology can be thought of as physical activity generally performed to improve someone's health and wellbeing. The main benefits of exercise in addressing the biological aspects of phobia include:

- Some exercise uses up or 'works off' hormones such as cortisol and adrenaline that contribute to the physiological stress response and feelings of anxiety
- High-intensity exercise can also produce stress hormones such as cortisol, training the body to deal with them in a healthy way
- Exercise can produce mood-enhancing chemicals in the brain such as endorphins, enhancing mental wellbeing
- Exercise can have a meditative effect, inducing a state of physiological and psychological calmness and relaxation



For a refresher on the various autonomic nervous system responses that may be affected by breathing retraining and exercise, head to lesson 2A: **Central and peripheral nervous systems**. The benefits of exercise for stress reduction are also explored in lesson 3D: **Coping with stress**, however not all of these benefits are appropriate for reducing phobic anxiety.

**Exercise** the performance of physical activity to improve a person's health and wellbeing

#### Psychological interventions for phobias 4.2.11.2

##### OVERVIEW

There are two psychological interventions for phobias you should be familiar with: cognitive behavioural therapy and systematic desensitisation.

##### THEORY DETAILS

You should also have an understanding of the psychological interventions for phobia, as these address the cognitive and mental processes which contribute to phobias. Again, this helps you to understand the importance of the biopsychosocial model in relation to both contributing factors and interventions for specific phobia.

### Cognitive behavioural therapy 4.2.11.2.1

As you've learned, cognitive behavioural therapy (CBT) is a method used to help someone replace their unhealthy thoughts (cognitions) and behaviours with more healthy ones. When treating someone with a specific phobia, the therapist first has to work with the patient to identify their thoughts and behaviours that may perpetuate and contribute to their phobia. Some of these you have already learned in the previous lesson.

Unhealthy thoughts and behaviours that may contribute to and perpetuate phobia include, but are not limited to

Thoughts (cognitions)	Behaviours
<ul style="list-style-type: none"> <li>Memory bias</li> <li>Catastrophic thinking</li> <li>A belief that the phobia can never be overcome</li> <li>A belief that the phobia can only get worse</li> <li>Embarrassment</li> <li>Extreme fear</li> </ul>	<ul style="list-style-type: none"> <li>Avoidance behaviours in which a person avoids their phobic stimulus and anything related to it at all costs</li> <li>The biological stress response</li> <li>Not seeking help</li> <li>Avoiding social activities that may expose a person to their phobia</li> </ul>

The presence of these cognitions and behaviours can mutually reinforce each other and perpetuate a phobia. This can be seen in figure 4, in which various cognitions and behaviours contribute to each other.

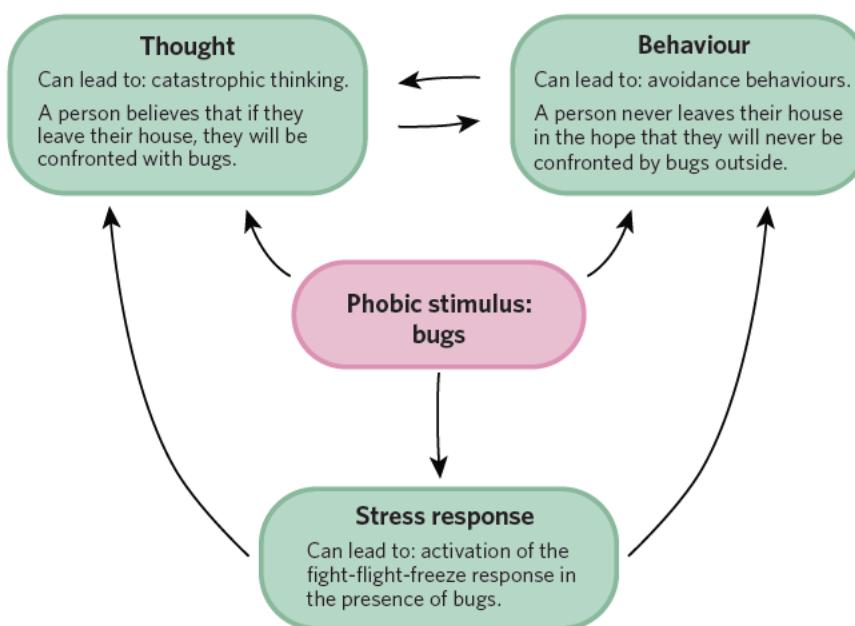


Figure 4 A representation of how both behaviours and cognitions can act to perpetuate and reinforce one another in relation to a phobia of bugs.

Once a person understands the interrelationship between unhealthy behaviours and cognitions, a therapist will work with them to develop strategies to overcome them. This involves identifying both thoughts and behaviours that are more healthy, which could potentially replace the unhealthy ones. In terms of thoughts, this could involve challenging them as hypotheses. For example, a person who believes they will die in a plane crash will be asked to consider that it is statistically unlikely. Healthier behaviours will also be recommended, such as going out and not performing avoidance behaviours, as well as employing relaxation techniques.

### Systematic desensitisation 4.2.11.2.2

Systematic desensitisation is a therapy technique used to overcome phobia involving a patient being exposed incrementally to increasingly anxiety-inducing stimuli, combined with the use of relaxation techniques.

In the previous lesson, you learned how classical conditioning contributes to the development of the conditioned fear response in phobia. Systematic desensitisation operates on the principles of classical conditioning, aiming to de-condition the association between the phobic stimulus and fear, by associating the phobic stimulus instead with relaxation.

**Cognitive behavioural therapy (CBT)** a form of psychotherapy which encourages individuals to substitute unhealthy cognitions and behaviours with more healthy ones.

**lesson link** You have learned about the application of CBT in lesson **10E: Sleep disorder interventions**. Although the specific cognitive and behavioural components of CBT for insomnia are usually different, the same processes are involved in CBT's treatment of phobias.

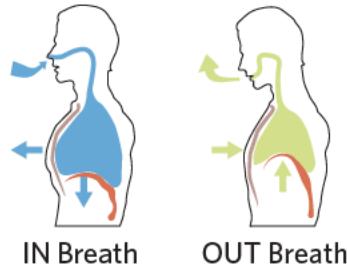
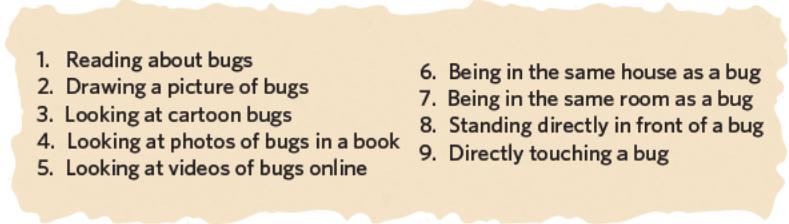
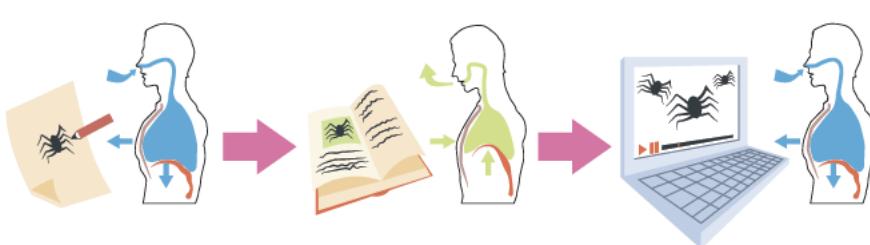
**lesson link** Various behaviours surrounding phobia that you have learned in this lesson and the last lesson **13B: Contributing factors to phobia** can be classified according to the Four P model in lesson **12A: Four P model**. Keep in mind that sometimes you might be asked to classify factors that contribute to or maintain phobia in terms of this model.

**lesson link** For a refresher on the principles of classical conditioning, head to lesson **5A: Classical conditioning**. In the previous lesson **13B: Contributing factors to phobia**, you learned how classical conditioning can lead to the development of the phobic fear response. In systematic desensitisation, the conditioned response (CR - fear to the phobic stimulus) to the conditioned stimulus (CS - the phobic stimulus) is weakened.

**Systematic desensitisation** a therapy technique used to overcome phobia involving a patient being exposed incrementally to increasingly anxiety-inducing stimuli, combined with the use of relaxation techniques.



There are four steps involved in the systematic desensitisation process:

Step	Details
<b>1. The learning of relaxation techniques.</b> A therapist might teach a patient a technique they can apply to reduce the physiological arousal and anxiety involved in the fear response.	One technique commonly used is breathing control such as that outlined in breathing retraining.  <b>IN Breath      OUT Breath</b>
<b>2. The development of a fear hierarchy.</b> This involves creating a list of anxiety-inducing experiences relating to the patient's phobia, listed in order of easiest to confront, to the most difficult to confront.	For a person with a phobia of bugs, a fear hierarchy might look like:  <ul style="list-style-type: none"> <li>1. Reading about bugs</li> <li>2. Drawing a picture of bugs</li> <li>3. Looking at cartoon bugs</li> <li>4. Looking at photos of bugs in a book</li> <li>5. Looking at videos of bugs online</li> <li>6. Being in the same house as a bug</li> <li>7. Being in the same room as a bug</li> <li>8. Standing directly in front of a bug</li> <li>9. Directly touching a bug</li> </ul>
<b>3. The gradual step-by-step exposure</b> to each item of the fear hierarchy beginning with the least anxiety-inducing stimulus, paired with practise of the learned relaxation techniques with each new exposure.	Each exposure to a step in the fear hierarchy is done in a controlled manner, with the use of relaxation techniques at each step. The patient does not move on to the next item in their fear hierarchy until the fear response is eliminated at each level. 
<b>4. The continuation of this systematic exposure</b> to items on the fear hierarchy until the most fear-inducing stimulus can be faced without producing the phobic response.	This process is often done with a therapist. At the end of this stage, a patient can confront their most-fear inducing stimulus without a fear response. 

## Social interventions for phobias 4.2.11.3

### OVERVIEW

One social intervention you should be familiar with is psychoeducation for families and supporters.

### THEORY DETAILS

To complete your understanding of the biopsychosocial model for the interventions for phobias, you need to understand the social component. Social interventions are those which act to address the social and interactional causes of phobias.

### **Psychoeducation for families and supporters 4.2.11.3.1**

Psychoeducation for families and supporters of people with phobia involves teaching them about the ways to manage and deal with a person's phobia. It also involves providing a more general education about the nature of phobia to increase families' and supporters' understanding of the mental health disorder. This can be beneficial to both the person with the phobia and their family and supporters. There are two important teachings for families and supporters you should be familiar with:

#### **Challenging unrealistic or anxious thoughts:**

As you've learned, a person with a phobia often has unrealistic and anxious thoughts about their phobic stimulus. This can come in the form of extreme anxiety, catastrophic thinking, memory biases and so on. Family and supporters are encouraged to actively challenge these thoughts in order to help a person with phobia to understand that some cognitive components of their fears are potentially unfounded and irrational. This should be done in a supportive, non-judgemental fashion. Like in CBT, this can help the person with a phobia begin to recognise their unhealthy thoughts.

#### **Not encouraging avoidant behaviours:**

Phobias cannot be solved through avoidant behaviours. While avoidant coping strategies might be useful for relieving less severe forms of stress, they do not provide long-term solutions for phobias. This is because phobias involve a deeply ingrained fear response that cannot be eliminated entirely with temporary fixes. As such, families and supporters are taught that they should not encourage avoidant behaviours, as they do not solve and only perpetuate the phobic anxiety.

**Psychoeducation** teaching individuals to better understand mental disorders and how to deal with and treat them

**lesson link** Not encouraging avoidant behaviours can be understood in terms of the perpetuating effects of operant conditioning, explored in the previous lesson **13B: Contributing factors to phobia**. Here, behaviours of avoidance are negatively reinforced through removing the undesirable (phobic) stimulus. This increases the likelihood of future avoidance and so this behaviour should not be encouraged by families and supporters.

### **Theory summary**

In this lesson, you have learned about the various interventions used to treat phobias. You should now be familiar with the biological interventions including benzodiazepines and relaxation techniques, the psychological interventions including cognitive behavioural therapy and systematic desensitisation, and the social intervention of psychoeducation for families and supporters. You should be able to describe and categorise each intervention, as well as clearly state and describe the steps of each intervention if relevant.

---

### **13C Activities**

- Fill out the steps involved in the following forms of therapy.

Breathing retraining	Benzodiazepines	Systematic desensitisation
Step 1:	Step 1:	Step 1:
Step 2:	Step 2:	Step 2:
	Step 3:	Step 3:
		Step 4:




# 13C QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition and indicate next to the definition which category of intervention it belongs to by marking it either:

**B** for biological interventions,    **or**    **P** for psychological interventions,    **or**    **S** for social interventions.

An example has been done for you.

- |                              |                                 |                        |            |
|------------------------------|---------------------------------|------------------------|------------|
| • Psychoeducation            | • Agonist                       | • Breathing retraining | • Exercise |
| • Systematic desensitisation | • Cognitive behavioural therapy | • Benzodiazepine       |            |

Definition	Key term	Category
A form of therapy which involves teaching a person about the interrelationships between thoughts and behaviours.	<b>Cognitive behavioural therapy</b>	<b>P</b>
a A method used to gradually present a person with their phobia with the use of relaxation techniques.		
b Teaching individuals how to understand and cope with a mental disorder.		
c A type of drug that works to initiate a response when it binds to the receptor sites of a neuron.		
d A type of medication that acts temporarily to relieve anxiety.		
e Physical activity carried out to better health and wellbeing.		
f An intervention used to educate a person about how to control their breathing in times of anxiety		

## Exam-style questions

### Remember and understand

### Question 2 (1 MARK)

One biological intervention for phobia is

- A** breathing retraining as it reduces cognitive bias.
- B** systematic desensitisation as it reduces psychological arousal.
- C** exercise as it works off stress hormones.
- D** cognitive behavioural therapy as it reduces psychological arousal.

Adapted from VCAA 2017 Exam MCQ34

### Question 3 (1 MARK)

Psychoeducation for family and supporters of a person with phobia works as

- A** a psychological intervention that teaches the importance of challenging unrealistic thoughts and not encouraging avoidant behaviours.
- B** a social intervention that teaches the importance of challenging unrealistic thoughts and not encouraging avoidant behaviours.
- C** a psychological intervention that teaches the importance of breathing retraining and exercise.
- D** a biological intervention that teaches the importance of breathing retraining and exercise.

**Question 4** (1 MARK)

Cognitive behavioral therapy and exercise are examples of which types of interventions for phobias?

- A social, biological
- B psychological, social
- C biological, psychological
- D psychological, biological

**Question 5** (2 MARKS)

Exercise is a relaxation technique used to reduce the phobic response.

Outline two ways exercise acts to biologically induce relaxation.

**Question 6** (3 MARKS)

Explain how breathing retraining can be used to reduce phobic anxiety.

**Question 7** (4 MARKS)

Describe how benzodiazepines work as short-acting anti-anxiety agents to treat phobias.

**Apply and analyse****Use the following information for questions 8 and 9.**

Omer has been experiencing uncontrollable anxiety whenever he thinks about going to work. He has nightmares every night before work, and always arrives at work shaky and with a high heart rate. Omer's psychologist works with him and also explains to his mother the importance of not letting her son stay home from work when he is feeling anxious.

**Question 8** (1 MARK)

When the psychologist spoke to Omer's mother, she is using

- A psychoeducation about the need to challenge unrealistic thoughts.
- B psychoeducation about the need to not encourage avoidant behaviours.
- C cognitive behavioural therapy.
- D systematic desensitisation.

**Question 9** (1 MARK)

Omer's doctor prescribed him the GABA agonist benzodiazepine to take when he goes to work. A benzodiazepine can treat specific phobia by

- A increasing the inhibitory effect of GABA.
- B increasing the excitatory effect of GABA.
- C decreasing the inhibitory effect of GABA.
- D decreasing the excitatory effect of GABA.

*Adapted from VCAA 2017 Exam MCQ45*

**Question 10** (7 MARKS)

Eliza has had a phobia of cats ever since she was little. She always feels nervous when walking down suburban streets, and will cross the road if she sees a cat in someone's front yard.

- a Explain how systematic desensitisation can be used to help Eliza overcome her phobia of cats. (4 MARKS)

*Adapted from VCAA 2017 Exam SAQ4e*

- b Describe how one other psychological intervention for phobia can be used to help Eliza with her phobia of cats. (3 MARKS)



**Questions from multiple lessons**

**Use the following information for questions 11-13.**

Grayson has a phobia of germs, and has recently moved into someone's old room in a friend's apartment. He can't stop thinking about the germs the person who used to live in his room might have left behind, and this often keeps him from being able to fall asleep at night.

**Question 11** (1 MARK)

What sleep disorder is Grayson experiencing as a result of his phobia?

- A parasomnia
- B dyssomnia
- C sleep-onset insomnia
- D specific phobia

**Question 12** (1 MARK)

What is one intervention that can be used to treat both Grayson's specific phobia and his sleep disorder?

- A bright light therapy
- B cognitive behavioural therapy
- C psychoeducation for families and supporters
- D systematic desensitisation

**Question 13** (1 MARK)

A potential social contributing factor to Grayson's response might be

- A catastrophic thinking.
- B the role of the stress response.
- C perpetuation by operant conditioning.
- D specific environmental triggers.

Adapted from VCAA 2017 Exam MCQ33

**Question 14** (2 MARKS)

Explain the role of the lock-and-key process in relation to the role of benzodiazepine GABA agonists.

**Question 15** (4 MARKS)

Fatima is extremely scared of the sound of running water. Whenever she hears water trickling or a tap being turned, she begins to shake and has to leave the area.

- a Is Fatima's response an example of specific phobia or anxiety? Justify your response. (2 MARKS)
- b Could exercise be considered an example of context-specific effectiveness for Fatima? Justify your response. (2 MARKS)

**Key science skills****Question 16** (1 MARK)

A researcher wanted to investigate the relationship between employing systematic desensitisation and levels of alertness. Using an EEG, the brain waves of participants were recorded whenever they were exposed to a new stimulus on their fear hierarchy. The researcher also asked participants to describe their mental state of alertness at each interval of exposure.

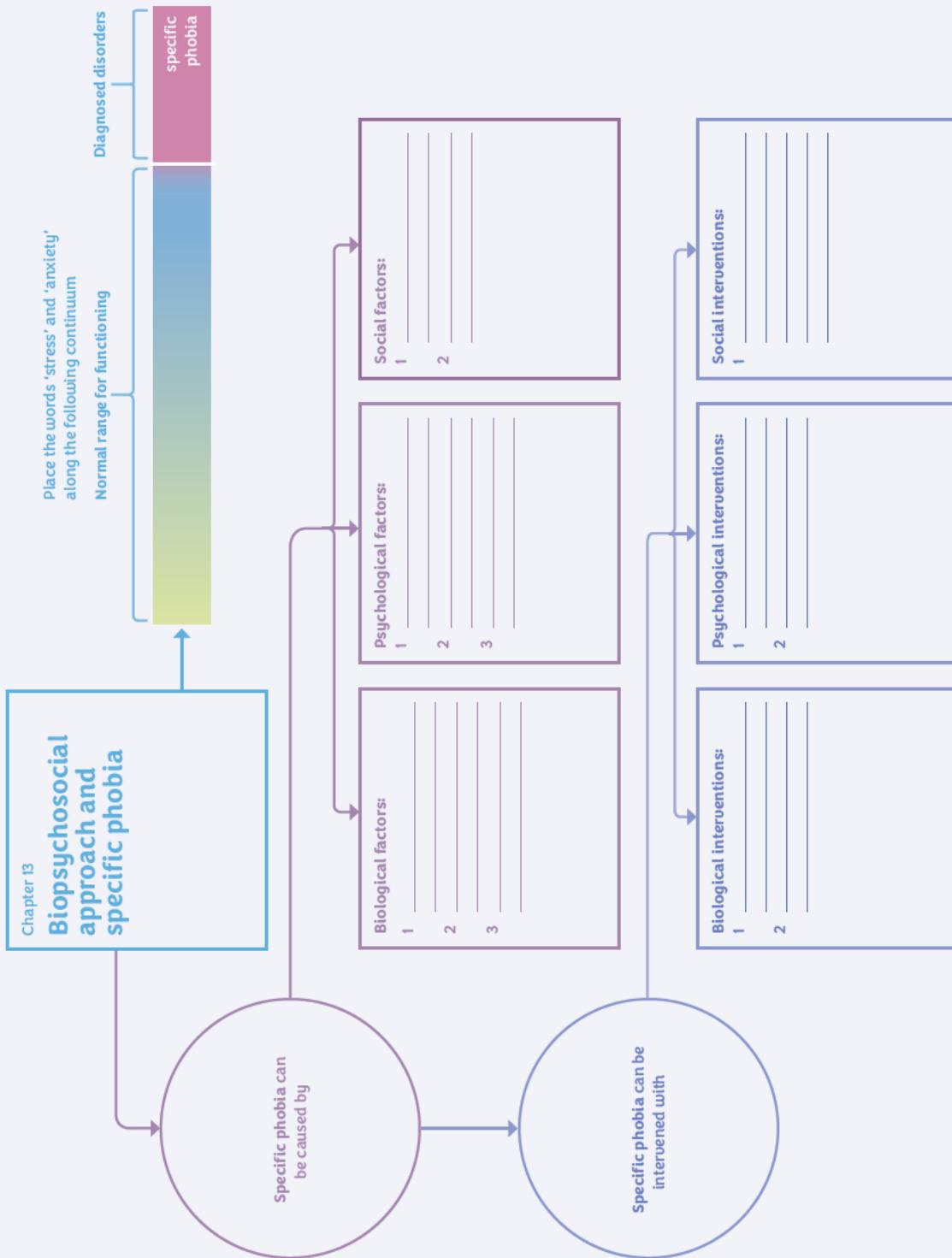
The type of data being collected by the EEG recordings and participants' description were respectively

- A subjective quantitative, objective qualitative
- B subjective qualitative, objective quantitative
- C objective qualitative, subjective quantitative
- D objective quantitative, subjective qualitative

# CHAPTER REVIEW ACTIVITIES

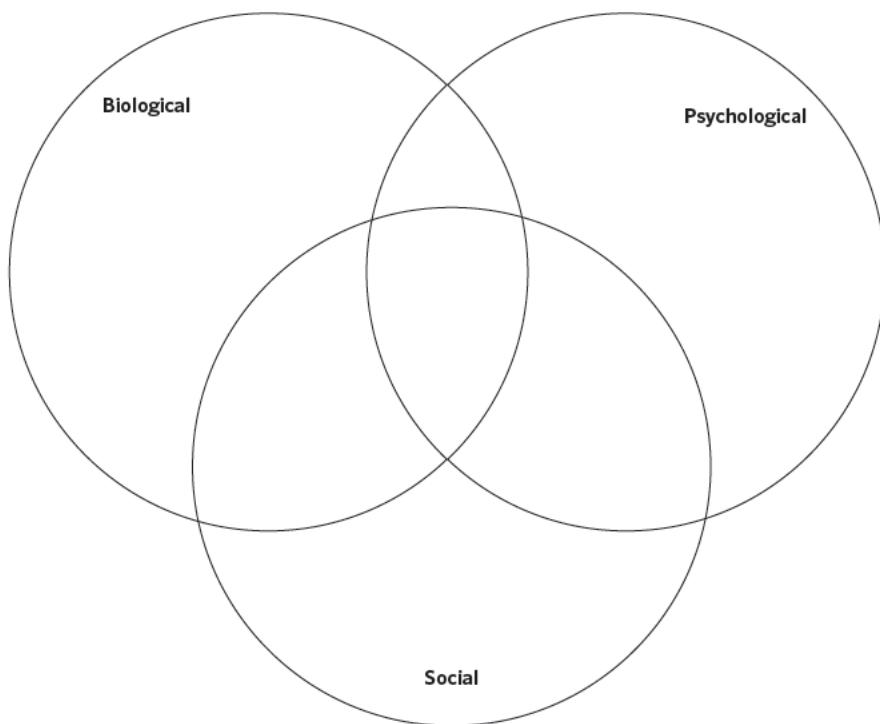
## Review activity 1: Mind map

Fill in the chapter summary mind map, or create your own.  
This includes all concepts from the chapter.



### Review activity 2: Venn diagram

Fill in the venn diagram, listing both contributing factors and interventions for specific phobia in each circle. Wherever the circles overlap, provide your own example of how the two types of factors could interact to either contribute to or treat specific phobia.



### Review activity 3: Mnemonics creation for contributing factors to phobia

There are lots of contributing factors to specific phobia you need to memorise, as well as the biopsychosocial category that they fit into. Create a mnemonic device to help you remember all the factors in each category. One mnemonic device in another lesson was the acronym 'BAT-D', which helped you remember the brain waves beta, alpha, theta and delta correctly from most to least alert. Now create an acronym, analogy, narrative or any other mnemonic device to help you remember factors that contribute to phobia.

Things to turn into a mnemonic:	Your mnemonics:
Biological: • GABA dysfunction • Role of the stress response • Long-term potentiation	
Psychological: • Precipitation by classical conditioning • Perpetuation by operant conditioning • Cognitive biases (you might want to include the two kinds: memory bias and catastrophic thinking)	
Social: • Specific environmental triggers • Stigma around seeking treatment	

### Review activity 4: Incorporating the Four P model

Using your knowledge from chapter 12, it is possible to categorise both the contributing factors to phobia and the interventions to treat phobia according to the Four Ps. Fill in the table by listing the contributing factors and interventions that belong in each box. The items to include are listed for you.

Contributing factors:	Interventions:
GABA dysfunction	Benzodiazepines
Role of the stress response	Relaxation techniques (you might want to specify breathing retraining and exercise)
Long-term potentiation	Cognitive behavioural therapy
Precipitation by classical conditioning	Systematic desensitisation
Perpetuation by operant conditioning	Psychoeducation for families and supporters
Cognitive biases (you might want to include the two kinds: memory bias and catastrophic thinking)	
Specific environmental triggers	
Stigma around seeking treatment	

Risk factor type	Contributing factor / Intervention
Predisposing	_____ _____ _____
Precipitating	_____ _____ _____
Perpetuating	_____ _____ _____
Protective	_____ _____ _____

## CHAPTER TEST

### Multiple choice questions

Use the following information for questions 1 and 2.

When Noah was little, he watched a scary documentary about thunderstorms and lightning and was particularly traumatised by what he saw. He now has a phobia of thunderstorms.

**Question 1** (1 MARK)

The scary documentary about thunderstorms and lightning was for Noah likely a

- A perpetuating risk factor.
- B specific environmental trigger.
- C predisposing risk factor.
- D cognitive bias.

**Question 2** (1 MARK)

Whenever Noah hears thunder, he thinks that a violent storm will occur and that lightning or flooding might kill him. In this situation, Noah's fears are an example of

- A memory bias which is a physiological contributing factor.
- B the stress response which is a social contributing factor.
- C catastrophic thinking which is a psychological contributing factor.
- D precipitation by classical conditioning which is a psychological contributing factor.



**Question 3** (1 MARK)

One biological contributing factor to phobias is

- A stigma around seeking treatment.
- B the role of the stress response.
- C specific environmental triggers.
- D precipitation by classical conditioning.

***Use the following information for questions 4 and 5.***

Little Albert was an 11-month-old baby who was classically conditioned in an experiment to develop a fear response to white rats. This occurred through the repeated pairing of the presentation of a white rat and a loud noise. After the experiment, Little Albert had a phobia of white rats as his fear response was never extinguished.

**Question 4** (1 MARK)

In the creation of Little Albert's phobia, the unconditioned stimulus and conditioned response were respectively

- A the loud noise, fear of the white rat.
- B the white rat, fear of the white rat.
- C the loud noise, fear of the loud noise.
- D the white rat, fear of the loud noise.

**Question 5** (1 MARK)

In terms of neural plasticity, Little Albert's phobic response was likely perpetuated by

- A the stress response.
- B long-term potentiation.
- C long-term depression.
- D GABA dysfunction.

*Adapted from VCAA 2018 exam MCQ9*

**Question 6** (1 MARK)

One difference between phobia and stress is that

- A phobia involves appraisal stages, whereas stress does not.
- B phobia activates the sympathetic nervous system, whereas stress does not.
- C phobia involves only distress, whereas stress does not.
- D phobia can be adaptive, whereas stress cannot.

*Adapted from VCAA 2017 Exam MCQ36*

**Question 7** (1 MARK)

Long-term potentiation can be considered a biological contributing factor to phobia when

- A the co-activation of neural signals involved in activating the fear response and the perception of a stimulus strengthens their association.
- B the co-activation of neural signals involved in activating the fear response and the perception of a stimulus weakens their association.
- C the neural signals involved in activating the fear response are strengthened more than the neural signals involved in perceiving a certain stimulus.
- D the neural signals involved in perceiving a certain stimulus are strengthened more than the neural signals involved in activating the fear response.

***Use the following information for questions 8 and 9.***

Euan developed a phobia of birds when he was a young child at kindergarten when a bird flew in through the window and swooped his head. Now as an adult, whenever Euan picks up his child from kindergarten he feels uneasy as he is reminded of his childhood experience. When it's spring time, Euan stays inside to avoid swooping magpies and feels relieved that he does not have to deal with them.

**Question 8** (1 MARK)

For Euan, his child's kindergarten serves as a

- A specific environmental-trigger.
- B memory bias.
- C state-dependent cue.
- D context-dependent cue.

**Question 9** (1 MARK)

Euan feeling relieved when he stays inside is an example of

- A avoidant coping.
- B perpetuation by operant conditioning.
- C approach coping.
- D precipitation by classical conditioning.

**Question 10** (1 MARK)

During the step-by-step exposure of systematic desensitisation, a person with a phobia is exposed to a fear-inducing stimulus, while using relaxation techniques. The division of the nervous system dominant when the fear-inducing stimulus is perceived, and the division dominant during the use of a relaxation technique are respectively

- A autonomic, somatic.
- B parasympathetic, sympathetic.
- C sympathetic, parasympathetic.
- D autonomic, parasympathetic.

**Short answer questions****Question 11** (10 MARKS)

Amelia and Grace are friends who are both scared of heights. When walking around their local creek one day, they had to cross a fairly high bridge to get over the water. Both girls began to worry as they approached the bridge. When they got to the start of the bridge, Amelia shakily clung to the sides but was able to start making her way across the bridge. Grace on the other hand, having hated heights since childhood, began to break down in tears, and was unable to set foot on the bridge.

- a In terms of stress, phobia, and anxiety, what was either girl experiencing? Justify your response. (4 MARKS)
- b In terms of coping strategies, how did Amelia and Grace confront the stressor of the bridge differently? Use examples in your response. (4 MARKS)
- c In terms of Lazarus and Folkman's Transactional Model, how might Grace and Amelia have appraised the stressor during primary appraisal? Justify your response. (2 MARKS)

**Question 12** (2 MARKS)

Identify and describe one psychological contributing factor to specific phobia.

**Question 13** (6 MARKS)

Dylan has a phobia of fish. He loves to swim, but thinks that the moment he steps in the water he will embarrass himself by yelling and screaming in fear of any fish he might touch.

- a Describe how the cognitive component of cognitive behavioural therapy (CBT) could be used to help Dylan reduce his catastrophic thinking about fish. (3 MARKS)
- b One day with friends, Dylan went for a swim at the beach and stepped on something squirmly. Thinking it was a fish, Dylan began to yell uncontrollably and flail his arms about. He could not control his movements. When he eventually got out of the water he felt exhausted, and felt like the experience went for about half an hour when in reality it was only a minute or two.

Comment on whether Dylan could be considered to be in an altered state of consciousness. Justify your response by commenting on the features of his psychological state. (3 MARKS)



**Question 14** (6 MARKS)

When Coen was younger, he had an angry cat in his family that often bit and scratched him. Overtime, the association between his cat and pain grew stronger, and he acquired a phobic response to all cats. Now, as a teenager, Coen finds his fear embarrassing and frustrating as it impacts his everyday life. Working with a therapist, Coen is attempting to use systematic desensitisation to get over his fear of cats.

- a In terms of classical conditioning, how will systematic desensitisation work to eliminate Coen's fear response? (3 MARKS)
- b In terms of predisposing, precipitating and perpetuating risk factors, describe what kind of contributing risk factor classical conditioning is for Coen's phobia. Outline the process of classical conditioning that is responsible for Coen's fear of all cats. (3 MARKS)

**Key science skills questions****Question 15** (1 MARK)

A researcher wanted to investigate the effects of gamma-amino butyric acid (GABA) short-acting anti-anxiety medication in the treatment of phobia. Group A, the experimental group, received the medication being trialled. Group B, the control group, received a placebo. Neither group were aware of the condition they had been assigned.

The method used in the scenario which meant that each group was unaware of the condition they had been assigned is known as

- A a single-blind procedure.
- B a double-blind procedure.
- C controlled variables.
- D participant control.

**Question 16** (6 MARKS)

A researcher and psychiatrist wanted to investigate the effectiveness of breathing retraining in helping patients to cope with and treat specific phobia. The psychiatrist asked several of his patients with a phobia to volunteer in the trial. The investigation took place over a three-month period. At the beginning of the three months, all participants were taught breathing techniques to use in the presence of phobic stimuli. These involved the use of controlled and counted inhalation through the nose, followed by controlled and counted exhalation from the diaphragm and through the mouth. In the trial-period, participants were accompanied by their therapist to confront their fear-inducing stimulus and employ the breathing techniques they had learned at the end of each month. After each exposure session, participants were asked to rank their anxiety levels during the use of breathing techniques on a rating scale from one to five. They were also asked to discuss with their therapist how they felt psychologically and physiologically. An example of the rating scale participants used is provided.

- a What kind of data was collected by the rating scales and in the interviews? (2 MARKS)
- b Identify one extraneous variable from the trial and describe how it may have affected results. (2 MARKS)
- c The results of the experiment revealed that month by month, participants' anxiety-ratings gradually decreased on average. Comment on whether the researcher can generalise these results to the population. (2 MARKS)

<b>Tick one:</b>	<b>Scale</b>
	1 - Not anxious at all
	2 - A little anxious
	3 - Somewhat anxious
	4 - Fairly anxious
	5 - Extremely anxious

**Extended response****Question 17** (10 MARKS)

Ever since Curtis was little, his mother has been very protective over him getting sick and bringing germs into the house. She constantly cleans, makes Curtis wash his hands as soon as he gets home from anywhere, and keeps a bottle of antiseptic in most rooms of the house. Whenever someone sneezes or vomits near her, she becomes very nervous and has to leave the space, and has even made people leave. When she escapes a sick person, Curtis's mother feels extremely relieved and is visibly more relaxed.

Curtis is now a teenager, and while he does not clean as much as his mother, he does get very anxious around sick people. If someone sneezes, he also leaves the room and becomes very agitated. A few times in his life, Curtis has fainted when someone vomited in the same room as him. He refuses to use toilets outside of his own home, and uses hand sanitiser at least ten times a day. He worries he will not be able to get a job after school, as the thought of working in a store or office makes him feel physically sick.

With reference to Curtis's situation, write a detailed analysis of his phobia. In your response, discuss any possible contributing factors to his phobia, including a discussion of any relevant models of learning and interventions that may be helpful in treating Curtis's phobia. In your response, refer to the biopsychosocial model.



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UNIT 4 AOS 2, CHAPTER 14

# 14

## Maintenance of mental health

### 14A Resilience

- resilience as a positive adaption to adversity including the relative influence of protective factors with reference to: adequate diet and sleep (biological); cognitive behavioural strategies (psychological); support from family, friends and community (social)

### 14B Behaviour change

- models of behaviour change with reference to the transtheoretical model including the stages of pre-contemplation, contemplation, preparation, action and maintenance/relapse

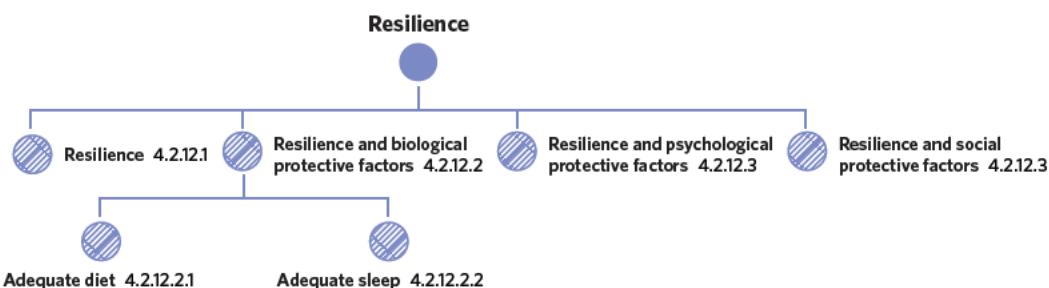


# 14A RESILIENCE

So far in this course, you have been looking at mental health and the factors that increase or decrease the likelihood of developing a mental health disorder. In this chapter, you will be focussing on ways to maintain good mental health. You will begin by learning about resilience and the factors that influence it.

14A. Resilience	14B. Behaviour change										
<b>Study design dot point</b>											
<ul style="list-style-type: none"> <li>resilience as a positive adaption to adversity including the relative influence of protective factors with reference to: adequate diet and sleep (biological); cognitive behavioural strategies (psychological); support from family, friends and community (social)</li> </ul>											
<b>Key knowledge units</b>											
<table> <tr> <td>Resilience</td> <td>4.2.12.1</td> </tr> <tr> <td>Adequate diet (Resilience and biological protective factors)</td> <td>4.2.12.2.1</td> </tr> <tr> <td>Adequate sleep (Resilience and biological protective factors)</td> <td>4.2.12.2.2</td> </tr> <tr> <td>Resilience and psychological protective factors</td> <td>4.2.12.3</td> </tr> <tr> <td>Resilience and social protective factors</td> <td>4.2.12.4</td> </tr> </table>		Resilience	4.2.12.1	Adequate diet (Resilience and biological protective factors)	4.2.12.2.1	Adequate sleep (Resilience and biological protective factors)	4.2.12.2.2	Resilience and psychological protective factors	4.2.12.3	Resilience and social protective factors	4.2.12.4
Resilience	4.2.12.1										
Adequate diet (Resilience and biological protective factors)	4.2.12.2.1										
Adequate sleep (Resilience and biological protective factors)	4.2.12.2.2										
Resilience and psychological protective factors	4.2.12.3										
Resilience and social protective factors	4.2.12.4										

In this lesson, you will apply a biopsychosocial approach to understand how **protective factors** influence a person's level of **resilience**. You will examine the concept of resilience as a way of responding to and overcoming stressors. You will also learn about how certain protective factors can increase resilience.



## Resilience 4.2.12.1

### OVERVIEW

Resilience is considered to be a positive adaption to adversity that involves responding to and overcoming life's stressors.

### THEORY DETAILS

Facing difficulties or hardships is an inevitable part of life that everyone has to deal with at some point. When facing such **adversity**, it is normal to feel fragile and down, and take some time away from your normal life activities. **Resilience** does not mean avoiding negative emotions, but rather, refers to the ability to adapt to and eventually overcome life's stressors and significant traumas. In this way, resilience is an essential element of maintaining mental health.

Resilience is considered a 'positive adaption' firstly, because it requires change or 'adaption', and secondly, because this change is a healthy or 'positive' means of coping with stressors. A person with high levels of resilience possesses the ability to overcome and respond to stressors, often referred to as the ability to 'bounce back'. The timeframe and methods used to achieve this depend on the significance of the stressor and circumstances unique to the individual. When a person experiences the death of a close relative or their partner for example, taking time off work or school and not being able to eat for some time would not be considered an example of low resilience. It is important to keep the nature of the adversity in mind when considering someone's levels of resilience.

**Adversity** the experience of a difficult or distressing situation

**Resilience** the ability to adapt to the environment and cope when stressors arise in order to return to a functioning state

**lesson link** As you learned in lesson 11B:

**Characteristics of a mentally healthy person**, mentally healthy people display high levels of resilience and are able to adapt to and overcome the stressors they encounter.

Levels of resilience are not static and are not genetically predetermined. With this in mind, a person's resilience can fluctuate over time and is influenced by different adversities. Improving resilience involves using methods which increase the ability to adapt to stressors. These are known as 'protective factors', and there are several with which you should be familiar. As you learned in lesson 12A: Four P model, protective factors prevent the occurrence or re-occurrence of mental health disorders and reduce the impact of stressors.



This lesson draws on two approaches to understanding mental health you've looked at before.

The first is the Four P model from lesson 12A: **Four P model**. The ways to increase resilience in this lesson are all examples of the fourth P: protective factors.

This lesson also draws upon the biopsychosocial approach to mental health, first explored in lesson 12B: **Biological risk factors**. It uses this approach to examine the protective factors, considering the way biological, psychological and social factors all interact and contribute to a person's level of resilience.

**Protective factor** a factor that prevents the occurrence or re-occurrence of mental health disorders



Image: BonNontawat/Shutterstock.com

**Figure 1** Resilience involves the ability to 'bounce back' like an elastic band. The significance of the stressor depends on how easy it is to return to normal functioning, just like how much elastic is stretched determines how much force is required to return to its former shape.

## Resilience and biological protective factors 4.2.12.2

### OVERVIEW

In terms of resilience, biological protective factors are those which increase a person's physiological functioning, making them better equipped to respond to and overcome stressors.

### THEORY DETAILS

There are many biological protective factors which can increase a person's resilience to stressors. This section focusses on two important factors: adequate diet and adequate sleep.

#### Adequate diet 4.2.12.2.1

Having an **adequate diet** greatly improves a person's physical health, and thereby mental health as well. Eating foods full of nutrients and high in energy equips a person with the ability to function day to day and maintain a more stable mood, as well as reducing their likelihood of getting sick. Besides eating foods high in nutrients and energy, it is important to consume a variety of foods that meet all the different needs of the body. This includes providing the body with the right protein and vitamin levels, as well as drinking the recommended amount of water each day.

Having an adequate diet contributes to a person's levels of resilience because it provides the baseline level of physical and mental health that allows for a person to adapt and change when faced with stressors.

#### Adequate sleep 4.2.12.2.2

As you are likely very familiar with, getting the recommended amount of sleep is vital for both physical and mental health. Receiving **adequate sleep**, similar to diet, equips a person with the ability to function effectively, maintain a steady mood and reduces their likelihood of sickness. This in turn increases resilience, as each of these tools allow a person to better respond to and overcome stressors.



For more ideas of biological protective factors, you can look at some of the biological interventions used to treat phobias in lesson 13C: **Interventions for phobia**. For example, breathing retraining and exercise could both be used to increase someone's resilience more generally.

You can also brainstorm more protective factors by looking at the biological risk factors for mental health in lesson 12B: **Biological risk factors**, and brainstorm solutions for them. For example, avoiding heavy substance use could be a biological protective factor that responds to the biological risk factor of 'substance use' in this lesson.

**Biological protective factors** factors that increase resilience by supporting healthy physiological functioning

**Adequate diet** a diet in which a person is provided with the nutrients and energy required to function healthily and effectively



Image: ifong/Shutterstock.com

**Figure 2** An adequate diet involves consuming more of the foods that provide energy and nutrients, and less of the foods that don't

**Adequate sleep** having enough and the right type of uninterrupted REM and NREM sleep in order to function healthily and effectively



For a refresher on the recommended amount of sleep for each age group, turn to lesson 9C: **Sleep across the lifespan**. For a refresher on the benefits of sleep to mental and physical functioning, turn to lesson 9B: **The purpose and function of sleep**, and for a refresher on the problems with sleep deprivation, turn to lesson 10A: **Sleep deprivation**.



## Resilience and psychological protective factors 4.2.12.3

### OVERVIEW

**Psychological protective factors** can increase resilience by equipping a person with cognitive strategies that allow them to respond to and overcome stressors. One important psychological protective factor is the use of cognitive and behavioural strategies.

### THEORY DETAILS

There are a range of psychological methods which can serve as protective factors to improve resilience. The use of **cognitive and behavioural strategies** is one important psychological protective factor which increases resilience levels. This factor draws from the theory of cognitive behavioural therapy (CBT), emphasising the interrelationship between cognition and behaviour. This relationship suggests that behaviours and thoughts (cognitions) interact and influence each other, where the improvement of one can lead to the improvement of the other. These include strategies of avoiding certain thought patterns such as catastrophising or ‘black-and-white thinking’.

#### Want to know more?

- Black-and-white thinking is when someone believes that if something goes wrong, then that whole object or experience is a failure, or not worth pursuing.
- Catastrophising is a cognitive bias in which people are more likely to think the situation is worse than it actually is.

To increase resilience, efforts should be taken to improve cognition by replacing unhealthy thoughts with more healthy ones. For example, this could take the form of replacing self-doubt with a measured self-confidence. Adjusting cognitions should be used in combination with behaviour change, which involves changing the actions a person performs to provide more healthy outcomes. This could, for example, take the form of seeking help when feeling low.



Figure 3 Cognitive and behavioural strategies are interrelated, each influencing the other, as well as a person's level of resilience

## Resilience and social protective factors 4.2.12.4

### OVERVIEW

**Social protective factors** are those methods which increase resilience by utilising the way people interact with others and their environment. One important social protective factor is getting support from family, friends and the community.

### THEORY DETAILS

Improving resilience through social strategies often involves getting **social support** from other people. This includes support from family, friends or community. These three different groups can provide their own unique support systems for an individual, offering different strategies to build up a person’s resilience and provide relief from stressors.

Possible benefits from these support groups include:

#### Family

- Unconditional love when you make a mistake
- Regular catch ups to vent emotions and share life details
- Familiar perspectives to go back to in times of uncertainty
- Support in difficult times, both emotionally and practically
- A sense of belonging to a relatively static and familiar group
- Encouragement to change and avoid unhealthy behaviours

**Psychological protective factors**  
factors that promote resilience by supporting a person's mental and cognitive functioning

**Cognitive and behavioural strategies** the techniques of cognitive behavioural therapy used to promote an individual's psychological resilience

**lesson link** You can brainstorm more specific psychological protective factors and cognitive and behavioural strategies by looking at the psychological risk factors for mental health in lesson 12C: **Psychological risk factors**, and coming up with solutions. For example, the psychological risk factor of poor self-efficacy could be acted upon with the behaviour change of joining a club, thereby making someone feel more confident in their social life and abilities.

**lesson link** You have already learned about the use of cognitive behavioural strategies and CBT in lessons 13C: **Interventions for phobias**, and 10E: **Sleep disorder interventions**. Both of these lessons include examples of cognitive and behavioural strategies that can improve an individual's mental health.

**Social protective factors**  
factors that increase resilience by providing social support

**Social support** the provision of assistance and care from family, friends, or the community

## Friends

- Fun and energising experiences
- Levels of intimacy and closeness that a person might not have with their family
- Support in difficult times, for example through providing distractions from difficult emotions, or assistance with self-care
- Reduction of stress and an increase in happiness
- A sense of belonging
- A sense of purpose

## Community

- Opportunities for interaction and bonding, such as at clubs for specific interests or at events like festivals
- A sense of belonging and connectedness to a wider social circle
- A sense of moral accomplishment, achieved by participation in collaborative community projects like working bees and school fetes
- Opportunities for personal growth and learning, such as at workshops and clubs
- Facilities and services for support, such as financial and medical assistance, or support for psychological difficulties such as groups for parenting or overcoming grief

If a person has strong relationships with all three of these groups, they are likely to have higher levels of resilience. It is important to utilise and rely on these groups for different purposes, as they can serve as invaluable tools for overcoming adversity.

### **Want to know more?**

Some psychologists distinguish between four different kinds of social support. This can be provided by family, friends or the community. These include:

- Appraisal support: This involves seeking advice from peers about one's own understanding of situations and the resources available to cope.
- Tangible assistance: This includes the provision of material or financial assistance by peers to help a person.
- Information support: This involves the provision of information by peers about how to manage or deal with adversity.
- Emotional support: This involves reassurance from peers to a person suffering that they have support and are cared for.

## Theory summary

In this lesson, you have learned about the concept of resilience and how it is important for maintaining mental health. You should now be able to describe the concept of resilience and discuss the influence of biological, psychological and social protective factors on it. Specifically, you should be able to discuss the protective factors of adequate diet and sleep (biological), cognitive and behavioural strategies (psychological) and support from family, friends and community (social).

### **Want to know more?**

The study of resilience within psychology falls under the subfield of positive psychology. Historically, the field of psychology focussed on mental health problems and mental illness but the field of positive psychology emphasises human flourishing and thriving. Instead of focussing on restoring people back to mental health, positive psychology looks at building wellbeing and happiness.

Resilience is a key concept within the field of positive psychology. Higher levels of resilience have been linked to higher levels of life satisfaction and happiness.



## 14A Activities

- 1 Indicate whether the following statements are true or false.

Statement	True/false
Many mental health professionals believe resilience to be an attribute that is essential for good health	
Tangible and appraisal assistance are examples of social support	
Having a balanced diet does not contribute towards the maintenance of good mental health	
Inadequate or poor sleep can adversely affect mental health by impairing affective, behavioural and cognitive functioning	

Adapted from Edrolo and A. Muller, 2017.

## 14A QUESTIONS

### Theory review questions

#### Question 1

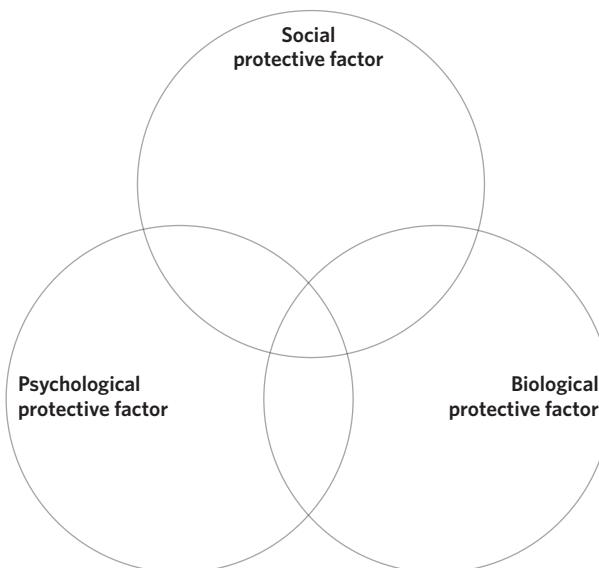
Match the key term from the lesson to the corresponding definition.

- Resilience
  - Adversity
  - Biological protective factors
  - Psychological protective factors
  - Social protective factors
- a Factors that increase resilience by supporting healthy physiological functioning \_\_\_\_\_
- b Hardship or distressing situations \_\_\_\_\_
- c Factors that target a person's mental and cognitive functioning \_\_\_\_\_
- d The ability to effectively respond to and overcome stressors and adversity \_\_\_\_\_
- e Factors that promote resilience through the provision of social support \_\_\_\_\_

#### Question 2

Fill in the venn diagram to identify whether each example is a biological, psychological or social protective factor that increases resilience.

- a Eating healthy meals with lots of vegetables
- b Venting to a friend about an upsetting incident at school
- c Having your parents help you pay for school supplies
- d Recognising when you are ruminating, and trying to change what you are thinking about
- e Keeping a sleep diary and trying to sleep eight hours a night
- f Joining a choir that practices weekly
- g Cutting out junk food
- h Going to a concert with friends



**Exam-style questions****Remember and understand****Question 3** (1 MARK)

Resilience most accurately refers to

- A the ability to 'bounce back' after hardship.
- B the quality or state of being physically strong.
- C the inability to change and be flexible in the face of trauma.
- D the ability to tolerate meanness or unkindness.

**Question 4** (1 MARK)

Resilience is considered a 'positive adaption' to adversity because it

- A involves the transformation of a person's identity to become tough and strong.
- B involves changing to become happy about the problems adversity presents.
- C involves changing in the face of problems or hardship in a way that is healthy and allows them to be overcome.
- D involves being happy about having to change or modify one's own behaviour and outlook.

**Question 5** (1 MARK)

One social protective factor which may promote resilience is

- A the use of cognitive and behavioural strategies.
- B accessing support from family and friends.
- C the consumption of healthy food.
- D avoiding going out to get adequate sleep.

**Question 6** (2 MARKS)

Explain how one psychological protective factor could influence a person's resilience.

**Apply and analyse****Use the following information for questions 7 and 8.**

Ever since Pim's brother died last year he has been filled with anger and rage. He has lost several of his closest friends after getting into conflicts with them and is constantly fighting with his parents at home. When he gets home from school, he stays up all night playing video games to keep his mind off things. His parents often ask him to talk about his brother and how he feels, but Pim refuses to speak to anyone.

**Question 7** (1 MARK)

In this situation, Pim is not showing resilience because

- A he is still angry and upset about his brother dying.
- B he has lost his closest friends.
- C he avoids thinking about his brother at night.
- D he hasn't demonstrated an ability to deal with his brother dying in a healthy way.

**Question 8** (1 MARK)

Which of the following identifies the biological and social risk factors demonstrated by Pim in the scenario?

- A Being filled with rage, having conflict with his friends.
- B Not getting adequate sleep, not getting support from family and friends.
- C Playing video games, refusing to speak to family and friends.
- D Loss of a significant relationship, refusing to speak to his parents.



**Question 9** (6 MARKS)

Athena has a dance recital coming up and is very stressed as she has a nasty cough. She worries that she won't be well enough to perform, and that she will let everyone in her team, including her teacher down if she isn't part of their routine. She has been in bed for a few days sick, and is feeling very hopeless and like she can't get better.

- a Describe one biological strategy Athena could use to increase her resilience. (3 MARKS)
- b Describe how employing cognitive and behavioural strategies could influence Athena's levels of resilience? (3 MARKS)

**Questions from multiple lessons****Use the following information for questions 10–12.**

Jireh is a professional figure skater who recently had an accident, hitting his head while skating. Although he is mostly okay, now when he skates, he often loses his balance and can't seem to perform the steps involved in his tricks. These tricks used to be second-nature to Jireh, so he now feels extremely frustrated and sad that he can't do them anymore. He has been crying at home a lot, constantly thinking about the prospect of his career being over. His brother suggested he see a psychologist for support.

**Question 10** (1 MARK)

What was the brain structure most likely damaged in Jireh's accident?

- A hippocampus
- B amygdala
- C cerebral cortex
- D cerebellum

**Question 11** (1 MARK)

Jireh was more likely to develop a mental illness after his accident. This was due to

- A GABA dysfunction.
- B disorganised attachment.
- C rumination.
- D the role of stigma as a barrier to accessing treatment.

Adapted from VCAA 2018 exam MCQ14

**Question 12** (1 MARK)

When Jireh's brother suggested he see a psychologist for support, he suggested a

- A psychological protective factor that could increase Jireh's resilience.
- B psychological predisposing factor that could increase Jireh's resilience.
- C social protective factor that could increase Jireh's resilience.
- D social predisposing factor that could increase Jireh's resilience.

**Question 13** (9 MARKS)

Jovan's aunt died a few years ago. After her death, Jovan bounced back fairly quickly and was able to continue with his daily functioning as normal. At the time, his mother who was very upset by the death of her sister, harshly told Jovan that he should be more upset and stay at home grieving for longer. Jovan's grandmother recently died a few weeks ago. Now, he is mindful of staying at home and thinking about his grandmother's death before going straight back to work.

- a Describe two characteristics of a mentally healthy person Jovan displayed after his aunt's death? (4 MARKS)
- b Explain how one relevant social protective factor could have influenced Jovan's mother's resilience after his aunt died. (2 MARKS)
- c Outline how the consequence of his behaviour during the period after his aunt's death has influenced Jovan's behaviour after the death of his grandmother. (3 MARKS)

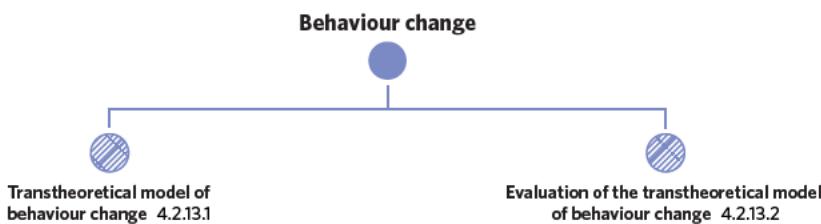
# 14B BEHAVIOUR CHANGE

So far in this chapter, you have learned about the concept of resilience and the protective factors that contribute to mental health. You have learned about biological, psychological and social protective factors and how these factors help individuals respond to and cope with stress. Now, you will learn about the transtheoretical model of behaviour change, including the strengths and weaknesses of this model.

14A. Resilience	14B. Behaviour change
<b>Study design dot point</b>	
<ul style="list-style-type: none"> <li>models of behaviour change with reference to the transtheoretical model including the stages of pre-contemplation, contemplation, preparation, action and maintenance/relapse</li> </ul>	
<b>Key knowledge units</b>	
Transtheoretical model of behaviour change	4.2.13.1
Evaluation of the transtheoretical model of behaviour change	4.2.13.2

In this lesson, you will be learning about the transtheoretical model of behaviour change.

Specifically, you will learn about the stages of this model, including **pre-contemplation, contemplation, preparation, action, maintenance** and **relapse**. You will also learn about the strengths and weaknesses of this model.



## Transtheoretical model of behaviour change 4.2.13.1

### OVERVIEW

The transtheoretical model of behaviour change describes the steps an individual takes to make a behaviour change. This involves moving through the stages of pre-contemplation, contemplation, preparation, action, maintenance and relapse.

### THEORY DETAILS

Have you ever tried to change a behaviour? Did you find it hard to take steps towards this change? Could you easily maintain the change? Change towards healthier behaviour is usually an extremely difficult and lengthy process. An individual often has to attempt to make a change multiple times before successfully maintaining the new behaviour.

The transtheoretical model of behaviour change helps to assess how ready an individual is to take the steps towards making a change for healthier behaviour. There are multiple stages involved in this model that an individual moves through. These are outlined in figure 1 and table 1. Each stage helps to track where an individual is at in their process of behaviour change.

**Transtheoretical model of behaviour change** a model which assesses an individual's readiness to change by looking at the different stages an individual may progress through as they move towards healthier behaviour

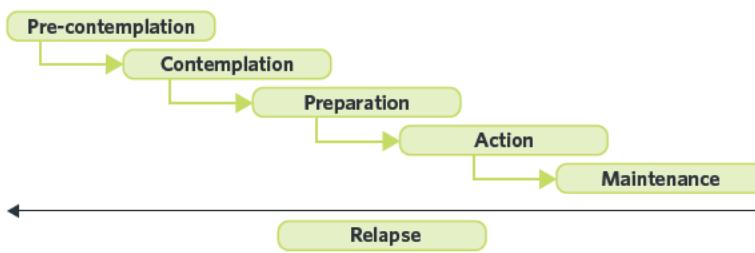


Figure 1 The five stages of the transtheoretical model of change. When changing behaviour, people move through these five sequential stages, but they may also experience relapse.



**Table 1** Characteristics of each stage of the transtheoretical model of change

Stage	Characteristics	
<b>1. Pre-contemplation</b>	<ul style="list-style-type: none"> <li>The individual is not yet ready for change</li> <li>There is a belief that the behaviour is not problematic</li> <li>Lack of motivation for change</li> <li>Dismissal of concerns from others about the unhealthy behaviour</li> <li>Belief that they are unable to change the behaviour</li> </ul>	<b>Pre-contemplation stage</b> during this stage the individual is unaware that their behaviour is problematic or unhealthy and has no intention to change their behaviour in the next six months
<b>2. Contemplation</b>	<ul style="list-style-type: none"> <li>Awareness that the behaviour is problematic</li> <li>Actively thinking about taking steps towards behaviour change within the next six months</li> <li>Not currently taking active steps towards behaviour change</li> </ul>	<b>Contemplation stage</b> during this stage the individual is aware that their behaviour is problematic or unhealthy and is considering taking action within the next six months, but has no active commitment to do so
<b>3. Preparation</b>	<ul style="list-style-type: none"> <li>Taking steps towards behaviour change within the next 30 days</li> <li>The individual has high motivation for change, but may have low confidence for success</li> </ul>	<b>Preparation stage</b> during this stage the individual has begun to take an active commitment towards changing their behaviour within the next 30 days
<b>4. Action</b>	<ul style="list-style-type: none"> <li>Active steps have been taken towards the behaviour change</li> <li>High motivation</li> <li>Behaviour change has lasted less than six months</li> <li>Social support is common at this stage</li> </ul>	<b>Action stage</b> during this stage the individual has made distinct behaviour change for less than six months
<b>5. Maintenance</b>	<ul style="list-style-type: none"> <li>The behaviour change has been consistent for at least six months</li> <li>The individual is active in taking measures to avoid relapse</li> </ul>	<b>Maintenance stage</b> during this stage the individual has made distinct behaviour change for more than six months and is working to prevent relapse
<b>Relapse</b>	<ul style="list-style-type: none"> <li>A temporary setback involving a return to the problem behaviour that is trying to be changed. This can occur at any stage. A relapse may be contrasted with a lapse, which refers to a temporary return to a previous stage rather than a complete and definitive return to the problem behaviour. A lapse may also occur at any stage</li> </ul>	<b>Relapse</b> a setback involving the return to a problem behaviour

**Want to know more?**

There is a potential sixth stage of the transtheoretical model which is called termination. This occurs after the maintenance stage and is achieved when individuals have made their behaviour change a habit. This habit is believed to be so stable that it is unlikely for individuals to experience relapse in their changed behaviour. Therefore their movement through the stages of the model has 'terminated'.

To help you understand each stage of the model, it is helpful to think of a behaviour change you may have attempted. This could involve attempting to spend less time on your phone, attempting to exercise more or attempting to implement more stress-reducing behaviours in to your routine.

**Example:**

Jade spends around six hours on her phone a day, constantly checking it during class and throughout the night, but does not view her behaviour as problematic. This suggests that she is in the **pre-contemplation** stage. Because she doesn't see a problem with her current behaviour, Jade has no intention to change her behaviour and attempt to reduce her screen time within the next six months.

Although she is unaware of her behaviour being problematic, Jade's parents and friends constantly remind her of how unhealthy it is to be constantly on her phone. This eventually leads her to the realisation that she needs to take steps towards healthier behaviour and spend less time on her phone. Although she realises this, she has not yet attempted change or made any plans to, placing her in the **contemplation** stage. This stage involves actively considering behaviour change within the next six months, without actually taking any steps in the direction of behaviour change.

A few months later, Jade decides that she needs to reduce the time she spends on her phone. She downloads a few apps which help to reduce screen time by restricting how much access she will have to certain apps at certain times. She has also decided that she will switch off her phone when in class. During this time, Jade is in the **preparation** stage of the model. She has taken some steps towards changing her behaviour within the next 30 days, having an active commitment to have healthier behaviour.

 Individuals with poor self-efficacy usually find it harder to make behavioural changes as they believe that they will be unable to achieve this change. Return to lesson **12C: Psychological risk factors** for more information on self-efficacy.

**Useful tip**

In order to move from the pre-contemplation stage to the contemplation stage, individuals often have to experience a negative event to trigger their motivation and make a change.

**Want to know more?**

Individuals who are in the preparation stage often tell their friends and family of their plans to make changes to their behaviour in the near future. This can help individuals making a behaviour change feel supported as their friends and family can encourage their actions.

After two weeks, Jade transitions to the **action** stage. This involves Jade switching on one of her new apps which applies a limit on how much time she can spend on certain apps and begins ‘night mode’ at 10:30pm, switching off her wifi and only allowing access to her music and alarms. She has made these distinct changes for two months.

After another eight months, Jade has continued to use her apps. She has also begun turning off her phone when arriving at school each morning and not turning it back on until the end of the school day. She has reduced her screen time to around two to three hours a day. At this point, Jade is experiencing the **maintenance** stage as she has made distinct behaviour change that has lasted for more than six months.

#### **Want to know more?**

You can implement different strategies to help ensure successful behaviour change. These strategies can be implemented at different stages of the transtheoretical model of behaviour change. Some of these strategies include:

- **Contemplation stage:** making a list of pros and cons of the behaviour change to encourage the change.
- **Preparation stage:** creating an action plan with multiple goals and steps to enhance motivation. This is often done with the help of a psychologist.
- **Preparation stage:** informing your friends and family that you are planning to make changes so that they can support this behaviour during the action stage.
- **Maintenance stage:** minimising or avoiding exposure to stimuli or events which may lead to relapse.

Although this model has a clear sequence that individuals move through, people can experience setbacks called **relapses**. A relapse is when an individual returns to performing the behaviour they are trying to change. In contrast, a lapse is a less significant “slide” back to a previous stage, rather than a complete return to the original problem behaviour. This may have a negative impact on their progress temporarily, but is viewed as a natural part of this model, with most individuals experiencing multiple lapses or relapses when attempting to make a behaviour change.

For Jade, a relapse might look like spending a whole day on her phone after months of reduced screen time. This setback is natural and won’t prevent her from being able to continue to maintain healthy behaviours in the long-term.

#### **Useful tip**

It is important to remember that the transtheoretical model of behaviour change is rarely a linear process, meaning that it often involves fluctuations between stages.

For this reason, individuals may visit each stage multiple times due to experiencing lapses and/or relapses. This continues until an individual has maintained their behaviour change for more than six months, where the behaviour is then considered changed. The more prepared an individual is to make change, the more likely they are to be successful and in the least amount of time.



An individual’s ability to recover after relapse is increased if an individual has high levels of resilience and can ‘bounce back’ from setbacks. Return to lesson **14A: Resilience** to refresh your knowledge on this concept.

## **Evaluation of the transtheoretical model of behaviour change** 4.2.13.2

### **OVERVIEW**

The transtheoretical model of behaviour change has both strengths and limitations when attempting to explain the processes of behaviour change individuals experience.

### **THEORY DETAILS**

The transtheoretical model of behaviour change helps to explain the processes involved in behaviour change, explaining its gradual nature. However, this process can vary greatly between individuals depending on which behaviour they are changing, as well as their unique personal characteristics. Overall, the model contains a number of strengths and weaknesses which are outlined in figure 2.



Strengths of the model	Limitations of the model
<ul style="list-style-type: none"> <li>• Helps to account for fluctuations and relapses in behaviour change and acknowledges that these can still lead to change in the long term</li> <li>• Provides a broad account of the processes involved in behaviour change</li> <li>• Acknowledges that change occurs gradually</li> </ul>	<ul style="list-style-type: none"> <li>• Time periods are not always consistent as outlined in the model, e.g. a person may experience maintenance after only a few months, rather than the specific period of six months the model outlines</li> <li>• There is limited research on the psychological processes involved in transitions between stages, as well as what motivates these transitions</li> <li>• The order of stages in this model has been questioned in terms of their accuracy and ability to fully cover all necessary actions of behaviour change</li> </ul>

Figure 2 The strengths and limitations of the transtheoretical model of behaviour change

## Theory summary

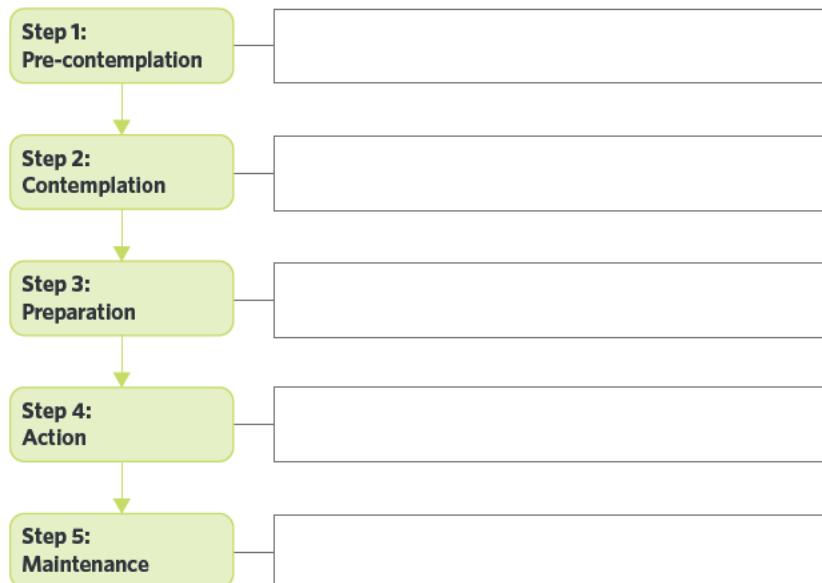
In this lesson, you have learned about the transtheoretical model of behaviour change. This model includes the stages of pre-contemplation, contemplation, preparation, action and maintenance, as well as occurrences of relapse. These stages have been summarised in table 2. You have also learned about the strengths and limitations of this model.

Table 2 Summary of the stages of the transtheoretical model of behaviour change

Stage	Description
Pre-contemplation	Unaware that behaviour is problematic or unhealthy with no intention to change behaviour in the next six months.
Contemplation	Aware that behaviour is problematic or unhealthy with the intention to change within the next six months but without active commitment.
Preparation	Active commitment to change behaviour in the next 30 days.
Action	Distinct behaviour change for less than six months.
Maintenance	Distinct behaviour change for more than six months while working to prevent relapse.

## 14B Activities

- 1 Choose a behaviour from your own life that you have changed or attempted to change (e.g. exercise, diet, caffeine intake, study habits). Note down the process you went through using the transtheoretical model. Be sure to record relapses.



Adapted from Edrolo and A.Muller, 2017.

# 14B QUESTIONS

## Theory review questions

### Question 1

Match the key term from the lesson to the corresponding definition.

- Transtheoretical model of behaviour change
  - Action stage
  - Contemplation stage
  - Maintenance stage
  - Preparation stage
  - Relapse
  - Pre-contemplation stage
- a The individual does not view their behaviour as problematic and is unlikely to take steps to change this behaviour within the next six months \_\_\_\_\_
- b The individual has made active progress towards changing their behaviour for less than six months \_\_\_\_\_
- c A model of behaviour that outlines a progression of stages that assesses the readiness of an individual to change and move towards healthier behaviour \_\_\_\_\_
- d The individual recognises their behaviour as problematic and is considering taking action within the next six months, but has no active commitment to do so \_\_\_\_\_
- e The individual has an active plan to change their behaviour within the next 30 days and has begun taking steps to achieve this \_\_\_\_\_
- f A setback involving the complete return to a problem behaviour \_\_\_\_\_
- g The individual has made distinct behaviour change for more than six months and is working to prevent relapse \_\_\_\_\_

## Exam-style questions

### Remember and understand

#### Question 2 (1 MARK)

One limitation of the transtheoretical model of behaviour change is that

- A there is limited research on the psychological processes involved in transitioning between stages.
- B researchers have speculated that there should be ten stages instead of five.
- C it does not help to explain how change is gradual.
- D it does not account for relapses in behaviour change.

#### Question 3 (1 MARK)

The transtheoretical model of behaviour change

- A is an unreliable resource as the stages are not in an accurate order.
- B has seven stages.
- C assesses an individual's readiness to change their behaviour.
- D concludes at the 'action' stage.

#### Question 4 (1 MARK)

Outline a limitation of the transtheoretical model of behaviour change.

### Apply and analyse

#### Question 5 (1 MARK)

Tahlia's doctor has advised her to reduce her daily caffeine intake as it is negatively impacting her health. Her doctor has referred her to a psychologist who has helped Tahlia develop an action plan to reduce her caffeine intake. Tahlia has since bought caffeine-free tea to help reduce her caffeine intake, but has not started using this tea yet.

Which of the following stages of the transtheoretical model of behaviour change is Tahlia currently in?

- A contemplation
- B pre-contemplation
- C action
- D preparation



Adapted from VCAA 2017 sample exam MCQ47

**Question 6** (1 MARK)

Daniel has recently implemented changes in his daily life in an attempt to become less stressed. In beginning this process, Daniel developed an action plan with his psychologist. Some of the goals in this plan included using breathing retraining and getting a full seven hours of sleep a night. He has since successfully implemented breathing retraining, taking deep and controlled breaths whenever he is exposed to stress-inducing stimuli. However, he hasn't yet attempted to sleep for a full seven hours, only getting about six hours of sleep each night.

In terms of the two goals of introducing breathing retraining and getting a full seven hours of sleep, it is most likely that Daniel is, respectively, in the stages of

- A action and preparation.
- B action and pre-contemplation.
- C maintenance and pre-contemplation.
- D contemplation and action.

Adapted from VCAA 2017 sample exam MCQ48

**Question 7** (1 MARK)

Alba has not undertaken any exercise for two years. One of his mates has asked him to take part in a marathon that is scheduled to take place a year from now. To take part in this marathon, Alba would need to begin vigorous training in six months time. Alba is still undecided as to whether he should join his mate in completing the marathon.

Alba is most likely to be in the

- A preparation stage.
- B pre-contemplation stage.
- C maintenance stage.
- D contemplation stage.

**Question 8** (1 MARK)

Bilal is constantly dehydrated as he only ever drinks soft drinks. He often feels fatigued but refuses to drink water because he doesn't like the taste. His parents always tell him he needs to drink more water and have even taken him to hear this from a doctor, but Bilal always shrugs off their concerns.

Bilal is most likely in which stage of the transtheoretical model of behaviour change?

- A termination
- B maintenance
- C pre-contemplation
- D contemplation

**Question 9** (2 MARKS)

Stacy has changed her behaviour to stop gambling and is currently in the maintenance stage. With reference to the scenario, explain some characteristics of this stage that Stacy might be experiencing.

**Question 10** (5 MARKS)

A few months ago, Alannah decided that she wanted to develop better study habits. Since then, she has begun implementing some changes across her day. These include not watching TV until her homework is complete and turning off her phone while studying. She maintains this behaviour for three months. After three months, she starts using her phone while studying and is much less productive, returning to her ineffective study habits.

- a Identify which stage of the transtheoretical model of behaviour change Alannah experienced when she successfully implemented behavioural changes for three months. (1 MARK)
- b When Alannah returns to her ineffective study habits after three months of behaviour change, what stage is she experiencing? Justify your response. (2 MARKS)
- c Explain one strength of the transtheoretical model of behaviour change which is evident in this scenario. Justify your response. (2 MARKS)

**Questions from multiple lessons****Question 11** (1 MARK)

Levi wishes to eat a healthier diet. He has bought a few healthy recipe books and has created an action plan outlining steps from his current diet towards a healthier one. However, he does not believe that he will be able to successfully make the change.

Levi is demonstrating

- A a relapse.
- B poor self-efficacy.
- C high levels of functioning.
- D coping flexibility.

**Question 12** (1 MARK)

Hunter has recently quit smoking after smoking for six years. To help him commit to this change, he has been using nicotine patches every day and has decided to spend less time with his friends who smoke.

Hunter is in the

- A pre-contemplation stage of the transtheoretical model of behaviour change.
- B after the conditioning stage of the classical conditional model.
- C consequence stage of operant conditioning.
- D action stage of the transtheoretical model of behaviour change.

**Question 13** (3 MARKS)

Azra has wanted to start meditating for a few months and has recently downloaded a few guided meditation apps. She believes that meditating will help reduce her stress levels. However, she has recently gone away on a holiday and has not begun incorporating meditation into her daily routine yet.

- a Identify Azra's current stage in the transtheoretical model and outline a behaviour she is likely to display during this stage. (2 MARKS)
- b Describe how Azra's brain waves will change while meditating, compared to being in a normal waking state. (1 MARK)

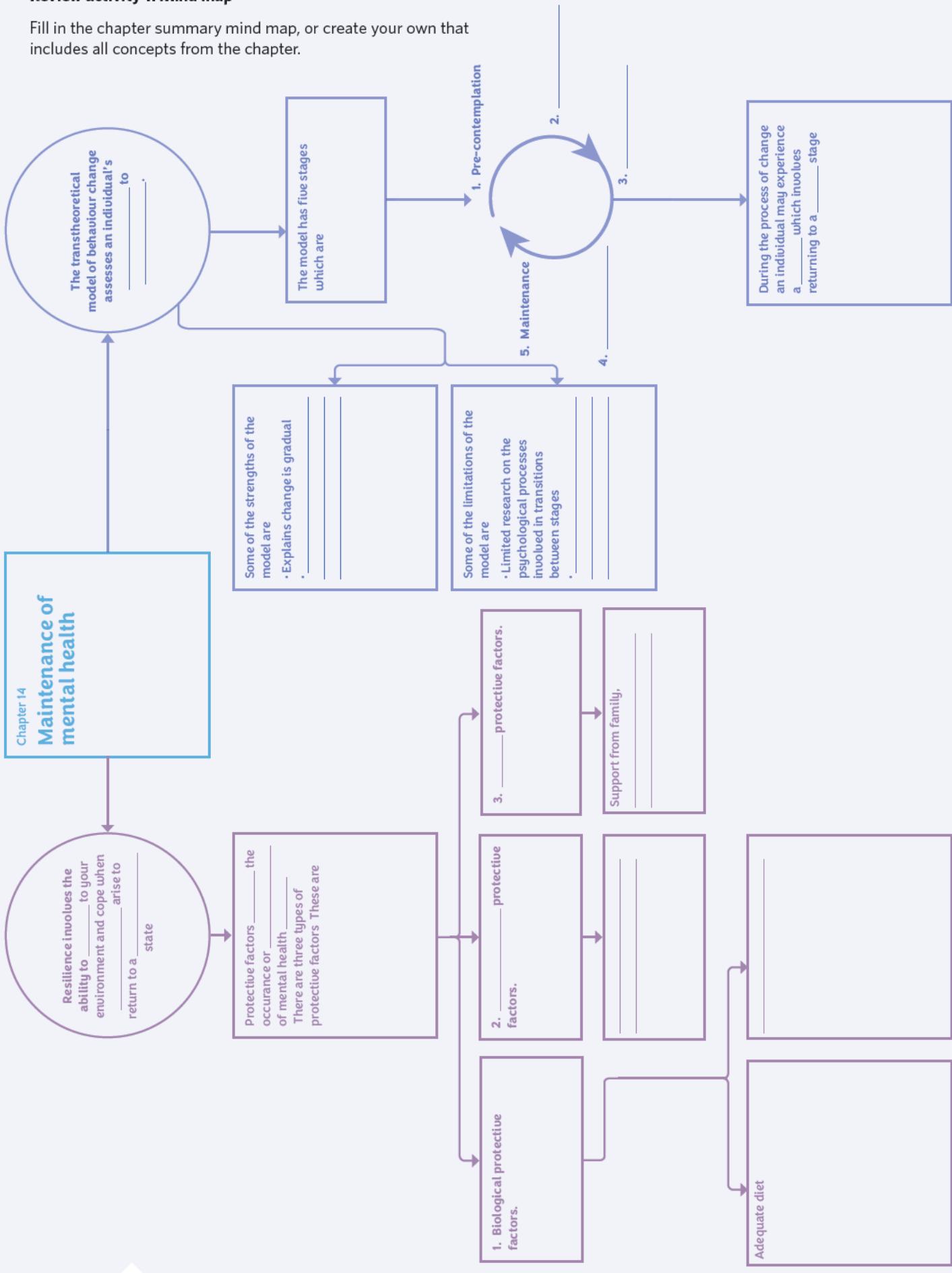
*Adapted from VCAA 2017 exam MCQ43*



# CHAPTER REVIEW ACTIVITIES

## Review activity 1: Mind map

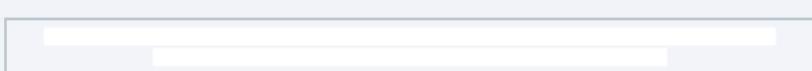
Fill in the chapter summary mind map, or create your own that includes all concepts from the chapter.



**Review activity 2: Example bank**

Fill in the table with your own notes.

Key terminology	Your own definition	Example
Resilience		
Adversity		
Protective factors		
Biological protective factors		
Psychological protective factors		
Social protective factors		
Transtheoretical model of behaviour change		
Pre-contemplation stage		
Contemplation stage		
Preparation stage		
Action stage		
Maintenance stage		
Relapse		



# CHAPTER TEST

## Multiple choice questions

### Question 1 (1 MARK)

According to the biopsychosocial model, which of the following is a psychological protective factor that promotes resilience?

- A ruminination
- B close relationships with friends and family
- C high self-esteem
- D socio-economic advantages

*Adapted from VCAA 2017 exam MCQ19*

### Question 2 (1 MARK)

Which of the following is the most correct description of the contemplation stage of the transtheoretical model of behaviour change?

- A Being unaware that behaviour is problematic or unhealthy.
- B Being aware that behaviour is problematic or unhealthy but not intending to make any changes to behaviour in the next six months.
- C Taking steps towards changing problematic or unhealthy behaviour.
- D Actively considering making a change to behaviour within the next six months.

### Question 3 (1 MARK)

Renata is currently attempting to lose weight. As part of this journey, she has recently signed up for a gym membership and has begun looking at healthy meal plans. Renata is most likely experiencing which stage of the transtheoretical model of behaviour change?

- A maintenance
- B preparation
- C contemplation
- D action

### Question 4 (1 MARK)

The biological protective factor of adequate sleep will help people avoid sleep deprivation. This protective factor will make people more likely to

- A experience and display appropriate emotional responses.
- B have slower reaction times.
- C have higher levels of intelligence.
- D experience less exposure to stressors.

*Adapted from VCAA 2018 exam MCQ33*

### Question 5 (1 MARK)

Lucien and Ava were both recently told by their doctors that their smoking was causing long-term damage to their lungs. Lucien was afraid of the impact that his health could have on his young family, and so he has started researching different ways he can quit smoking. Ava, on the other hand, was not fazed by the doctor's comments and continues to smoke. Which of the following identifies the stages of the transtheoretical model demonstrated by Lucien and Ava?

	Lucien	Ava
A	Maintenance	Contemplation
B	Action	Preparation
C	Preparation	Maintenance
D	Preparation	Pre-contemplation

**Question 6** (1 MARK)

Declan and Marco's mum was recently diagnosed with cancer. In coping with this stress, Marco has been attempting to think of his mother's diagnosis as something his family will overcome and become closer in doing so. In contrast, Declan has been ranting to his friends about how unfair it is and has recently joined a local support group.

Which of the following identifies the correct protective factors which Declan and Marco, respectively, are experiencing?

	<b>Declan</b>	<b>Marco</b>
A	Adequate sleep	Support from friends and the community
B	Support from friends and the community	Cognitive behavioural strategies
C	Social support	High self-efficacy
D	Adequate diet	Cognitive distortions

**Question 7** (1 MARK)

Jye has been working with his psychologist for several months to improve his quality of sleep through better sleep hygiene practices. His psychologist identified that Jye is in the maintenance stage of the transtheoretical model of behaviour change. A behaviour that Jye would likely demonstrate during this stage is

- A ruminating on the negative effects of his poor sleep habits.
- B telling his friends about the changes he has made to his sleep habits.
- C poor self-efficacy to cope with change.
- D gathering information about healthy sleep habits.

*Adapted from VCAA 2018 Exam MCQ43*

**Use the following information for questions 8–10.**

Leon is a pilot who experiences a high degree of stress. He has been experiencing high levels of stress for almost a year now and has recently been having difficulty falling asleep the night before a flight. He has also been feeling unwell and experiencing headaches for the last two weeks. To help cope with the stress he feels before flying he goes to the gym and feels much calmer as a result.

**Question 8** (1 MARK)

Which hormone is Leon likely to have high levels of following prolonged levels of stress over the past year?

- A cortisol
- B glutamate
- C endorphins
- D dopamine

**Question 9** (1 MARK)

Which stage of the General Adaptation Syndrome is Leon likely experiencing?

- A maintenance
- B resistance
- C exhaustion
- D secondary appraisal

**Question 10** (1 MARK)

What is one way in which exercise may **not** reduce Leon's stress?

- A Endorphins may be released into Leon's bloodstream
- B Excess cortisol may be used up
- C Increasing the efficiency of his cardiovascular system which will reduce his stress response
- D It will reduce his future likelihood of being exposed to stressors



### Short answer questions

**Question 11** (1 MARK)

Outline one limitation of the transtheoretical model of behaviour change.

**Question 12** (1 MARK)

Outline one strength of the transtheoretical model of behaviour change.

**Question 13** (1 MARK)

Outline a difference between the action and maintenance stages of the transtheoretical model of behaviour change.

**Question 14** (5 MARKS)

Caleb works as a lawyer and for the past five years has been stressed, resulting in him not sleeping well, not regularly exercising and gaining weight. Recently, he decided that he needed to change this and has started making exercise a part of his weekly routine. He has joined a local football club where he is motivated by his teammates to regularly attend. He has been going to training consistently over the last two months and is feeling stronger and healthier.

- a Identify the stage of the transtheoretical model that Caleb is currently demonstrating. Justify your response. (2 MARKS)
- b Identify one risk factor that Caleb has experienced that could contribute to his mental health. (1 MARK)
- c Outline one protective factor that Caleb is utilising and explain the effect this has on his mental health. (2 MARKS)

*Adapted from VCAA 2017 Exam MCQ34*

**Question 15** (7 MARKS)

Willow has always felt that she had a 'short-temper'. Recently, she had a loud argument with a colleague at work and her manager recommended that she see someone to help her with managing her anger. Willow's doctor referred her to a counsellor and she had her first session today.

- a With reference to the transtheoretical model, what stage of change is Willow demonstrating? Justify your response. (2 MARKS)
- b Outline how Willow's counsellor could teach her to use breathing retraining as a way to manage her anger. (3 MARKS)
- c What type of coping strategy is breathing retraining? Justify your response. (2 MARKS)

*Adapted from VCAA 2017 Exam MCQ34*

**Question 16** (5 MARKS)

Maxine is going on a holiday to Italy in six months. She has decided that she wants to try and learn the language before so she can communicate with the locals when she visits. Her friend recently told her of an app she could use which helps adults learn new languages.

Outline what Maxine may experience in each stage of the transtheoretical model of behaviour change. Use a relevant example to justify your response.



## BONUS – CARTOON QUESTIONS

Using the flip cartoon of the brain in the corners of the pages of this book, answer the following questions.

### Multiple choice questions

#### Question 1 (1 MARK)

Which of the following psychological risk factors for mental health is the cartoon brain most clearly confronted by?

- A. ruminination
- B. stress
- C. impaired reasoning and memory
- D. disorganised attachment

#### Question 2 (1 MARK)

The cartoon brain exercising in response to the stressor of studying can be thought of as

- A. a cognitive behavioural strategy.
- B. rumination.
- C. poor self-efficacy.
- D. social support.

### Short answer questions

#### Question 3 (3 MARKS)

Suggest how the cartoon brain exercising might serve as a protective factor for its own mental health.

#### Question 4 (4 MARKS)

When looking at the cartoon brain and its actions, comment on how the brain is displaying two characteristics of a mentally healthy person.





# UNIT 4

# AOS3

## Practical investigation

**The investigation requires the student to identify an aim, develop a question, formulate a research hypothesis including operationalised variables and plan a course of action to answer the question and that takes into account safety and ethical guidelines.**

**Students then undertake an experiment that involves the collection of primary qualitative and/or quantitative data, analyse and evaluate the data, identify limitations of data and methods, link experimental results to science ideas, reach a conclusion in response to the question and suggest further investigations which may be undertaken.**

### Outcome 3

On completion of this unit the student should be able to design and undertake a practical investigation related to mental processes and psychological functioning, and present methodologies, findings and conclusions in a scientific poster.

# A 'HOW TO' GUIDE TO PRACTICAL INVESTIGATIONS

**A practical investigation in VCE Psychology requires the student to question, plan, undertake, analyse, and report upon a particular topic of scientific enquiry.**

## Planning practical investigations

### Research question and background

Consider the research question or the topic that you will investigate. Make sure that your idea is practical to investigate with the resources you are likely to have access to. Conduct some background research on the topic to find out what is already known, and find out results from any previous research that has been conducted in the area. This will help you determine a relevant aim, hypothesis and variables.

### Type of investigation

Think about what type of investigation is most suitable to answer your research question. Using the wrong type of might mean that your results are not as reliable or valid as they could be. Consider whether an experiment, observation, self-report questionnaire or rating scale, interview, case study, or longitudinal study is most suitable to help answer your research question.

For example, to determine whether boys or girls are more aggressive in the playground, an observational study could be used. To find out what people think about a new product, a self-report questionnaire or interview would be a good approach. To test out one method of doing something against another, an experiment would be the most suitable technique.

### Experimental research design

If it is an experiment, what type of experimental research design is most suitable? Independent groups, repeated measures and matched participants designs each have their advantages and limitations for your particular experiment. Recognise that these limitations may create extraneous or confounding variables that need to be controlled.

For example, an independent groups design might be useful if you want to run two conditions at the same time; however, it might also mean that individual participant differences (from having different people in the control and experimental groups) could impact the results of the experiment.

### Sampling and allocation

Consider who your participants will be, how many you need and how you will choose them. Convenience sampling is often used; however, you may also be able to implement random sampling or stratified sampling techniques. You can allocate participants to groups at random or based on convenience.

Again, each method has its strengths and limitations that may need to be considered. You will need to consider these and decide how you will control for any limitations so they don't affect the results. The type of sampling and the sample size used could affect whether you can generalise your results to the population, so consider these when designing your investigation.

For example, random sampling might be used to select a group of students from the whole Year 12 cohort at one school. The method of selection could be done via a computer random number generator and their student ID numbers. Random allocation to groups could also be used, by tossing a coin to determine their placement in control or experimental groups.

## Minimising extraneous and confounding variables

There are many different ways extraneous and confounding variables could affect your investigation, so it is important to consider them ahead of time to avoid them ruining your results. You might use repeated measures or matched participants to control individual participant differences. You could use a placebo alongside a single-blind procedure to minimise the impact of the placebo effect. Single- and double-blind procedures can help to control the placebo and experimenter effects.

When using a repeated-measures design, counterbalancing can be used to help limit the impact of order effects on the results. Standardised instructions and procedures are important to make sure that the way the investigation is carried out is consistent each time it is conducted.

For example, if you thought individual participant differences such as levels of anxiety would affect the results, then you might consider using a repeated measures design (to minimise the individual differences) with counterbalancing (to minimise the order effect), and you would use standardised instructions and procedures to deliver information to your participants.

## Ethics and safety

Always follow the ethical and safety guidelines recommended for working with people and animals. Normally an ethics board would need to approve the research proposal before it went ahead. In this case, you will need to make sure you follow the ethical principles to ensure your participants are looked after and that your research is ethically appropriate.

Consider issues such as informed consent, voluntary participation, withdrawal rights, deception, debriefing and confidentiality. Your particular investigation may also have other safety concerns so think carefully about how to look after your participants.

For example, when writing an informed consent statement, outline all of the ethical rights that the participant must be entitled to (such as withdrawal rights, debriefing, confidentiality). Participants would understand the true aims of the investigation (lack of deception), the procedures and the risks involved, and would indicate their willingness to participate by signing their name. After the investigation, participants should have the chance to access the results and have their individual identities kept anonymous.

## Method and data collection procedures

With all of the above in mind, it should now be fairly simple to put it all together and plan your method and the way you will collect the data. Make sure you are able to collect the most relevant form of data to answer your research question (qualitative or quantitative). Ensure that you have a reliable and valid way to collect this data, and that you have considered how you will use this data to generate a summary of the results.

For example, if you want to obtain people's opinions, it would be most relevant to use a form of self-report, such as an interview or questionnaire. If quantitative data was required, then you could use a rating scale to measure people's opinions, while also collecting qualitative data if participants described their experiences or beliefs as well.

## Writing up practical investigations

You will need to be able to prepare a report/scientific poster that summarises your practical investigation. The style you use to write and present the information will need to follow the rules and guidelines set by the American Psychological Association or (APA) – these rules are followed by academics in psychology all over the world.

This guide will show you how to present your research so that it fits in with the guidelines required for your report/scientific poster.

Table 1: VCAA guidelines for the required content to be presented in a Scientific Investigation\*

SECTION	REQUIRED CONTENT
<b>Title</b>	<ul style="list-style-type: none"> <li>• Question under investigation</li> </ul>
<b>Introduction</b>	<ul style="list-style-type: none"> <li>• Explanation or reason for undertaking investigation, background information on psychological concepts, aim, variables and prediction/hypothesis</li> </ul>
<b>Methodology</b>	<ul style="list-style-type: none"> <li>• Summary of method, including participants, materials and procedure</li> <li>• Identification and management of risks and ethical considerations</li> </ul>
<b>Results</b>	<ul style="list-style-type: none"> <li>• Presentation of summarised data/evidence in appropriate format to illustrate trends, patterns or relationships</li> </ul>
<b>Discussion</b>	<ul style="list-style-type: none"> <li>• Analysis and evaluation of data</li> <li>• Identification of limitations in data/method and suggested improvements</li> <li>• Linking of results to relevant psychological concepts</li> </ul>
<b>Conclusion</b>	<ul style="list-style-type: none"> <li>• Conclusion that provides a response to the question</li> </ul>
<b>References and acknowledgements</b>	<ul style="list-style-type: none"> <li>• Referencing and acknowledging of sources/quotations used in the research.</li> </ul>

\*Adapted from VCAA Psychology Study Design 2017–2021 p. 13

### Title

A title should contain the variables that are being tested in your investigation (the independent and dependent variable). Try to keep it simple though – no need to operationalise your title.

#### Sample title (research question style):

'Does meditation reduce stress levels?'

### Introduction (Approx. 200 words)

#### Explanation/reason for research

Put your research into context. Why is it an interesting or important area for investigation? How is finding out the answer to your question going to contribute to our understanding of the topic? Why are you spending time bothering to look at this topic? In your report, make your first sentence an opening statement that puts your topic into perspective.

#### Sample explanation:

Stress is a dangerous health condition that increasingly affects many people around the world. It is therefore important to find ways to reduce people's experience of stress.

## Background information/psychological concepts

If you introduce any specific psychological ideas or terminology, it is important to define your key terms. Summarise any specific theories, and mention past research studies if you aim to replicate that research or support those findings.

It is important to show that any predictions you make have a theoretical basis, and aren't just ideas you have made up 'off the top of your head'. Be sure to make links between the concepts and research to demonstrate a deeper level of understanding.

### Sample background information starters:

'Stress is defined as...' 'Meditation is thought to reduce stress by...' 'One previous study in this area found that...'

## Aim

An aim is the statement of what you intend to find out. Sometimes you want to answer a question, sometimes you want to find support for a theory or replicate past research. Later, your conclusion should address the aim of your research. When you write your aim in the introduction, it should be phrased in future tense – the study hasn't been investigated yet.

### Sample aim:

This study aims to determine whether meditation is able to reduce a person's level of stress.

## Hypothesis

A hypothesis is a testable prediction about the expected outcomes of your study. It needs to contain the following things: a population of interest, the independent variables being manipulated, and the predicted effect that this will have on the dependent variable.

You do not have to operationalise the variables when you write the research hypothesis.

The population only needs to be specific when it is relating to a particular target group of individuals (e.g., 'teenagers with anxiety disorders').

When you write your hypothesis in the introduction, it should be phrased in future tense – it hasn't been tested out yet.

### Sample hypothesis:

It is hypothesised that teenagers who meditate each day will experience a greater reduction in stress levels, compared to teenagers who do not engage in any meditation.

## Variables

You may need to provide the specific variables being tested, and show how they will be made operational. Remember the independent variable (IV) is the variable that the researcher is manipulating, changing or selecting for, and the dependent variable (DV) is the outcome or measurement of this. To operationalise means to give as much detail as possible about the specific treatment conditions, and how they were measured. Good operationalisation would allow someone else to replicate (copy) your study.

### Sample operationalised independent variable:

Whether participants meditate for 30 minutes each day for a period of one month, or do not complete any meditation for the same time period.

### Sample operationalised dependent variable:

The mean difference in stress levels before and after the 30-day period, measured by a self-report stress questionnaire.

## Method (Approx. 200 words)

### Participants

The participants should be summarised in terms of:

- Number (total number of participants in the sample)
- Gender (numbers of each gender)
- Age (specific age, year level, mean age or age range)
- Sampling technique (e.g., convenience sampling)
- Special characteristics (e.g., split-brain patients)

You should try to summarise this in one sentence – you can use brackets to help with this.

#### Sample participants statement:

Participants included 20 Year 12 Students (10 male and 10 female), selected via convenience sampling from Greendale High School.

### Materials

Include a brief list of items required to complete the study. You might need to mention specific documents used, for example informed consent statements, or particular questionnaires. Think about what someone else would need to have in order to replicate your study properly. You might need to justify why you have chosen to use a particular item as well.

#### Sample materials list:

This research study requires an informed consent statement, a digital timer to time the procedure, a digital audio recording of a meditation session with relaxation music, a device to play the audio recording on and a participant results sheet with stress rating scale to record responses.

### Procedure

The procedure section needs to outline the steps involved in carrying out the investigation. In particular, you should be able to justify or explain why you chose to perform your investigation in that particular way. Your research should be able to be replicated.

Your summary should include selection and allocation procedures, mention of the experimental research design, and the specific procedures used to collect, and then analyse the data. You should show how obvious extraneous or confounding variables have been eliminated. There might be different ways to display your procedure in your write-up. VCAA mention you might use a flowchart to summarise your method or include a photograph of a setup.

#### Sample procedure:

1. An email will be sent to all Greendale High Year 12 students asking for volunteers for a stress reduction program. 20 volunteers will be invited to take part (10 male, 10 female) and will read and sign informed consent statements. Parental consent will be obtained for underage volunteers.
2. All students will fill out a questionnaire asking them about their perceived stress levels. A total stress score (out of 50) is determined.
3. Ten students (5 male, 5 female) will be randomly allocated to each group via drawing names out of a hat to reduce allocation bias.
4. Using an independent groups design, so both groups can run at the same time, 10 students in Group A will be asked to meditate 30 minutes each day (listen to provided meditation audio track on personal audio device) before they go to bed. Parents will be asked to confirm they have done this properly.
5. Ten students in Group B will be asked to do their normal bedtime routine (no meditation).
6. After 30 days, all groups will complete the same stress questionnaire and stress score is again calculated.
7. Data for each group will be collated, and the mean stress score for Group A will be compared to Group B.

## Safety and ethical considerations

Include a very brief summary of any important ethical or safety concerns and how you plan to ensure these are looked after.

### Sample ethical statement:

Prior to taking part in the study, students will read and sign an informed consent document outlining the true aims of the study, the procedures and risks involved in taking part, and their rights as participants. They will take part voluntarily and if they indicate that they do not want to take part, or want to leave after commencing, they will be allowed to do so.

After the researchers have gathered all the data, they will invite participants to view the group results and can provide external help or support if anyone is distressed during the experiment or feedback session. All participant results will be kept confidential and no names will be released.

## Results (Approx. 200 words including graphical representations)

The results of the practical investigation should be presented in a summary format that is, no raw data. Sometimes a table will be a useful way of displaying the summarised data; however, quite often a graphical representation will be a more effective way to show the trends and relationships.

It would not usually be effective to present both a graph and a table as they tend to show the same data, just in different ways.

- Pie graphs and bar charts display data in which one of the variables is categorical (e.g., different emotions: happy, sad, angry, surprised, scared).
- Line graphs display data in which both the independent and dependent variables are continuous (e.g., changes in happiness levels over a period of one week).
- Scattergrams show an association between two variables (e.g. the relationship between happiness and income).

When drawing graphs, students should note that:

- the graph needs to clearly and accurately represent the data – choose appropriate graph and legible scale
- the independent variable is represented on the horizontal axis while the dependent variable is represented on the vertical axis; these axes should be appropriately labelled
- the graph should be given a title that indicates the IV and the DV.

In the results section you should also provide a sentence that summarises the data in words, but do not analyse or evaluate these results yet – this happens in the discussion section.

### Sample written summary:

The results show that before any treatment, Group A had a mean self-reported stress rating of 36.4 out of 50, whereas Group B scored 33.7. Following meditation training, Group A scored a mean of 31.5 out of 50, whereas Group B, who did not do any meditation, scored 32.6.

### Sample results display:

The data shown as a table and a graph.

Table 1: Mean self-reported stress ratings

Structure	Group A (meditation)	Group B (no meditation)
Mean stress rating out of 50 Time 1	36.4	33.7
Mean stress rating out of 50 Time 2	31.5	32.6
Reduction in mean stress rating between Time 1 and Time 2	4.9	1.1

Investigating the effect of meditation on self-reported stress rating

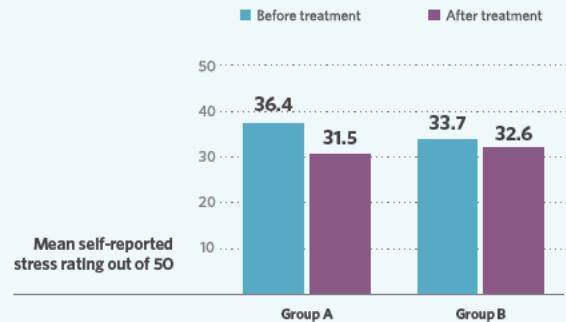


Figure 1 The effect of meditation on self-reported stress rating

## Discussion (Approx. 250 words)

### Analysis of results

The results need to be analysed, interpreted and evaluated in terms of the hypothesis.

Start this section by restating the hypothesis (paraphrasing is okay). The hypothesis should now be phrased in past tense, because the research has been conducted. Then move on to briefly describe the results to show whether they fully support, partially support or do not support the stated hypothesis. Avoid using language such as ‘proved’, ‘disproved’, ‘correct’ or ‘incorrect’; rather, use words like ‘supported’, ‘indicated’ and ‘suggested’. You should link to the variable from the current investigation and avoid being too general in your statements.

#### Sample analysis of results:

It was hypothesised that teenagers who meditated each day would experience a greater decrease in stress levels than teenagers who did not take part in any meditation. The results of this experiment showed that the amount that Group A (meditation group) was able to reduce their stress levels over 30 days was significantly greater than the amount that Group B (no activity group) was able to reduce their stress levels over the same time period. These results therefore provide support for the hypothesis.

### Linking results to theory

You should then move to comparing your results to past research investigations or theories. Look back to what you have said in your introduction, and compare and contrast your findings with that. Again, you may paraphrase or re-summarise what had been previously found, compare with what you have found in the current research, and make an explicit statement as to how well the current data supports the previous ideas.

#### Sample links to theory:

Meditation is thought to relieve stress levels by allowing the individual to focus on a single element, such as their breathing, intentionally relaxing their muscles, or on a single noise. In doing so, this reduces attention on the stressors, and gives the individual a chance to refocus. In this study the results showed that the teenagers who learnt how to meditate, and did so for 30 consecutive days, were able to reduce their stress levels more than teenagers who did not meditate. This supports the idea that meditation can reduce the experience of stress.

### Limitations

It is important to consider whether there might be any alternative explanations for the results. Consider any flaws in your research design and methodology as well as any issues with the procedures that may have arisen during testing (possible confounding variables or extraneous variables). Discuss any limitations you have identified in terms of the possible effect they have had on results.

#### Sample limitation/extraneous variable:

Given that participants completed a self-report questionnaire on their stress levels it is possible that they were not honest about their initial stress levels or how much they had reduced after the 30 days. This means that the larger reduction in stress shown by the meditation group could have been due to an intentional or unintentional belief in the effectiveness of the meditation rather than the actual meditation.

### Suggestions for improvement

A matching and logical solution or minimisation of each of the identified limitations should be provided for any future research replications.

#### Sample improvement:

To verify participants' levels of stress, physiological measures such as heart rate/blood pressure could be used in conjunction to participants' self-reports.

## Conclusion (Approx. 150 words)

The conclusion can be quite difficult to write and should definitely be written last. It should make sense even if you haven't read the whole report.

The conclusion should link to the aim of your research study and summarise your main research findings in relation to this aim, including whether the hypothesis was supported or not. You may look at how much you can generalise from the results and their implications in relation to current theoretical understanding or real-life applications. You may also describe what future work needs to be done in the future to further improve understanding of this topic.

### Sample conclusion:

This research study aimed to investigate whether meditation was able to reduce stress levels. Through conducting this research study with a sample of teenagers, the hypothesis that meditation could reduce stress levels was supported by the obtained data. This indicates that meditation could be used by people experiencing high stress levels to help relieve and cope better with their experience of stress. Future research should aim to look at improving the reliability and validity of the way that stress is measured in the study. This will help gain a more accurate understanding of the power of meditation to make positive improvements to people's health and wellbeing.

## References

If you use any quotes, definitions or ideas directly from another source, you must accurately reference this source. Your references need to follow an established system. Usually in psychology the format is the APA system, or the Harvard system. This includes a short citation in the text when you use the information, and a full reference at the end to show other people where they can find the original information to read for themselves.

### APA sample in text reference:

(Luk-Tung, Muller, Young, Crocket & Adem, 2017)

### APA sample reference list:

Luk-Tung, S., Muller, A., Young, L., Crocket, S. & Adem, M. (2017). *Edrolo VCE Psychology. Units 3 & 4. Student Book* (1st Ed.). Melbourne: Edrolo.

## Acknowledgements

You may also need or want to thank individuals for specific contributions (for example, access to specialist equipment use, statistical advice, laboratory assistance) at the end of your report.

## Scientific posters

On the following pages are two examples of scientific posters that contain the required sections.



# DOES BACKGROUND NOISE AFFECT CONCENTRATION ON A DIFFICULT TASK?

## Introduction

Being able to concentrate is an important ability, particularly in situations that require an individual to maintain focus and alertness. One such example is driving a car or studying for an important exam. Background noise, such as music, could serve as a distraction and break concentration in these important situations. It is therefore important to find out what type of noise is best for completing a task that requires concentration. Past research has indicated that listening to certain genres of music at a loud volume can impair performance on cognitive tasks (Dolegui, 2013).

The aim of this investigation is to find out how different noise distractors affect performance on a task that requires concentration.

It is hypothesised that VCE students who experience no background noise will take less time to complete a logic puzzle, compared to when they listen to loud instrumental music or a loud verbal conversation.

The operationalised independent variable is the type of background noise participants are exposed to while completing the task; either no background noise, a recording of loud instrumental music, or a recording of a loud verbal conversation. The operationalised dependent variable is the mean time (minutes) taken to complete a logic puzzle.



Image: UMB-O/Shutterstock.com

## Method

**Participants:** Twenty students (12 male and 8 female) aged between 16 and 17.5 from Beachside Secondary College, chosen via random stratified sampling.

**Materials:** Informed consent document, three logic puzzles of equal difficulty, recording of loud instrumental music, recording of loud verbal conversation, device to play recordings on, pen to complete puzzle.

**Procedure:** Students are briefed on research and sign an informed consent document before taking part in this repeated measures experiment. In a room with no background noise, students complete logic puzzle #1, administered by the first research assistant. The time taken to complete the puzzle is recorded. After a short break, participants complete logic puzzle #2 with assistant number two, in a room that has loud instrumental music playing. Lastly, participants complete logic puzzle #3, with the third assistant, in a room that has a loud verbal conversation playing. Results (time taken) for each condition are collated and a mean is calculated.

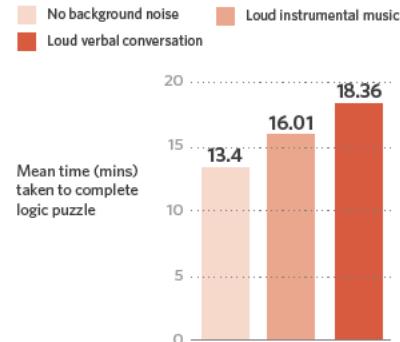
**Ethics and Safety:** Researchers must ensure that the volume of the recordings does not exceed safe limits to avoid ear damage. Participants will be aware of the nature and risks of the study and will indicate their willingness to participate (voluntary participation) via signing an informed consent document.

The results show that the mean time taken to complete the logic puzzle with no background distraction was 13.40 minutes.

The mean time taken to complete a similar puzzle with loud instrumental music playing was 16.01 minutes, and a mean trace of 18.36 minutes for a puzzle completed with loud verbal conversation playing.

## Results

### Investigating the effect of background noise on puzzle completion speed



## Discussion

It was hypothesised that completing a logic puzzle with no background noise would take less time to complete, compared to when there was loud background noise. The results found that the time taken to complete the puzzle with no background noise distraction was statistically significantly less than when there was loud music or conversation playing in the background. This indicates that the hypothesis was supported.

These results suggest that having loud music or loud conversation in the background, while trying to complete a task that requires concentration like a logic puzzle, is going to affect concentration and impair performance. This also suggests that the best conditions for completing a complex task is no background noise.

It is possible these results are due to an extraneous variable. Because participants took part in all three conditions, their performance could have been affected by the sequence that they did the tasks in (order effect), for example getting tired of logic puzzles by the third trial thus taking longer to complete. In the future, the conditions should be counterbalanced for different participants to minimise the order effect.

## Conclusion

This study found that loud background noises affected concentration, and therefore performance, on a difficult task. This implies that when completing a complex task, it should be done in quiet conditions with no background noise. However, because of the small sample size it is difficult to generalise the results to the whole population. Future studies should look at fixing some of the identified issues in order to continue looking at this important issue affecting performance.

## References

Dolegui, A. S. (2013). "The Impact of Listening to Music on Cognitive Performance." *Inquiries Journal/Student Pulse*, 5(09).

Retrieved from <http://www.inquiriesjournal.com/a?id=762>

## Acknowledgements

The students of Beachside Secondary College.



## DOES MEDITATION REDUCE STRESS LEVELS?

### INTRODUCTION

Stress is a dangerous health condition that increasingly affects many people around the world. In particular, certain groups of people such as teenagers or busy adults might be more vulnerable to experiencing stress and the associated wellbeing problems it leads to. It is therefore important to find ways to reduce people's experience of stress. Stress is defined as a state of psychological or physiological tension that occurs when a person's ability to cope is strained or exceeded (Luk-Tung, Muller, Young, Crocket & Adem (2017).

Meditation is an intentional activity that allows the individual to focus on a particular stimulus (a sound, a single thought, their breathing) and block out all other distractions. Meditation is thought to help relieve stress through allowing the individual to focus their attention away from the stressor.

This study aims to determine whether meditation is able to reduce a person's level of stress. It is hypothesised that teenagers who meditate each day will experience a greater reduction of stress levels, compared to teenagers who do not engage in any meditation.

The independent variable is whether participants meditate for 30 minutes each day for a period of one month, or do not complete any meditation for the same time period. The dependent variable is the mean difference in stress levels before and after the 30-day period, measured by a self-report stress questionnaire.

### METHOD

**Participants:** 20 Year 12 Students (10 male and 10 female), selected via convenience sampling from Greendale High School.

**Materials:** informed consent statement, a digital timer to time the procedure, a digital audio recording of a meditation session with relaxation music, a device to play the audio recording on, a participant results sheet with stress rating scale to record responses.

**Ethics:** Prior to taking part in the study, students will read and sign an informed consent document outlining the true aims of the study, the procedures and risks involved in taking part and their rights as participants. They will take part voluntarily and if they indicate that they do not want to take part, or want to leave after commencing, they will be allowed to do so. After the researchers have gathered all the data, they will invite participants to view the group results and can provide external help or support if anyone is distressed during the experiment or feedback session. All participant results will be kept confidential and no names will be released.

### METHOD

Email sent to Greendale High Year 12 students asking for volunteers for a stress reduction program. Twenty volunteers invited to take part (10 male, 10 female). Informed consent statements read and signed. Parental consent obtained for underage volunteers.

Students fill out questionnaire asking them about their perceived stress levels. A total stress score (out of 50) is determined.

**Independent group A:** 10 students (5 male, 5 female) randomly allocated (names drawn from hat).

Meditate 30 mins each day (listen to provided meditation audio track on personal audio device) before they go to bed. Parents will be asked to confirm they have done this properly. Continue for 30 days.

**Independent group B:** 10 students (5 male, 5 female) randomly allocated (names drawn from hat).

Do their normal bedtime routine (no meditation). Continue this for 30 days.

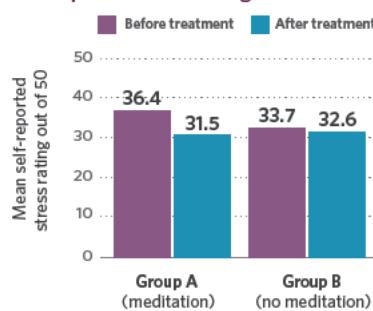
All groups complete same stress questionnaire, stress score is calculated. Data for each group is collated, mean stress score for **Group A** is compared to **Group B**.

### RESULTS

The results show that before any treatment, Group A had a mean self-reported stress rating of 36.4 out of 50, whereas Group B scored 33.7.

Following meditation training, Group A scored a mean of 31.5 out of 50, whereas Group B, who did not do any meditation, scored a stress rating of 32.6 out of 50.

#### Investigating the effect of meditation on self-reported stress rating



**References:** Luk-Tung, S., Muller, A., Young L., Crocket, S. & Adem, M. (2017). *Edrolo VCE Psychology. Units 3 & 4. Student Book* (1st Ed.). Melbourne: Edrolo.

**Acknowledgements:** Thanks to the 2016 Year 12 Psychology class at Greendale High School for putting together the stress rating questionnaire. Also thanks to the ICT department for helping with the audio recording requirements of this study.

### DISCUSSION

It was hypothesised that teenagers who meditated each day would experience a greater decrease in stress levels than teenagers who did not take part in any meditation. The results of this experiment showed that the amount that Group A (meditation group) was able to reduce their stress levels over 30 days was greater than the amount that Group B (no activity group) was able to reduce their stress levels over the same time period. These results therefore provide support for the hypothesis.

Meditation is thought to relieve stress levels by allowing the individual to focus on a single element, such as their breathing, intentionally relaxing their muscles, or a single noise. In doing so, this reduces attention on the stressors, and gives the individual a chance to refocus. In this study the results showed that the teenagers that learnt how to meditate, and did so for 30 consecutive days, were able to reduce their stress levels more than teenagers who did not meditate. This supports the idea that meditation can reduce the experience of stress.

Given that participants completed a self-report questionnaire on their stress levels it is possible that they were not honest about their initial stress levels or how much they had reduced after the 30 days. This means that the larger reduction in stress shown by the meditation group could have been due to an intentional or unintentional belief in the effectiveness of the meditation rather than the actual meditation.

To verify participants' levels of stress, physiological measures such as heart rate/blood pressure could be used in conjunction to participants' self-reports in future investigations.

### CONCLUSION

This research study aimed to investigate whether meditation was able to reduce stress levels. Through conducting this research study with a sample of teenagers, the hypothesis that meditation could reduce stress levels was supported by the obtained data.

This indicates that meditation could be used by people experiencing high stress levels, to help relieve and cope better with their experience of stress. Future research should aim to look at improving the reliability and validity of the way that stress is measured in the study. This will help gain a more accurate understanding of the power of meditation to make positive improvements to the health and wellbeing of people.

## 1A Aims, hypotheses and variables

### Theory review questions

- |          |                               |                             |
|----------|-------------------------------|-----------------------------|
| <b>1</b> | <b>a</b> Independent variable | <b>b</b> Hypothesis         |
| <b>c</b> | Operationalisation            | <b>d</b> Dependent variable |
| <b>e</b> | Population                    | <b>f</b> Aim                |
| <b>g</b> | Variables                     |                             |

### Exam-style questions

#### Remember and understand

- 2** C. a testable prediction of the relationship between the independent and dependent variables.
- 3** A. the variable that is measured by the researcher.
- 4** C. A variable that has defined how it will be either measured or manipulated.

#### Apply and analyse

- 5** B. IV: whether students listened to music while studying or not; DV: a measure of students' academic performance
- 6** D. how many new terms students could recall on a memory test.
- 7** [IV: Participants' diet<sup>1</sup>]  
[DV: Participants' reported mood<sup>2</sup>]

I have identified a relevant IV for this study.<sup>1</sup>

I have identified a relevant DV for this study.<sup>2</sup>

- 8** [Operationalised IV: participants either practised a guided meditation for at least 5 minutes a day, or they did not practise any meditation<sup>1</sup>]  
[Operationalised DV: The students' test scores for their next SAC as a letter grade.<sup>2</sup>]

I have identified a relevant IV for this study, and outlined how it will be manipulated.<sup>1</sup>

I have identified a relevant DV for this study, and outlined how it will be measured.<sup>2</sup>

- 9** [It was hypothesised that<sup>1</sup>][year 12 students who slept on average 8 hours a night over a period of a month, would achieve higher test results in their upcoming SAC than students who slept for less than 8 hours on average.<sup>2</sup>]

I have started my hypothesis with 'It was hypothesised that'.<sup>1</sup>

I have included the independent and dependent variables.<sup>2</sup>

I have stated the direction of my hypothesis.

- 10** [It was hypothesised that<sup>1</sup>][people who reported higher levels of stress would perform worse on cognitive tasks, as compared to those who reported lower levels of stress.<sup>2</sup>]

I have started my hypothesis with 'It was hypothesised that'.<sup>1</sup>

I have included the independent and dependent variables.<sup>2</sup>

I have stated the direction of my hypothesis.

## 1B Scientific research methodologies

### Theory review questions

- |          |                                   |                                      |
|----------|-----------------------------------|--------------------------------------|
| <b>1</b> | <b>a</b> Repeated measures design | <b>b</b> Rating scale                |
| <b>c</b> | Experiment                        | <b>d</b> Experimental group          |
| <b>e</b> | Observational study               | <b>f</b> Longitudinal study          |
| <b>g</b> | Independent groups design         | <b>h</b> Control group               |
| <b>i</b> | Interview                         | <b>j</b> Self-report                 |
| <b>k</b> | Case study                        | <b>l</b> Matched participants design |
| <b>m</b> | Cross-sectional study             | <b>n</b> Questionnaire               |

### Exam-style questions

#### Remember and understand

- 2** A. provide a baseline against which the effects of the independent variable are measured.
- 3** C. participant variables are more controlled for than in the independent groups design.
- 4** D. participants are put into pairs and one member of each pair is placed in the control condition, and the other member is placed in the experimental condition
- 5** [One limitation of using only data collected from interviews is that the data is subjective and therefore makes it difficult to accurately compare and draw conclusions.<sup>1</sup>]

I have outlined one limitation of using interviews.<sup>1</sup>

- 6** [One strength of using case studies is that it produces very detailed data, giving researchers an in-depth understanding of a participant's experience.<sup>1</sup>][However, a limitation is that because case studies are only conducted on a small group of individuals, it can be difficult to generalise any findings to a wider population.<sup>2</sup>]

I have outlined one strength of using case studies.<sup>1</sup>

I have outlined one limitation of using case studies.<sup>2</sup>

#### Apply and analyse

- 7** A. not exercise at all.
- 8** B. case study.
- 9** [Dr Garfield has used an independent-groups research design.<sup>1</sup>][One advantage of using this type of design is that it is time-efficient to conduct.<sup>2</sup>]
- I have identified the experimental research design as independent-groups.<sup>1</sup>
- I have outlined one advantage of independent-groups design.<sup>2</sup>
- I have referred to the character's name in my response (Dr Garfield), and to the research scenario.

- 10** [Emilia could use a repeated-measures research design.<sup>1</sup>][This would involve the participants not exercising while completing the control condition, and then exercising during the experimental condition, comparing the differences of wellbeing of these participants as recorded through the self-report.<sup>2</sup>]



## Exam-style questions

### Remember and understand

- 2 D. confounding variables that can occur in repeated-measures experiments.
- 3 B. counterbalancing
- 4 A. the placebo effect.

### Apply and analyse

- 5 B. Only the research assistant knew who would receive the mood enhancing medication.
- 6 C. To control for participant expectations.
- 7 [Dr Samira may have also wanted to know participants' age in order to control for participant-related variables that may affect the results.<sup>1</sup>]

I have outlined one reason why participants' age may have been collected.<sup>1</sup>

I have referred to the character's name in my response (Dr Samira), and to the scenario.

- 8 [Justin should consider the extraneous variable of individual participant differences.<sup>1</sup>] [For example, if all of the participants in the sample have tutors this may not be representative of his research population and therefore impact his results.<sup>2</sup>]

I have identified an extraneous variable Justin should consider.<sup>1</sup>

I have provided a reason to justify my response.<sup>2</sup>

I have referred to the character's name in my response (Justin), and to the scenario.

Other acceptable responses could include:

- Other relevant extraneous variables, as long as they have been appropriately justified.

- 9 a [Counterbalancing was used to minimise potential order effects.<sup>1</sup>]

I have identified a relevant technique used to minimise potential confounding variables.<sup>1</sup>

- b [One potential confounding variable in Dr Romish's experiment was lack of standardised instructions and procedures,<sup>1</sup>] [as on the last day participants had to identify the purple square amongst orange squares instead of amongst pink squares.<sup>2</sup>]

I have identified a potential confounding variable.<sup>1</sup>

I have explained the confounding variable.<sup>2</sup>

I have referred to the character's name in my response (Dr Romish), and to the scenario.

Other acceptable responses could include:

- Relevant participant-related variables.

### Questions from multiple lessons

- 10 C. random sampling and standardised procedures
- 11 [Informed consent can be breached when a placebo is used<sup>1</sup>] [because participants may be unaware of the nature of the experiment,

specifically they may be unaware that they are receiving an inactive medication before they consent to participate.<sup>2</sup>]

I have identified that informed consent may be breached.<sup>1</sup>

I have explained why informed consent may be breached.<sup>2</sup>

## 1E Ethical considerations

### Theory review questions

- |     |                         |   |                  |
|-----|-------------------------|---|------------------|
| 1 a | Withdrawal rights       | b | Confidentiality  |
| c   | Voluntary participation | d | Debriefing       |
| e   | Informed consent        | f | Deception        |
| g   | No-harm principle       | h | Ethics committee |

### Exam-style questions

#### Remember and understand

- 2 B. Informed consent can be gained by informing both the participant and their legal guardians of the nature of the study, and allowing the legal guardian to sign the consent form on the participant's behalf.
- 3 C. the privacy of participants is protected.
- 4 A. each participant's own results in the study.

#### Apply and analyse

- 5 A. debriefing
- 6 C. no-harm principle
- 7 C. informed consent.
- 8 [As participants in the investigation are under the age of 18 (as the study is on children in early childhood centres), they are unable to provide informed consent,<sup>1</sup>] [and so a legal guardian can do so on their behalf in order for them to participate in the research.<sup>2</sup>]

I have described that the participants are under 18, and so can't give informed consent.<sup>1</sup>

I have described that legal guardians can provide consent on their behalf.<sup>2</sup>

I have referred to the experiment scenario in my response.

- 9 [Mr Kirra has breached voluntary participation<sup>1</sup>] [as his students were not able to freely choose to participate, as their semester grade was dependent on their participation.<sup>2</sup>]

I have identified that voluntary participation was breached.<sup>1</sup>

I have used an example from the scenario to support this.<sup>2</sup>

I have referred to the character's name in my response (Mr Kirra), and to the scenario.

- 10 [Dr Kemmel has breached the ethical consideration of voluntary participation,<sup>1</sup>] [as his students did not choose to participate in his research.<sup>2</sup>] [He could have informed them that he would run an experiment involving deception at the beginning of the semester, and only use the phone numbers of students who agreed to participate in order to not breach this ethical consideration.<sup>3</sup>]





**Apply and analyse**

- 4** B. high reliability
- 5** [Dr Vinh was unable to generalise his results because his case study investigation only had a small sample size of ten people, which is likely not representative of the wider population.<sup>1</sup>]
- I have described one reason why the results were unable to be generalised.<sup>1</sup>
- I have referred to the character's name in my response (Dr Vinh), and to the scenario.
- 6** [The results indicate that Jensen's hypothesis is supported, in that participants who slept more had a lower average score on the impulsivity rating scale.<sup>1</sup> However, caution should be taken when concluding that sleep directly affects impulsivity,<sup>2</sup> as the presence of confounding variables could affect the validity of the results.<sup>3</sup>]
- I have summarised the results of the investigation and provided a possible conclusion.<sup>1</sup>
- I have indicated that Jensen should be cautious in making a conclusion.<sup>2</sup>
- I have provided a reason why he should be cautious.<sup>3</sup>
- I have referred to the character's name in my response (Jensen), and to the scenario.

**Questions from multiple lessons**

- 7** A. convenience sampling
- 8** D. generalise to the wider population
- 9 a** [IV: The age of the participants<sup>1</sup>]  
[DV: Participants' attitude towards smartphone technology<sup>2</sup>]
- I have correctly identified the IV.<sup>1</sup>
- I have correctly identified the DV.<sup>2</sup>
- b** [Dr Isla's hypothesis that older people had more negative attitudes towards smartphone technology was not supported by the investigation's results.<sup>1</sup> Although the 35-54 age group had a more negative attitude score towards smartphone technology as compared to the 15-34 year old group, the 55+ year old group had a more positive attitude than the 35-54 year old age group.<sup>2</sup>]
- I have indicated that the hypothesis was not supported.<sup>1</sup>
- I have referred to the results in the graph to justify this.<sup>2</sup>
- I have referred to the character's name in my response (Dr Isla), and to the scenario.

**Chapter 1 test****Multiple choice questions**

- 1** B. are allocated to both the control and experimental group.
- 2** D. The participant and the person conducting the experiment are unaware of which condition the participants have been assigned to.
- 3** C. to help validate the effect of the independent variable on the dependent variable.
- 4** A. convenience sampling.
- 5** A. subjective data, because participants provided a self-report using a questionnaire.
- 6** C. IV: whether participants used social support or physical exercise as a stress management technique; DV: the self-reported level of stress on a rating scale of 0-10.
- 7** A. a valid conclusion can be made about the effect of the independent variable on the dependent variable.
- 8** D. random sampling and counterbalancing.
- 9** B. It eliminates confounding variables due to participant differences.
- 10** B. order effects, due to participants having already completed the concentration task in the control condition before the experimental condition.

**Short answer questions**

- 11 a** [Informed consent was not upheld in this experiment,<sup>1</sup> as Kate was not aware of the true nature of the research before she consented.<sup>2</sup>]
- I have identified that informed consent was not upheld.<sup>1</sup>
- I have explained how it was not upheld in this scenario.<sup>2</sup>
- I have referred to the character's name in my response (Kate), and to the scenario.

Other acceptable responses could include:

- Debriefing
  - The use of deception
- b** [Deception in experiments involves the participants not being aware of all of the details of the experiment, and can be used when the results of the experiment rely on the participants not knowing the nature of the study.<sup>1</sup> In this scenario, Kate was unaware that the study was about social influence before participating.<sup>2</sup> When deception is used, debriefing should also occur. This is when participants are told about the true nature of the study.<sup>3</sup> Kate was not told that it was actually a study on social influence, as opposed to visual perception, at the conclusion of the study so debriefing did not occur.<sup>4</sup>]

- I have described the role of deception in experiments.<sup>1</sup>
- I have outlined how it was used in this scenario.<sup>2</sup>
- I have described the purpose of debriefing.<sup>3</sup>
- I have outlined how it occurred in this scenario.<sup>4</sup>
- I have referred to the character's name in my response (Kate), and to the scenario.

- 12 a** [This is an example of a case study.<sup>1</sup>]
- I have identified that this is a case study.<sup>1</sup>
- b** [One limitation of using a case study in research is that it is difficult to generalise the results to the wider population, due to the small sample size.<sup>1</sup>]
- I have outlined one relevant limitation of using case studies.<sup>1</sup>

- 13 a** [It was hypothesised that<sup>1</sup>][students who consumed coffee before completing the reaction time task would perform better than those who did not consume coffee.<sup>2</sup>]

I have started my hypothesis with "It was hypothesised that".<sup>1</sup>

I have included the independent and dependent variables.<sup>2</sup>

I have stated the direction of my hypothesis.

- b** [One ethical consideration could be informed consent.<sup>1</sup>[Dr Tran would need to make sure that the participants understood the details and extent of the study, as well as any potential risks involved, before consenting to participate.<sup>2</sup>]

I have identified one ethical consideration.<sup>1</sup>

I have described this ethical consideration.<sup>2</sup>

I have referred to the character's name in my response (Dr Tran), and to the scenario.

Other acceptable responses could include:

- No-harm principle
- Voluntary participation
- Withdrawal rights
- Confidentiality

- c** [An independent group design is cost-effective and time-efficient to conduct.<sup>1</sup>]

I have described a relevant advantage of independent-group designs.<sup>1</sup>

Other acceptable responses could include:

- Avoids the confounding variables of order effects

- 14 a** [A convenience sampling procedure was used,<sup>1</sup>][as although all households in Australia were sent the questionnaire, only the data of the 20 percent of households who replied was analysed for the study.<sup>2</sup>]

I have identified that convenience sampling was used.<sup>1</sup>

I have provided a reason to justify my response.<sup>2</sup>

- b** [A limitation of using questionnaires is that it relies on self-reported data.<sup>1</sup>[This data may not be accurate because people may respond with what they think experimenters would want to hear, rather than how they actually feel.<sup>2</sup>]

I have outlined one limitation of using questionnaires.<sup>1</sup>

I have explained how this limitation may impact the results.<sup>2</sup>

- 15** [The independent variable of this study is level of stress,<sup>1</sup>]  
[operationalised as whether the participants were exposed to consistent loud sirens or not during the learning phase.<sup>2</sup>][The dependent variable of this study is the ability to recall,<sup>3</sup>][operationalised as the number of word pairs participants were able to accurately recall three days after the learning phase.<sup>4</sup>]

I have identified the independent variable.<sup>1</sup>

I have operationalised the independent variable.<sup>2</sup>

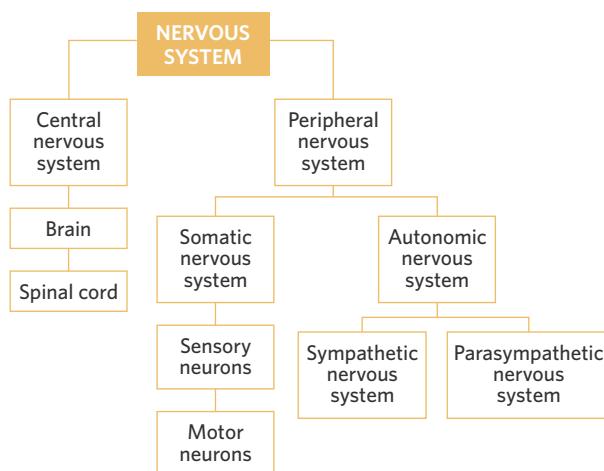
I have identified the dependent variable.<sup>3</sup>

I have operationalised the dependent variable.<sup>4</sup>

## 2A Central and peripheral nervous systems

### Theory review questions

- 1**
- a** Central nervous system
  - b** Peripheral nervous system
  - c** Sympathetic nervous system
  - d** Parasympathetic nervous system
  - e** Autonomic nervous system
  - f** Somatic nervous system
- 2**



- 3** A. 1) Sensory/afferent, 2) Motor/efferent
- 4** C. Sensory messages → Spinal cord → Brain → Spinal cord → Motor messages

### Exam-style questions

#### Remember and understand

- 5** D. Sleep, eating and reproduction
- 6** C. the sympathetic nervous system increases physiological arousal, whereas the parasympathetic nervous system decreases it.
- 7** D. the central and the somatic.
- 8** [Two primary functions of the parasympathetic nervous system include: Maintaining the body at an optimal level of functioning<sup>1</sup>] [and returning the body to optimal functioning after heightened arousal.<sup>2</sup>]

I have identified one function of the parasympathetic nervous system.<sup>1</sup>

I have identified another function of the parasympathetic nervous system.<sup>2</sup>

- 9** [Examples of sympathetic nervous system activation in response to a threat could include dilation of the pupils<sup>1</sup>] [and increased heart rate.<sup>2</sup>]

I have identified one sympathetic nervous system response.<sup>1</sup>

I have identified another sympathetic nervous system response.<sup>2</sup>

Other acceptable responses could include:

- Other sympathetic responses e.g. dilation of blood vessels.

- 10** [When someone touches a hot pan, the sensory receptors on their hand would register the heat.<sup>1</sup>] [Through sensory neural messages, this would be sent to the brain via the spinal cord.<sup>2</sup>] [The brain would register this information from the peripheral nervous system, and send out another message to it via motor neural messages.<sup>3</sup>] [This would reach the skeletal muscles of the hand, causing it to remove the hand from the heat.<sup>4</sup>]

- I have explained how the sensory stimulus was first registered by sensory receptors.<sup>1</sup>
- I have explained that a sensory neural message is sent from the PNS to the brain via the spinal cord.<sup>2</sup>
- I have explained how the brain coordinates a response, and initiates a specific response (to move the hand) by sending motor neural messages.<sup>3</sup>
- I have explained how this would cause the skeletal muscles in the hands to respond.<sup>4</sup>

#### Apply and analyse

- 11** C. Somatic, sympathetic, sympathetic
- 12** C. Dilated pupils and increased release of glucose
- 13** A. Sympathetic nervous system, sympathetic nervous system
- 14** C. Sympathetic nervous system
- 15** [She saw her boss's name: sympathetic nervous system.<sup>1</sup>] [She picked up her phone: somatic nervous system.<sup>2</sup>]

I have correctly identified the sympathetic nervous system.<sup>1</sup>

I have correctly identified the somatic nervous system.<sup>2</sup>

- 16** [He felt too hot: sensory.<sup>1</sup>] [He took his scarf and beanie off: motor.<sup>2</sup>]

I have correctly identified sensory neural messages.<sup>1</sup>

I have correctly identified motor neural messages.<sup>2</sup>

- 17** **a** [Division: Somatic nervous system.<sup>1</sup>] [Response: A voluntary/conscious motor response.<sup>2</sup>]

I have correctly identified the somatic nervous system as the relevant division of the nervous system in this scenario.<sup>1</sup>

I have correctly identified that Oliver is exhibiting a voluntary/conscious motor response.<sup>2</sup>

- b** [The sensory receptors on Oliver's leg would have registered the sensation of the ant and sent sensory neural messages.<sup>1</sup>] [This information would then have been transmitted to his brain via his spinal cord, and his brain would have sent a motor message via the motor neural pathways<sup>2</sup>] [to the skeletal muscles of his hand to brush the ant away.<sup>3</sup>]

I have identified that Oliver's sensory receptors would have registered the sensation and sent a sensory message.<sup>1</sup>

I have explained that this information would have travelled via the spinal cord to the brain and that the brain would have sent motor messages to respond.<sup>2</sup>

I have identified that the motor messages told Oliver to move his hand.<sup>3</sup>

I have referred to the character's name in my response (Oliver), and to the scenario.<sup>4</sup>

## **Key science skills**

- 18 A. quickly initiate a response to a threat.

19 A. debriefing

20 B. high reliability

21 [The researcher would need to consider the no physical/psychological harm principle<sup>1</sup>] and make sure that the way a sympathetic response is triggered does not cause any harm to participants.<sup>2</sup>

  I have identified one relevant ethical principle.<sup>1</sup>

  I have explained how this would need to apply to the particular research scenario.<sup>2</sup>

Other acceptable responses could include:

- Debriefing

## 2B The spinal reflex

## Theory review questions



## **Exam-style questions**

- Remember and understand**

  - 2** B. involuntary.
  - 3** D. It is an unconscious involuntary response to sensory stimuli.
  - 4** B. enabling faster reaction times to harmful stimuli.
  - 5** [The somatic nervous system.]

  I have correctly identified the somatic nervous system.<sup>1</sup>

- 6 [Sensory neurons carry information via the PNS to the spinal cord.<sup>1</sup>] [Via interneurons, motor messages are immediately relayed telling the body to move.<sup>2</sup>] [As the motor response occurs, the brain receives the original sensory message.<sup>3</sup>]

  I have outlined that sensory neurons carry messages to the spinal cord.<sup>1</sup>

  I have outlined that interneurons immediately relay a motor message telling the body to move.<sup>2</sup>

  I have outlined that the body responds while the brain receives the sensory message.<sup>3</sup>

## Apply and analyse

- 7 B. the spinal cord

8 [Pierce's response was an involuntary spinal reflex response involving the mechanism of the spinal sensory-motor circuit.<sup>1</sup>] [This would have involved the sensory neurons relaying the burn of the candle to the spinal cord,<sup>2</sup>] [which then, via interneurons, would immediately send a motor message to initiate an automatic motor response telling Piece to yank his hand away from the flame,<sup>3</sup>] [prior to the conscious awareness of the pain in the brain.<sup>4</sup>]

- I have correctly named the response as a spinal reflex arc or mechanism of the spinal sensory-motor circuit.<sup>1</sup>
  - I have correctly described that sensory neurons would carry sensory information to the spinal cord.<sup>2</sup>
  - I have correctly described the role of interneurons immediately relaying motor messages telling Pierce to move his hand.<sup>3</sup>
  - I have correctly identified that this response occurred before conscious awareness.<sup>4</sup>
  - I have used the language of the spinal reflex arc, referring to unconscious/involuntary response, immediately, interneurons, motor messages/neurons, sensory messages/neurons and the spinal cord
  - I have referred to the character's name in my response (Pierce), and to the scenario.

## Questions from multiple lessons

- 9 C. Both responses involve an immediate motor response.
  - 10 C. the sympathetic, the somatic.
  - 11 C. her heart racing was involuntary and so was pulling her hand back.
  - 12 D. the spinal reflex
  - 13 [While the spinal reflex and conscious motor responses both involve the brain and the spinal cord,<sup>1</sup> [the motor message is relayed immediately from the spinal cord in the spinal reflex instead of being sent from the brain in a conscious motor response.<sup>2</sup>]

  I have correctly identified a similarity between the spinal reflex and a conscious motor response to sensory stimuli.<sup>1</sup>

  I have correctly identified a difference between the spinal reflex and a conscious motor response to sensory stimuli.<sup>2</sup>

Other acceptable responses could include:

### Similarities:

- Both involve a conscious component at some point
  - Both respond to sensory stimuli
  - Both can enhance survival

## Differences

- The spinal reflex is an unconscious, involuntary response, while the conscious motor response is voluntary
  - The spinal reflex responds to sensory stimuli more quickly than a conscious motor response
  - The spinal reflex depends on interneurons, whereas a conscious motor response does not
  - Spinal reflexes are unlearned and innate, whereas conscious responses are not

## **Key science skills**

- 14 a** [The graph suggests that the higher the temperature of the plate, the quicker the motor response is after touching it.<sup>1</sup>]

  I have correctly outlined the relationship between the temperature of the plate and the immediacy of motor responses.<sup>1</sup>

- b** [These results might suggest that as temperature increases, the likelihood of experiencing a reflex response also increases<sup>1</sup>][seen in the speed of the response increasing with temperature.<sup>2</sup>]

I have suggested that temperature increasing might increase the likelihood of a reflex response occurring.<sup>1</sup>

I have used the results of the experiment to justify my response, referring to the relationship found between temperature and speed of response.<sup>2</sup>

- c** [An ethical principle breached by this research was the no-harm principle.<sup>1</sup>][This is because participants would have had to have been physically harmed by the increase in temperature in the experiment.<sup>2</sup>]

I have correctly identified that the no-harm principle was breached.<sup>1</sup>

I have described how this principle was breached in relation to the experiment scenario.<sup>2</sup>

## 2C The neuron

### Theory review questions

- |              |                     |             |                    |
|--------------|---------------------|-------------|--------------------|
| <b>1 a I</b> | Neural transmission | <b>II</b>   | Presynaptic neuron |
| <b>III</b>   | Dendrites           | <b>IV</b>   | Axon               |
| <b>V</b>     | Postsynaptic neuron | <b>VI</b>   | Synapse            |
| <b>VII</b>   | Axon terminals      | <b>VIII</b> | Neural reception   |
| <b>IX</b>    | Myelin              |             |                    |
- b** 1 - Dendrites, 2 - Axon, 3 - Myelin, 4 - Axon terminals,  
5 - Synapse, 6 - Neural reception, 7 - Neural transmission,  
8 - Presynaptic neuron, 9 - Postsynaptic neuron.

### Exam-style questions

#### Remember and understand

- 2** C. 1 - myelin, 2 - axon, 3 - axon terminals, 4 - dendrites  
**3** B. insulate and transmit neural information.  
**4** C. dendrites, axon, axon terminals, synapse  
**5** [Dendrites receive neural messages from the synapse.<sup>1</sup>]

I have correctly identified the function of dendrites as receiving neural messages.<sup>1</sup>

- 6** 1. [Dendrites.<sup>1</sup>], 2. [Axon.<sup>2</sup>], 3. [Myelin.<sup>3</sup>], 4. [Axon terminals.<sup>4</sup>]

I have correctly labelled point 1 as dendrites.<sup>1</sup>

I have correctly labelled point 2 as axon.<sup>2</sup>

I have correctly labelled point 3 as myelin.<sup>3</sup>

I have correctly labelled point 4 as axon terminals.<sup>4</sup>

#### Apply and analyse

- 7** C. myelin.  
**8** A. increased difficulty in transmitting neural messages.

## 2D Neurotransmitters

### Theory review questions

- |            |                    |          |                      |
|------------|--------------------|----------|----------------------|
| <b>1 a</b> | Neurotransmitter   | <b>b</b> | Lock-and-key process |
| <b>c</b>   | Presynaptic neuron | <b>d</b> | Postsynaptic neuron  |
| <b>e</b>   | Receptor sites     | <b>f</b> | Excitatory effect    |
| <b>g</b>   | Glutamate          | <b>h</b> | Inhibitory effect    |
| <b>i</b>   | GABA               |          |                      |
- 2** C. X - Receptor site - lock; Y - Neurotransmitter - key
- 3** The **neurotransmitter** is released from the **presynaptic neuron** into the synapse. It diffuses across the synapse to meet the **receptor site** on the dendrite of the **postsynaptic neuron**. In this process, the neurotransmitter is considered to be the **key** and the receptor site is the **lock**, where only a specific neurotransmitter is the correct shape to fit with the receptor site and activate either an **excitatory** or an **inhibitory** response.

### Exam-style questions

#### Remember and understand

- 4** D. acting as an excitatory neurotransmitter released across the synaptic gap.  
**5** B. The neurotransmitter acts as a key because it is the correct shape to bind to specific receptor sites which act as the lock.  
**6** D. glutamate, which has an excitatory effect.  
**7** D. decreasing the likelihood of the postsynaptic neuron firing.  
**8** [Both excitatory and inhibitory neurotransmitters are needed for optimal brain functioning.<sup>1</sup>][Excitatory neurotransmitters ensure neurons perform a specific function e.g. glutamate for learning by making other neurons more likely to fire,<sup>2</sup>][whereas inhibitory neurotransmitters make sure that over-excitation doesn't occur and damage neurons, or cause problems by making them less likely to fire.<sup>3</sup>]

I have explained that both excitatory and inhibitory neurotransmitters are needed for optimal brain functioning.<sup>1</sup>

I have explained the function/purpose of excitatory neurotransmitters.<sup>2</sup>

I have explained the function/purpose of inhibitory neurotransmitters.<sup>3</sup>

- 9** [The key difference between glutamate and GABA is the effect they have on neural transmission when they reach the postsynaptic neuron.<sup>1</sup>][Glutamate is an excitatory neurotransmitter, meaning its effect on the postsynaptic neuron is to increase the likelihood of neural transmission.<sup>2</sup>][In contrast, GABA is an inhibitory neurotransmitter, meaning its effect on the postsynaptic neuron is to decrease the likelihood of neural transmission.<sup>3</sup>]

I have correctly identified that the difference between glutamate and GABA is their effect on the postsynaptic neuron.<sup>1</sup>

I have correctly stated that glutamate is an excitatory neurotransmitter, and outlined its function.<sup>2</sup>

I have correctly stated that GABA is an inhibitory neurotransmitter, and outlined its function.<sup>3</sup>

I have used the language of neural transmission, referring to excitatory and inhibitory effects.

- 10** [The lock-and-key process is used to explain how neurotransmitters communicate neural information from neuron to neuron.<sup>1</sup>] [The key in the analogy is the neurotransmitter<sup>2</sup>] [with a distinct structure that must fit into a corresponding lock.<sup>3</sup>] [The lock is the receptor sites on the dendrites of the postsynaptic neuron,<sup>4</sup>] [only opened and activating the neuron when accessed by the right key.<sup>5</sup>]

I have explained what the lock-and-key process is.<sup>1</sup>

I have correctly identified that the key is the neurotransmitter.<sup>2</sup>

I have explained what the key must do/is.<sup>3</sup>

I have correctly identified that the lock is the receptor sites on the postsynaptic neuron.<sup>4</sup>

I have explained how the lock works.<sup>5</sup>

I have used the language of the lock-and-key process, referring to presynaptic neuron, postsynaptic neuron, receptor sites, neurotransmitters, lock and key.

- 11** [After reaching the synaptic buttons of a presynaptic neuron, excitatory neurotransmitters will enter the synapse.<sup>1</sup>] [As the neurotransmitter is the key, there must be the right lock or receptor sites on the postsynaptic neuron's dendrites for it to bind to.<sup>2</sup>] [After binding to the receptor sites<sup>3</sup>] [an excitatory neuron will produce its effect, making the postsynaptic neuron more likely to fire and carrying on the neural impulse.<sup>4</sup>]

I have explained that neurotransmitter is released into the synapse.<sup>1</sup>

I have explained how the neurotransmitter acts as a key for the complementary receptor site or lock.<sup>2</sup>

I have explained that the key binds to the lock.<sup>3</sup>

I have explained that the excitatory effect makes the postsynaptic neuron more likely to fire.<sup>4</sup>

I have used language relating to neural transmission, like synapse, dendrites, excitatory effect, lock, key and receptor sites.

### Apply and analyse

- 12** A. not enough inhibitory neural transmission.

### Questions from multiple lessons

- 13** C. move more slowly from one end of the neuron to the other.

- 14** [1 - synaptic buttons.<sup>1</sup>] [2 - synapse.<sup>2</sup>] [3 - neurotransmitters.<sup>3</sup>] [4 - receptor sites.<sup>4</sup>] [5 - dendrites.<sup>5</sup>]

I have correctly labelled point 1 as synaptic buttons or terminal buttons.<sup>1</sup>

I have correctly labelled point 2 as synapse or synaptic gap.<sup>2</sup>

I have correctly labelled point 3 as neurotransmitters.<sup>3</sup>

I have correctly labelled point 4 as receptor sites.<sup>4</sup>

I have correctly labelled point 5 as dendrites or dendritic spines.<sup>5</sup>

### Key science skills

- 15** a [Dr Freeman used convenience sampling.<sup>1</sup>]

I have correctly identified that Dr Freeman used a convenience sample.<sup>1</sup>

I have referred to the character's name in my response (Dr Freeman), and to the scenario.

- b [Dr Freeman undertook a case study<sup>1</sup>] [as only a small and specific group of participants was used.<sup>2</sup>]

I have correctly identified case study as the kind of investigation.<sup>1</sup>

I have justified why it was a case study.<sup>2</sup>

I have referred to the character's name in my response (Dr Freeman), and to the scenario.

- c [Dr Freeman cannot generalise her results<sup>1</sup>] [because she conducted a case study, and so her sample size is too small to be a good representation of any population.<sup>2</sup>]

I have correctly identified that the results cannot be generalised.<sup>1</sup>

I have explained why the results cannot be generalised.<sup>2</sup>

I have referred to the character's name in my response (Dr Freeman), and to the scenario.

## 2E Chronic nervous system changes due to neurotransmitter dysfunction

### Theory review questions

- 1** **Parkinson's disease** is a progressive nervous system disease characterised by both motor and non-motor symptoms. It involves interference to the neurotransmitter **dopamine**, caused by neuronal loss and degeneration in a structure of the brain known as the **substantia nigra**.

### Exam-style questions

#### Remember and understand

- 2** D. decreased dopamine production.

- 3** C. impaired fine motor movement

- 4** D. Cause - decreased dopamine production; Motor symptom - impaired motor movement

- 5** [Parkinson's disease can make motor control slowed and more rigid<sup>1</sup>] [as well as lead to a general feeling of fatigue.<sup>2</sup>]

I have correctly identified one relevant symptom of Parkinson's disease.<sup>1</sup>

I have correctly identified one other relevant symptom of Parkinson's disease.<sup>2</sup>

Other acceptable responses could include:

- Tremors
- Cognitive difficulties
- Mental health issues
- Increased sensitivity to pressure
- Reduced balance
- Other relevant symptoms of Parkinson's disease
- Postural irregularity
- Reduced fine motor movements

**6** [Parkinson's disease is caused by the dysfunction of the neurotransmitter dopamine.<sup>1</sup>][This occurs when the brain suffers neuronal loss, causing a reduction in dopamine production.<sup>2</sup>][This causes a range of symptoms, especially reduced motor function, as dopamine works to regulate voluntary motor functioning.<sup>3</sup>]

I have correctly stated dopamine as the neurotransmitter affected in Parkinson's disease.<sup>1</sup>

I have correctly described the neurotransmitter dysfunction as a result of insufficient dopamine production.<sup>2</sup>

I have explained how symptoms of Parkinson's disease result from this dopamine reduction.<sup>3</sup>

#### Apply and analyse

**7** A. dopamine.

**8** [Mert likely displayed a decrease in dopamine production<sup>1</sup>][and motor symptoms such as muscle tremors.<sup>2</sup>]

I have correctly identified a change in neural function relevant to Parkinson's disease.<sup>1</sup>

I have correctly identified a change in motor function relevant to Parkinson's disease.<sup>2</sup>

I have referred to the character's name in my response (Mert), and to the scenario.

Other acceptable responses could include:

Changes in neural function:

- Neuronal degeneration
- Neuronal loss (specifically in the substantia nigra)

Changes in motor function:

- Impaired motor movements
- Reduced balance

#### Questions from multiple lessons

**9** B. reduction of required keys.

**10** A. inadequate excitation and inhibition.

**11** B. somatic nervous system.

**12** [When Gerry touches the cup of tea, the sensory receptors of his hand register the temperature of the tea cup as more hot than it is.<sup>1</sup>][Through sensory neural messages, this sensation is sent to the brain via the spinal cord.<sup>2</sup>][The brain would register this information and coordinate a motor response to put the cup down.<sup>3</sup>][However, as he has Parkinson's disease, Gerry would likely experience difficulty coordinating this voluntary response in his brain (due to inadequate dopamine production).<sup>4</sup>][An inadequate message would then be sent to his skeletal muscles to put the cup down, resulting in his shaky movements.<sup>5</sup>]

- 
- I have explained how the sensory receptors inaccurately register the temperature of the cup.<sup>1</sup>
- 
- I have explained how sensory messages of the cup's temperature are sent to the brain via the spinal cord.<sup>2</sup>
- 
- I have explained how the brain would attempt to coordinate a relevant motor response.<sup>3</sup>
- 
- I have explained that this might be problematic given relevant neural effects of Parkinson's disease.<sup>4</sup>
- 
- I have explained how the shaky, voluntary response would occur at the skeletal muscles.<sup>5</sup>
- 
- I have referred to the character's name in my response (Gerry), and to the scenario.

## Chapter 2 test

### Multiple choice questions

- 1** A. it increases the likelihood of the postsynaptic neuron firing an action potential.
- 2** A. neurotransmitter dysfunction, impairing voluntary movements.
- 3** D. decreased dopamine production
- 4** D. an unconscious motor response in the spinal cord.
- 5** C. central and somatic.
- 6** A. synapse, dendrite, axon, axon terminal.
- 7** B. insulate and protect the axon.
- 8** A. prepare her visceral muscles and glands to deal with a threat.
- 9** C. motor
- 10** B. receive neurotransmitters from the synapse.

### Short answer questions

- 11** [After reaching the synaptic buttons of a presynaptic neuron, dopamine will be released into the synapse.<sup>1</sup>][As it is the key, there must be the right lock, or dopamine receptor sites, on the postsynaptic neuron's dendrites for it to bind to.<sup>2</sup>][After binding to the receptor sites<sup>3</sup>][dopamine will produce its effect on the postsynaptic neuron<sup>4</sup>][sending messages necessary for voluntary movement.<sup>5</sup>]
- 
- I have explained that dopamine is released into the synapse.<sup>1</sup>
- 
- I have explained how dopamine acts as a key for the complementary receptor site or lock.<sup>2</sup>
- 
- I have explained that the key binds to the lock.<sup>3</sup>
- 
- I have explained that dopamine has an effect on the postsynaptic neuron.<sup>4</sup>
- 
- I have explained that this effect will allow neurons to send messages required to perform voluntary movements.<sup>5</sup>
- 
- I have used language relating to neural transmission, like synapse, dendrites, lock, key and receptor sites.

- 12** [Interneurons function to communicate messages between sensory and motor neurons at the spinal cord.<sup>1</sup>] [allowing a motor response to be quickly coordinated without the conscious awareness of the brain.<sup>2</sup>]

I have explained that interneurons allow communication between sensory and motor neurons.<sup>1</sup>

I have explained the purpose of this in the spinal reflex arc.<sup>2</sup>

- 13 a** [Jyah might also be experiencing widened pupils,<sup>1</sup>] [which allow her to let more light into her eyes to better allow her to see a threat.<sup>2</sup>] [She might also experience an increased breathing rate<sup>3</sup>] [which allows her to increase oxygenation to her body to better confront a threat.<sup>4</sup>]

I have identified one other sympathetic response.<sup>1</sup>

I have explained how this response enhances survival in the face of a threat.<sup>2</sup>

I have identified one other sympathetic response.<sup>3</sup>

I have explained how this response enhances survival in the face of a threat.<sup>4</sup>

I have referred to the character's name in my response (Jyah), and to the scenario.

Other acceptable responses could include:

- Other sympathetic responses, so long as they were explained in terms of how they help someone respond to a threat

- b** [When Jyah sees her buzzer light up, the sensory receptors of her eyes will register the light.<sup>1</sup>] [Through sensory neural messages, this will be sent to her brain via her spinal cord.<sup>2</sup>] [The brain would register this information from the peripheral nervous system, and send another message to it via motor neural messages telling her to respond.<sup>3</sup>] [This would reach the skeletal muscles of her hand, telling her to press the buzzer.<sup>4</sup>]

I have explained how the sensory stimulus of the light of her buzzer was first registered by sensory receptors in her eyes.<sup>1</sup>

I have explained that a sensory neural message is sent from the PNS to the brain via the spinal cord.<sup>2</sup>

I have explained how the brain coordinates a response, and initiates a specific response (to press the buzzer) by sending motor neural messages.<sup>3</sup>

I have explained how this would cause the skeletal muscles in Jyah's hand to respond.<sup>4</sup>

I have referred to the character's name in my response (Jyah), and to the scenario.

- 14** [After reaching the axon terminals of a presynaptic neuron, GABA will be released into the synapse.<sup>1</sup>] [As GABA is the key, there must be the right lock, or GABA receptor sites, on the postsynaptic neuron's dendrites for it to bind to.<sup>2</sup>] [After binding to the receptor sites<sup>3</sup>] [GABA will produce its inhibitory effect, making the postsynaptic neuron less likely to fire an action potential.<sup>4</sup>]

I have explained that GABA is first released into the synapse.<sup>1</sup>

I have explained how GABA acts as a key for the complementary receptor site or lock.<sup>2</sup>

I have explained that the key binds to the lock.<sup>3</sup>

I have explained that the inhibitory effect of GABA makes the postsynaptic neuron less likely to fire.<sup>4</sup>

I have used language relating to neural transmission, like synapse, dendrites, inhibitory effect, lock, key and receptor sites.

### Key science skills questions

- 15 a** [Repeated measures.<sup>1</sup>]

I have correctly identified the research design as repeated measures.<sup>1</sup>

- b** [One advantage of this research design is that it eliminates participant-related extraneous variables<sup>1</sup>] [as the same participants are used in either condition.<sup>2</sup>] [However, a disadvantage is that it may create order effects,<sup>3</sup>] [such as participants being less stressed in the second condition as they have already been exposed to the stressor.<sup>4</sup>]

I have identified one relevant advantage of a repeated measures design.<sup>1</sup>

I have briefly explained how this advantage helps the current experiment.<sup>2</sup>

I have identified a relevant disadvantage of repeated measures design.<sup>3</sup>

I have briefly explained how this disadvantage might negatively impact the current experiment.<sup>4</sup>

- c** [The independent variable in this experiment is the presence of a pleasant smell,<sup>1</sup>] [operationalised as either the presence or non-presence of a pleasant smell.<sup>2</sup>] [The dependent variable in this experiment is sympathetic nervous system responses,<sup>3</sup>] [operationalised as a measure of participants' heart rates in either condition.<sup>4</sup>]

I have correctly identified the independent variable as the presence of a pleasant smell.<sup>1</sup>

I have correctly operationalised the independent variable.<sup>2</sup>

I have correctly identified the dependent variable as sympathetic nervous system responses.<sup>3</sup>

I have correctly operationalised the dependent variable.<sup>4</sup>



### Apply and analyse

- 7 A. mobilise her body to confront a stressor.
- 8 [Jude is currently experiencing the alarm reaction stage, specifically shock.<sup>1</sup>] This is because his physical functioning has fallen below optimal levels in the face of the blood, clear in his body temperature falling.<sup>2</sup>]

I have correctly identified the stage as alarm; shock.<sup>1</sup>

I have provided evidence from the scenario to describe this stage.<sup>2</sup>

I have used the language of General Adaptation Syndrome, referring to alarm reaction and shock.

I have referred to the character's name in my response (Jude), and to the scenario.

- 9 a [While Dillon experienced fight<sup>1</sup>] [as seen through him singing the song in the face of a stressor (the audience/performance)<sup>2</sup>] [Cora experienced freeze<sup>3</sup>] [as seen in her inability to sing in front of the audience as she stands frozen.<sup>4</sup>]

I have correctly identified that Dillon experienced fight.<sup>1</sup>

I have provided evidence from the scenario to describe this.<sup>2</sup>

I have correctly identified that Cora experienced freeze.<sup>3</sup>

I have provided evidence from the scenario to describe this.<sup>4</sup>

I have referred to the characters' names in my response (Dillon and Cora), and to the scenario.

- b [While Dillon was likely in alarm; counter shock<sup>1</sup>] [seen in his ability to confront the stressor with heightened arousal (singing and feeling energised),<sup>2</sup>] [Cora was likely in alarm; shock<sup>3</sup>] [as her reactions fell below normal functioning, seen in her being still and not able to sing.<sup>4</sup>]

I have correctly identified that Dillon was in counter shock.<sup>1</sup>

I have provided evidence from the scenario to support this.<sup>2</sup>

I have correctly identified that Cora was in shock.<sup>3</sup>

I have provided evidence from the scenario to support this.<sup>4</sup>

I have referred to the characters' names in my response (Dillon and Cora), and to the scenario.

### Questions from multiple lessons

- 10 D. parasympathetic, then sympathetic

- 11 a [Dexter is likely experiencing alarm reaction - shock<sup>1</sup>] [as his physiological reactions have fallen below normal functioning (clear in his need to rest) in the face of a stressor, and his body is responding as though it is injured.<sup>2</sup>]

I have correctly identified the stage Dexter is experiencing as alarm reaction - shock.<sup>1</sup>

I have described this stage as involving the body's reactions falling below optimal functioning.<sup>2</sup>

I have referred to the character's name in my response (Dexter), and to the scenario.

- b [Dexter's partner would likely be experiencing a reduced production of the neurotransmitter dopamine.<sup>1</sup>]

I have correctly identified the change in neural function as a reduced production of dopamine.<sup>1</sup>

I have referred to the character's name in my response (Dexter's partner), and to the scenario.

### Key science skills

- 12 a [It was hypothesised<sup>1</sup>] [that male participants<sup>2</sup>] [would experience the onset of the exhaustion stage<sup>3</sup>] [earlier than females.<sup>4</sup>]

I have begun my hypothesis with a phrase like 'It was hypothesised...' <sup>1</sup>

I have included the independent variable of gender.<sup>2</sup>

I have included the dependent variable of the timing of the exhaustion stage.<sup>3</sup>

I have stated the direction of my prediction.<sup>4</sup>

Other acceptable responses could include:

- The opposite direction of prediction, i.e. that females would experience an earlier onset of the exhaustion stage than males

- b [Convenience sampling.<sup>1</sup>]

I have correctly identified the sampling procedure used as convenience.<sup>1</sup>

- c [Professor Prictor would measure cortisol levels as they are a good indicator of the stage of General Adaptation Syndrome that participants are in.<sup>1</sup>] [This is relevant to the study, as during the exhaustion stage, cortisol levels drop after a period of sustained high levels during resistance.<sup>2</sup>] [If participants presented a drop in cortisol level, Professor Prictor could suggest that they had possibly entered the exhaustion stage.<sup>3</sup>]

I have explained that cortisol levels help to identify the stage of the General Adaptation Syndrome people are in.<sup>1</sup>

I have explained how cortisol levels might specifically show the exhaustion and resistance stage, relevant to the experiment scenario.<sup>2</sup>

I have related this to how Professor Prictor could identify whether a participant had entered the exhaustion stage.<sup>3</sup>

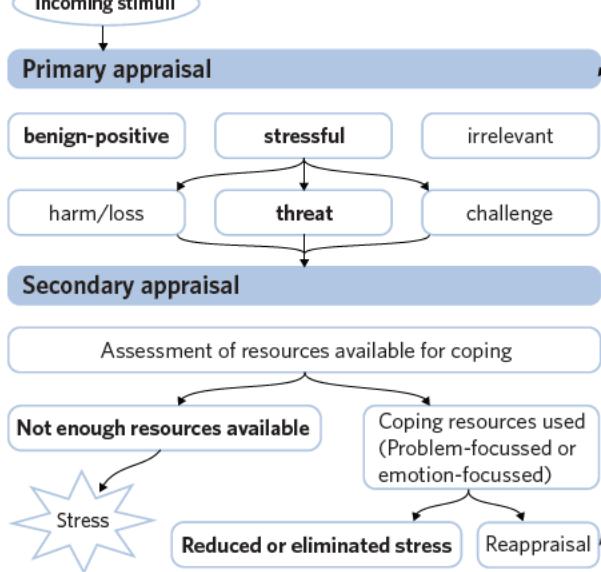
I have referred to the character's name in my response (Professor Prictor), and to the scenario.

## 3C Psychological processes of stress

## Theory review questions

- |          |          |                 |          |           |
|----------|----------|-----------------|----------|-----------|
| <b>1</b> | <b>a</b> | Irrelevant      | <b>b</b> | Challenge |
|          | <b>c</b> | Benign-positive | <b>d</b> | Stressful |
|          | <b>e</b> | Harm/loss       | <b>f</b> | Threat    |

- ## **2 Incoming stimuli**



- |            |                         |          |                         |
|------------|-------------------------|----------|-------------------------|
| <b>3 a</b> | Appraisal               | <b>b</b> | Primary appraisal       |
| <b>c</b>   | Coping                  | <b>d</b> | Reappraisal             |
| <b>e</b>   | Secondary appraisal     | <b>f</b> | Problem-focussed coping |
| <b>g</b>   | Emotion-focussed coping |          |                         |

## **Exam-style questions**

### **Remember and understand**

- 4 D. assessment of the nature of the stressor.
  - 5 C. primary appraisal assesses the nature of the stressor, while secondary appraisal assesses the coping resources available.
  - 6 B. an individual believes there is an imbalance between the coping resources available and the demands a stressor.
  - 7 [One strength is that it highlights the subjective nature of the stress response for the individual which can help to explain why different people respond to stressors differently<sup>1</sup>][while a limitation is that the primary and secondary appraisal stages may occur simultaneously.<sup>2</sup>]

  I have identified one relevant advantage of the Transactional model.<sup>1</sup>

  I have identified one relevant disadvantage of the Transactional model.<sup>2</sup>

Other acceptable responses could include:

#### **Advantages:**

- Allows for consideration of cognitive processes within the stress response
  - Human subjects were used as a source of data during the creation of the model
  - Reappraisal stage acknowledges that a stressor and its demands may change overtime

- Coping stage (emotion and problem-focussed strategies) provide suggestions for dealing with a stressor

#### **Disadvantages:**

- Arguably, it attributes too active a role for the individual; individuals are not necessarily aware of why they feel certain kinds of stress as primary appraisal suggests
  - Does not include biological processes of stress
  - Cannot easily be tested by research, as human subjects not necessarily aware of all stages of appraisal

- 8 [Primary appraisal involves assessing the nature of the stressor and its impact on the individual.<sup>1</sup>] [Initially, primary appraisal involves deeming the stressor as benign-positive, stressful or irrelevant. For example, if an individual was worried about an upcoming exam, they would identify it as 'stressful'.<sup>2</sup>] [Secondly, primary appraisal involves deciding the kind of stress that is caused, being either a challenge, threat or having caused harm/loss. For example, if an individual sees their exam as an opportunity to do well, they would deem the stressor a 'challenge'.<sup>3</sup>]

-   I have correctly outlined the purpose of primary appraisal as assessing the nature of a stressor.<sup>1</sup>

- I have explained the first component of primary appraisal with a relevant example.<sup>2</sup>

-   I have explained the second component of primary appraisal with a relevant example.<sup>3</sup>

-   I have used the language of the Transactional model, referring to benign-positive, stressful, irrelevant, challenge, threat and harm/loss.

### **Apply and analyse**

- 9 B. primary appraisal, where he considers accidents and financial pressure as a threat.

10 A. secondary appraisal, where he considers problem-focussed approaches for coping with his stressor.

11 A. emotion-focussed coping, in which Thomas avoided dealing with the stressor.

12 a [During primary appraisal, Yasmin would have deemed the situation 'stressful' and as a 'threat'<sup>1</sup>][to her wellbeing because of the potential pressure it would put on her while she was studying.<sup>2</sup>][On the other hand, Dean does not have to study yet, so although he would also deemed the situation 'stressful', he likely would have viewed it as a 'challenge'<sup>3</sup>][because he perceives it as a positive opportunity to find enjoyable work.<sup>4</sup>]

-   I have correctly identified Yasmin's primary appraisal as a threat.<sup>1</sup>

-   I have justified this with information from the scenario.<sup>2</sup>

- I have correctly identified Dean's primary appraisal as a challenge.<sup>3</sup>

-   I have justified this with information from the scenario.<sup>4</sup>

-   I have used the language of the Transactional Model, referring to stressful, threat and challenge.

-   I have referred to the character's name in my response (Dean and Yasmin), and to the scenario.

**b** [Yasmin could employ wishful thinking,<sup>1</sup>] by imagining that she will cope well living off less savings than before her trip<sup>2</sup> [and she could distract herself<sup>3</sup>] from her lack of savings by hanging out at her friend's house when she is not studying.<sup>4</sup>]

I have identified one relevant emotion-focussed coping strategy.<sup>1</sup>

I have explained how Yasmin could employ it.<sup>2</sup>

I have identified a second relevant emotion-focussed coping strategy.<sup>3</sup>

I have explained how Yasmin could employ it.<sup>4</sup>

I have referred to the character's name in my response (Yasmin), and to the scenario.

Other acceptable responses could include:

- Other relevant emotion-focussed coping strategies, such as denial, so long as they were correctly applied to the scenario.

#### Questions from multiple lessons

**13 a** [Acculturative stress.<sup>1</sup>]

I have correctly identified that Sonya's stress is an example of acculturative stress.<sup>1</sup>

**b** [Sonya likely appraised the 'stressful' situation as harm/loss,<sup>1</sup> as she regards her loss of friends and identity as damage that has already occurred.<sup>2</sup>]

I have identified the specific kind of primary appraisal Sonya experienced as stressful - harm/loss.<sup>1</sup>

I have provided an example from the scenario to justify this.<sup>2</sup>

I have used the language of the Transactional model, referring to stressful and harm/loss.

I have referred to the character's name in my response (Sonya), and to the scenario.

**c** [Sonya is experiencing the alarm reaction stage of the General Adaptation Syndrome, specifically counter shock.<sup>1</sup>] This is because her sympathetic nervous system responses are engaged and at high levels, enabling her to have a high resistance to the stressor and the resources to be able to cope with it.<sup>2</sup>]

I have identified alarm reaction (counter shock) as the stage Sonya is experiencing.<sup>1</sup>

I have described the evidence for Sonya being in counter shock.<sup>2</sup>

I have used the language of the General Adaptation Syndrome, referring to alarm reaction and counter shock.

I have referred to the character's name in my response (Sonya), and to the scenario.

**14** [The General Adaptation Syndrome is a biological model tracking the physiological process of the stress response,<sup>1</sup> whereas the Transactional Model is a psychological model in that it allows for subjective mental interpretation of stress and how it can be tracked.<sup>2</sup>]

I have identified and explained the General Adaptation Syndrome as a biological model.<sup>1</sup>

I have identified and explained that the Transactional Model is psychological.<sup>2</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses could include:

- That the General Adaptation Syndrome focusses on biological features of the stress response whereas the Transactional Model focusses on psychological/cognitive features

#### Key science skills

**15 a** [Independent groups.<sup>1</sup>]

I have correctly identified the experimental design as independent groups.<sup>1</sup>

**b** [Qualitative.<sup>1</sup>]

I have correctly identified the type of data collected as qualitative.<sup>1</sup>

**c** [The vodka-flavoured water served as a placebo<sup>1</sup>] so that the extraneous variable of the placebo-effect was controlled for, ensuring both groups believed that they had consumed alcohol. This means that any results due to the believed effects of alcohol consumption was the same across both conditions, allowing comparisons to be made across groups more fairly.<sup>2</sup>]

I have correctly identified that the vodka-flavoured water was administered as a placebo.<sup>1</sup>

I have explained how the use of a placebo helps to control for extraneous variables affecting experimental results.<sup>2</sup>

I have referred to the character's name in my response (Dr Robert), and to the scenario.

## 3D Coping with stress

### Theory review questions

**1 a** Context-specific effectiveness

**b** Exercise

**c** Avoidance coping

**d** Coping

**e** Approach coping

**f** Coping flexibility

### Exam-style questions

#### Remember and understand

**2** B. the coping mechanism used and the demands of the stressor.

**3** A. approach strategies confront a stressor, whereas avoidance strategies actively evade a stressor.

**4** [Exercise can help reduce stress psychologically by providing opportunity for social interaction, serving as a distraction from a stressor.<sup>1</sup>] Exercise can help reduce stress biologically by using up stress hormones like cortisol that keep the body in a reactive sympathetic state.<sup>2</sup>]

- 
- I have identified one psychological way exercise reduces stress.<sup>1</sup>
- 
- I have identified one biological way exercise reduces stress.<sup>2</sup>

Other acceptable responses could include:

Advantages:

- Other psychological and biological ways exercise helps to reduce stress

- 5 [Coping flexibility refers to the ability to change coping strategies to best suit the changing demands of a stressor.<sup>1</sup>][This helps to reduce stress, as the strategies used more accurately target the stressor.<sup>2</sup>][For example, if someone has the stressor of an upcoming football game and begins to cope by exercising, but then finds out a good player on their team won't be able to play the game, they might show coping-flexibility by scheduling more training sessions with their teammates.<sup>3</sup>]

- 
- I have defined coping flexibility as the ability to change one's coping strategies.<sup>1</sup>
- 
- I have explained how using coping flexibility helps deal with a stressor.<sup>2</sup>
- 
- I have provided a relevant example demonstrating how coping flexibility can be used.<sup>3</sup>

#### Apply and analyse

- 6 D. exercise and avoidance strategies.
- 7 C. an avoidance strategy.
- 8 a [Genevieve was using avoidant coping strategies<sup>1</sup>][because dropping her daughter off at kindergarten meant that she did not have to deal directly with the stressor of looking after her.<sup>2</sup>]

- 
- I have correctly identified avoidant as the kind of coping strategy used.<sup>1</sup>
- 
- I have justified why dropping her daughter off was an avoidant coping strategy.<sup>2</sup>
- 
- I have used the language of coping, by referring to avoidant coping strategies.
- 
- I have referred to the character's name in my response (Genevieve), and to the scenario.

- b [Genevieve was using an approach coping strategy<sup>1</sup>][because booking a doctor's appointment directly confronts the source of the stressor, targeting her daughter's sickness.<sup>2</sup>]

- 
- I have correctly identified approach as the kind of coping strategy used.<sup>1</sup>
- 
- I have justified why booking her daughter an appointment was an approach coping strategy.<sup>2</sup>
- 
- I have used the language of coping, by referring to approach coping strategies.
- 
- I have referred to the character's name in my response (Genevieve), and to the scenario.

- c [Coping flexibility refers to the ability to change coping strategies depending on the changing elements of the stressor.<sup>1</sup>][Genevieve employed this by changing her coping strategy from avoidant coping (dropping her daughter off at kindergarten), to approach coping when the stressor worsened (her daughter got more sick) by booking an appointment.<sup>2</sup>][This shows flexibility because as the demands of the stressor increased, the coping strategy became more confrontational.<sup>3</sup>]

- 
- I have explained the concept of coping flexibility.<sup>1</sup>
- 
- I have explained how Genevieve changed her coping strategies within the scenario.<sup>2</sup>
- 
- I have explained how this example of coping flexibility helped Genevieve to effectively deal with her stressor.<sup>3</sup>
- 
- I have referred to the character's name in my response (Genevieve), and to the scenario.

#### Questions from multiple lessons

- 9 A. an insufficient production of the neurotransmitter dopamine.
- 10 C. coping flexibility
- 11 a [Janet is currently experiencing the resistance stage of the General Adaptation Syndrome.<sup>1</sup>][This is clear in her ability to work non-stop which would require sustained mobilisation of the body, and the fact that she is beginning to feel sick.<sup>2</sup>]

- 
- I have correctly identified resistance as the stage of the General Adaptation Syndrome Janet is in.<sup>1</sup>
- 
- I have provided examples of Janet's scenario that support this stage.<sup>2</sup>
- 
- I have referred to the character's name in my response (Janet), and to the scenario.

- b [Context-specific effectiveness is when the coping mechanism used is appropriate for the demands of the stressor.<sup>1</sup>][Because Janet has so many stressors with work and packing up her house, exercise demonstrates context-specific effectiveness.<sup>2</sup>][As she is sick from non-stop work, and is feeling overwhelmed, exercise is a good way to relieve some stress. This is because exercise can help use up stress hormones like cortisol which may be responsible for her weakening immune system.<sup>3</sup>]

- 
- I have explained what context-specific effectiveness requires.<sup>1</sup>
- 
- I have said whether or not physical exercise fulfils the requirements of context-specific effectiveness.<sup>2</sup>
- 
- I have justified why her running is or isn't an appropriate coping mechanism.<sup>3</sup>
- 
- I have referred to the character's name in my response (Janet), and to the scenario.

Other acceptable responses could include:

- That running is not an example of context-specific effectiveness, so long as it was justified e.g. because it means she won't have time to deal with her stressors, or because she is getting sick, a better strategy could be to rest so that she does not enter exhaustion.

- c [Both Janet's work assessment and her separation are forms of 'life events'<sup>1</sup>][because they are a significant change that force her to adapt to new circumstances. In this case, finding a new home and getting used to being alone, and adjusting to many more hours of work.<sup>2</sup>]

- I have stated that the source of the stressor is a life event.<sup>1</sup>
- I have explained why this is an example of life event with evidence from the scenario.<sup>2</sup>
- I have referred to the character's name in my response (Janet), and to the scenario.

### Key science skills

- 12 a [A researcher could obtain a stratified sample by selecting relevant characteristics for their study, and dividing the population into groups (strata) based on these characteristics. They would then select participants from those strata for the sample in proportion to how they appear in the population.<sup>1</sup>][For example, gender might be relevant to the effects of exercise on stress, so the researcher could count how many people of each gender attends La Trobe and replicate this percentage in the sample.<sup>2</sup>]

- I have explained that a stratified sample requires selection of the sample on the basis of how certain characteristics appear in the population.<sup>1</sup>
- I have explained how a researcher could obtain a stratified sample in this scenario.<sup>2</sup>
- I have referred to the experiment scenario in my response.

- b [The independent variable is exercise<sup>1</sup>][operationalised as either jogging or walking.<sup>2</sup>]

- I have correctly identified the independent variable as exercise.<sup>1</sup>
- I have operationalised the independent variable in line with the scenario as jogging or walking.<sup>2</sup>

## Chapter 3 test

### Multiple choice questions

- 1 C. the ability to change coping strategies depending on the changing demands of a stressor.
- 2 A. resistance.
- 3 A. it takes into account the subjective nature of the stress response.
- 4 C. secondary appraisal and is exhibiting an approach strategy.
- 5 B. coping flexibility.
- 6 B. major stress.
- 7 A. life event
- 8 C. avoidance coping.
- 9 D. context-specific effectiveness.
- 10 C. about the same level of sympathetic nervous system responses.

### Short answer questions

- 11 a [In primary appraisal, Antoni appraised the flooding as stressful; harm/loss,<sup>1</sup>] as he thought about all the damage that had already occurred and how it meant he could never have a repaired house.<sup>2</sup> [In terms of secondary appraisal, Antoni believed he did not have adequate coping resources<sup>3</sup>][evident in his lack of confidence in his ability to rebuild.<sup>4</sup>]

- I have correctly identified Antoni's primary appraisal as stressful; harm/loss.<sup>1</sup>
- I have provided evidence from the scenario to support this.<sup>2</sup>
- I have correctly identified Antoni's secondary appraisal as the assessment of not having adequate coping resources.<sup>3</sup>
- I have provided evidence from the scenario to support this.<sup>4</sup>
- I have referred to the character's name in my response (Antoni), and to the scenario.

Other acceptable responses could include:

- You may have said Antoni appraised the stressor as a threat to his ability to live in a house and have a good life
- b [Antoni is likely in resistance<sup>1</sup>][seen in his display of resistance characteristics such as his susceptibility to colds due to the prolonged release of cortisol.<sup>2</sup>]

- I have correctly identified that Antoni is experiencing resistance.<sup>1</sup>
- I have provided evidence from the scenario that supports the resistance stage.<sup>2</sup>
- I have referred to the character's name in my response (Antoni), and to the scenario.

Other acceptable responses could include:

- Other justifications for Antoni experiencing resistance including the ability to continue to fight the stressor at an above normal level of functioning and/or his focussing of energy only on the stressor of his house

- c [Coping flexibility refers to the ability to adjust coping strategies in the face of the unique or changing demands of a stressor.<sup>1</sup>][Antoni is demonstrating coping flexibility<sup>2</sup>][seen in his change in approach to focus on repairing one room as his money ran out.<sup>3</sup>]

- I have described the concept of coping flexibility.<sup>1</sup>
- I have correctly identified that Antoni is demonstrating coping flexibility.<sup>2</sup>
- I have described how Antoni demonstrated coping flexibility.<sup>3</sup>
- I referred to the character's name in my response (Antoni), and to the scenario.

- 12 [Approach coping involves directly confronting the source of stress,<sup>1</sup>][for example, by making a list of steps needed to overcome a stressor and completing it step-by-step.<sup>2</sup>][On the other hand, avoidance coping involves evading the stressor and focusing attention away from it,<sup>3</sup>][for example, by denying the existence of a stressor.<sup>4</sup>]

- I have explained what approach coping involves using a feature that can be contrasted to avoidance

- I have provided an example of an approach coping strategy.<sup>2</sup>
- I have explained what avoidance coping involves, contrasting a feature with approach coping.<sup>3</sup>
- I have provided an example of avoidance coping.<sup>4</sup>
- I have used an appropriate distinguishing phrase, such as 'on the other hand'.
- 13** [Secondary appraisal involves an assessment of the coping resources available and needed to confront a stressor.<sup>1</sup>] [For example, if the stressor is an upcoming examination, a secondary appraisal could be a judgement of how many hours are needed to study each day, and deciding whether these hours will be enough to cope.<sup>2</sup>]
- I have outlined what secondary appraisal involves.<sup>1</sup>
- I have provided an example of a secondary appraisal.<sup>2</sup>
- 14 a** [Cecilia likely made the primary appraisal of the stressor being a stressful; threat<sup>1</sup>] [evident in her immediate horror and fear for her future health.<sup>2</sup>] [On the other hand, Andrew likely made the primary appraisal of the stressor being irrelevant,<sup>3</sup>] [as he immediately dismissed a diagnosis of Parkinson's disease as impossible for Cecilia given her age.<sup>4</sup>]
- I have correctly identified Cecilia's primary appraisal as stressful; threat.<sup>1</sup>
- I have provided evidence from the scenario to support this.<sup>2</sup>
- I have correctly identified Andrew's primary appraisal as irrelevant.<sup>3</sup>
- I have provided evidence from the scenario to support this.<sup>4</sup>
- I have used the language of Lazarus and Folkman's Transactional Model, referring to stressful; threat and irrelevant.
- I have referred to the character's name in my response (Cecilia and Andrew), and to the scenario.
- Other acceptable responses could include:
- You may have identified Andrew's appraisal as benign-positive if you justified it appropriately using the scenario
- b** [If Cecilia's muscle shakiness is due to Parkinson's, this would be due to dysfunction of the neurotransmitter dopamine.<sup>1</sup>] [This would cause shakiness in muscles due to neurodegeneration that causes not enough dopamine to be produced,<sup>2</sup>] [meaning insufficient motor messages are transmitted, resulting in the symptom of shaky muscles.<sup>3</sup>]
- I have identified dopamine as the neurotransmitter that has been disrupted.<sup>1</sup>
- I have identified that the dysfunction of dopamine is due to insufficient production.<sup>2</sup>
- I have described how this would result in poor motor messages, manifesting in the symptom of muscle shakes.<sup>3</sup>
- I have referred to the character's name in my response (Cecilia), and to the scenario.

### Key science skills questions

- 15 a** [The aim of this experiment was to compare the effect of life events and acculturative stress on cortisol levels.<sup>1</sup>]
- I have stated an appropriate aim for the research.<sup>1</sup>
- b** [One extraneous variable is participant differences,<sup>1</sup>] [such as how varied the stressors' significance might be to each individual (divorce and losing a job might be very different in terms of the amount of stress they cause for different people).<sup>2</sup>] [Dr Peppe could rectify this by making participants' stressors more similar, e.g. by only sampling participants who have experienced divorce, and participants who have moved from another country who have no Australian friends and family.<sup>3</sup>] [Another extraneous variable is that of non-standardised testing conditions.<sup>4</sup>] [As the study was over a ten-month period, there was no way to ensure that the conditions participants were in over this period didn't change and affect their cortisol levels.<sup>5</sup>] [Dr Peppe could rectify this by asking participants to self-report stressors that come up in their life over the testing period, to compare and track any possible extraneous variables on results more accurately.<sup>6</sup>]
- I have identified one relevant extraneous variable.<sup>1</sup>
- I have explained how this may have affected results in relation to the experiment scenario.<sup>2</sup>
- I have described a way Dr Peppe may reduce this extraneous variables in future replications of the study.<sup>3</sup>
- I have identified one other relevant extraneous variable.<sup>4</sup>
- I have explained how this may have affected results in relation to the experiment scenario.<sup>5</sup>
- I have described a way Dr Peppe may reduce this extraneous variables in future replications of the study.<sup>6</sup>
- I have referred to the character's name in my response (Dr Peppe), and to the scenario.
- Other acceptable responses could include:
- Other extraneous variables, as long as you have also explained how this may have affected the results and provided a relevant way Dr Peppe could control for them in a future experiment
- c** [As the women had been experiencing high-level stress for an extended period, they were likely in the exhaustion stage of the GAS.<sup>1</sup>] [In this stage, the body cannot sustain high levels of functioning in response to stressors, and so reactions fall below normal levels of functioning, correlating to a drop in cortisol levels.<sup>2</sup>]
- I have identified that participants would have been experiencing the exhaustion stage.<sup>1</sup>
- I have explained why this would occur in relation to the scenario, and how it corresponds to a fall in cortisol levels.<sup>2</sup>
- I have referred to the experiment scenario in my response.
- Other acceptable responses could include:
- You may have identified that the stressor was no longer present, and so they no longer were experiencing any stage in the GAS or an above-average level of cortisol

## 4A Long-term potentiation and long-term depression

### Theory review questions

- 1** **a** long-term potentiation      **b** synaptic plasticity  
**c** neural plasticity      **d** long-term depression

### Exam-style questions

#### Remember and understand

- 2** A. synapses are strengthened between neurons that are coactivated.  
**3** C. Long-term potentiation and long-term depression are equally important because their combination ensures optimal use of synaptic connections required for learning.  
**4** [Long-term depression functions to ensure the optimal amount of synaptic connections are present for learning, weakening any that are unnecessary.<sup>1</sup>] [It occurs when postsynaptic neurons within a neural pathway experience subthreshold stimulation,<sup>2</sup>] [resulting in the weakening of certain neural connections/memory traces that are not regularly activated.<sup>3</sup>]

I have described a function of long-term depression.<sup>1</sup>

I have explained that it occurs due to the low-intensity or subthreshold stimulation of postsynaptic neurons.<sup>2</sup>

I have explained that it results in the weakening of neural connections or memory traces.<sup>3</sup>

Other acceptable responses could include:

Other functions of long-term depression, such as:

- Long-term depression works alongside long-term potentiation to allow for the optimal strength and number in neural connections for learning.
- Long-term depression allows for new memories to replace unnecessary memories.

#### Apply and analyse

- 5** A. long-term potentiation  
**6** B. long-term depression  
**7** A. the restrengthening of previously formed synapses.  
**8** [Duncan's employees would experience long-term potentiation, which would operate to strengthen the connection between neurons required to perform the new typing method that are repeatedly coactivated.<sup>1</sup>] [Long-term depression would operate to weaken the memory trace of the previous typing method as the new one was learned. This would be due to the postsynaptic neurons involved in the old method being suboptimally stimulated.<sup>2</sup>]

I have explained the role of long-term potentiation in learning the new typing method.<sup>1</sup>

I have explained the role of long-term depression in learning the new typing method, explaining that it would weaken the neural connections used in the old method.<sup>2</sup>

I have used phrases relating to long-term potentiation such as 'repeatedly coactivated', and phrases relating to long-term depression, such as 'suboptimal stimulation of postsynaptic neurons'.

I have referred to the character's name in my response (Duncan), and to the scenario.

- 9** **a** [At parts A and C of the graph, long-term potentiation is functioning to strengthen Orla's accuracy.<sup>1</sup>] [This is because the memories and neural associations required to aim accurately are, over time, being strengthened with practice.<sup>2</sup>] [because of the strengthening of the synapses that are repeatedly coactivated during Orla's practice.<sup>3</sup>]

I have correctly identified the process as long-term potentiation.<sup>1</sup>

I have explained that Orla's rise in accuracy is due to experience-dependent strengthening of relevant memories and associations.<sup>2</sup>

I have explained the neural process behind this strengthening of memories.<sup>3</sup>

I have referred to the character's name in my response (Orla), and to the scenario.

- b** [As Orla was shooting instead of practising archery for a one-year period, her archery accuracy would have decreased due to long-term depression.<sup>1</sup>] [because of the subthreshold activation of postsynaptic neurons in the neural pathways required for archery, and the subsequent weakening of the relevant memory trace in favour of memory traces required instead for shooting.<sup>2</sup>]

I have described that Orla's experience of less frequent practice would have led to long-term depression.<sup>1</sup>

I have described the neural process behind long-term depression, referring to subthreshold stimulation of postsynaptic neurons.<sup>2</sup>

I have referred to the character's name in my response (Orla), and to the scenario.

#### Questions from multiple lessons

- 10** B. avoidance coping.  
**11** A. long-term potentiation  
**12** [During long-term potentiation, postsynaptic neurons have receptor sites (locks),<sup>1</sup>] [that repeatedly get activated by neurotransmitter (keys)<sup>2</sup>] [that cause them to send a neural message to other neurons, strengthening the neural pathway that consistently experiences this lock-and-key process.<sup>3</sup>]
- I have explained the role of receptor sites as locks in long-term potentiation.<sup>1</sup>
- I have explained the role of neurotransmitters as keys in long-term potentiation.<sup>2</sup>
- I have explained that the repetition of the lock-and-key process in a neural pathway causes it to strengthen in long-term potentiation.<sup>3</sup>

- 13 a** [Pia likely could not perform well due to being in the exhaustion stage.<sup>1</sup>] [Because of this, Pia's immunity had weakened and her cortisol levels were reduced, meaning she could not achieve her best.<sup>2</sup>]

I have explained why Pia could not perform well due to being in the exhaustion stage of the General Adaptation Syndrome.<sup>1</sup>

I have provided evidence from the scenario to support Pia being in the exhaustion stage.<sup>2</sup>

I have referred to the character's name in my response (Pia), and to the scenario.

- b** [Pia likely feels less stressed because long-term potentiation<sup>1</sup>] [has helped to strengthen many of the memories for skills that she uses at gradings, meaning Pia no longer sees gradings as a significant source of distress.<sup>2</sup>] [This occurs due to the long-lasting strengthening of neural connections between neurons that are repeatedly coactivated through her practice.<sup>3</sup>]

I have identified long-term potentiation as the relevant component of neural plasticity.<sup>1</sup>

I have explained why this process would ease Pia's stress with reference to memory.<sup>2</sup>

I have explained the neural processes behind long-term potentiation.<sup>3</sup>

I have referred to the character's name in my response (Pia), and to the scenario.

#### Key science skills

- 14 a** [The researcher likely used rats as regular brain scans in humans would have been too invasive/difficult to conduct.<sup>1</sup>]

I have provided one reason the researcher would have used rats rather than humans.<sup>1</sup>

I have referred to the experiment scenario in my response.

Other acceptable responses could include:

- That because rats have shorter lifespans, viewing their brain scans over just a few weeks might be enough of an indication of changes relating to plasticity, whereas in humans a longer time period might be needed
- Other reasons, so long as they were relevant to the particular research scenario

- b** [No,<sup>1</sup>] [because the sample of rats is a different species to humans, and so would not be reflective of the true nature of plasticity in their brains.<sup>2</sup>]

I have correctly identified that the researcher couldn't generalise to humans.<sup>1</sup>

I have provided a reason as to why the researcher could not generalise, with reference to the sample not being representative of a human population.<sup>2</sup>

I have referred to the experiment scenario in my response.

## 4B Neurotransmitters and neurohormones

### Theory review questions

- |            |                  |          |              |
|------------|------------------|----------|--------------|
| <b>1 a</b> | Neurotransmitter | <b>b</b> | Glutamate    |
|            |                  | <b>c</b> | Neurohormone |
|            |                  | <b>d</b> | Adrenaline   |

### Exam-style questions

#### Remember and understand

- 2 A. exciting postsynaptic neurons, making them more likely to fire and strengthen connections.
- 3 D. Classification - A neurohormone; Role - Helps to consolidate emotionally arousing experiences.
- 4 [Neurotransmitters are chemicals that are sent across the synapse to another neuron,<sup>1</sup>] [such as glutamate.<sup>2</sup>] [Contrastingly, neurohormones are released instead into the bloodstream<sup>3</sup>] [such as adrenaline.<sup>4</sup>]

I have explained that neurotransmitters are released into the synapse/sent between neurons.<sup>1</sup>

I have provided an example of a neurotransmitter.<sup>2</sup>

I have explained that neurohormones are released into the bloodstream.<sup>3</sup>

I have provided an example of a neurohormone.<sup>4</sup>

I have used an appropriate distinguishing word, such as 'contrastingly'.

#### Apply and analyse

- 5 B. glutamate
- 6 C. adrenaline
- 7 [Gough would have experienced the release of adrenaline during his heightened emotional experience with the snake.<sup>1</sup>] [The release of adrenaline would stimulate the release of noradrenaline which activates the amygdala. After being activated, the amygdala is then able to help consolidate the emotional memory.<sup>2</sup>]

I have correctly identified the neurohormone involved as adrenaline.<sup>1</sup>

I have explained its role in consolidating emotional memories.<sup>2</sup>

I have referred to the character's name in my response (Gough), and to the scenario.

#### Questions from multiple lessons

- 8 A. acts as a key that must fit into the right lock or receptor site.
- 9 a [Adrenaline is the neurohormone<sup>1</sup>] [likely involved in the consolidation of Hien's embarrassing memory, as it is responsible for the consolidation of emotionally arousing memories.<sup>2</sup>]

I have correctly identified adrenaline as the relevant neurohormone.<sup>1</sup>

I have explained adrenaline's role in consolidating emotionally arousing memories.<sup>2</sup>

I have referred to the character's name in my response (Hien), and to the scenario.

**b** [Long-term depression is caused by the repeated subthreshold stimulation of postsynaptic responses causing a memory trace/neural pathway to weaken.<sup>1</sup>] [In Hien's case, this would be the low stimulation of neurons in memory traces/neural pathways responsible for speaking Russian as he instead learns French, leading to him forgetting how to speak Russian.<sup>2</sup>]

I have described how long-term depression occurs.<sup>1</sup>

I have explained how this would have led to Hien forgetting to speak Russian.<sup>2</sup>

I have referred to the character's name in my response (Hien), and to the scenario.

**10 a** [Abbi would have been experiencing alarm reaction, shock.<sup>1</sup>] [During this time, she experienced a temporary decrease in resistance to a stressor, clear in her activation of the 'freeze response' as she stood still in fear.<sup>2</sup>]

I have correctly identified the stage as alarm reaction, shock.<sup>1</sup>

I have described what is involved in experiencing shock with reference to the scenario.<sup>2</sup>

I have referred to the character's name in my response (Abbi), and to the scenario.

**b** [Adrenaline.<sup>1</sup>]

I have correctly identified the neurohormone as adrenaline.<sup>1</sup>

**c** [Abbi would have likely appraised the stressor as stressful and a threat<sup>1</sup>] [because she perceived the stressor of being lost and alone as having a potential to cause her harm in the future, if she didn't find her dad.<sup>2</sup>]

I have identified a relevant primary appraisal for Abbi.<sup>1</sup>

I have explained how Abbi would have appraised the stressor this way.<sup>2</sup>

I have used the language of primary appraisal, referring to threat or harm/loss.

I have referred to the character's name in my response (Abbi), and to the scenario.

### Key science skills

**11** C. long-term potentiation.

**12** A. Glutamate, an important neurotransmitter in learning.

**13** D. objective quantitative data.

## Chapter 4 test

### Multiple choice questions

**1** D. long-term potentiation.

**2** B. a challenge.

**3** A. neurotransmitters are released into the synaptic gap, while neurohormones are released into the bloodstream.

**4** D. glutamate, GABA.

- 5** B. A long-lasting decrease in neural communication following a subthreshold activation of a synaptic pathway.
- 6** C. The sympathetic and parasympathetic nervous system, respectively.
- 7** C. Adrenaline, as a neurohormone into Bobby's bloodstream.
- 8** A. Bobby was experiencing eustress, as he viewed the stressor of the date as positive.
- 9** B. Acting as an excitatory neurohormone released across the synaptic gap.
- 10** A. An increased number of connections at the synapse.

### Short answer questions

**11 a** [In learning Italian, Enya experienced long-term potentiation.<sup>1</sup>] [This involved a long-lasting increase in synaptic strength of the neural pathways representing her language learning, as Enya became more fluent over time through increased activation of these neural pathways.<sup>2</sup>]

I have identified that the process of long-term potentiation occurred.<sup>1</sup>

I have explained the process of learning Italian with reference to the neural processes involved in long-term potentiation, specifically to the increase in synaptic strength following repeated co-activation of neurons in a pathway.<sup>2</sup>

I have referred to the character's name in my response (Enya), and to the scenario.

**b** [Long-term depression refers to the long-lasting weakening of the synaptic strength of a neural pathway following a repeated low-intensity stimulation of postsynaptic neurons, resulting in a weakening of synaptic connections.<sup>1</sup>] [After Enya returned home from Italy, she experienced long-term depression due to no longer activating the neural pathways representing her language-learning, which meant that after two years she was unable to speak Italian as the memory trace was weakened.<sup>2</sup>]

I have provided a relevant description of long-term depression.<sup>1</sup>

I have explained how Enya forgot to speak Italian with reference to the process of long-term depression, specifically that this occurred due to a lack of activation of a neural pathway/memory trace.<sup>2</sup>

I have referred to the character's name in my response (Enya), and to the scenario.

**12 a** [Long-term potentiation.<sup>1</sup>]

I have identified long-term potentiation as the neural process involved in Kevin's learning.<sup>1</sup>

**b** [Glutamate is the primary excitatory neurotransmitter responsible for processes of memory and learning.<sup>1</sup>] [The function of glutamate is to excite neurons, making them more likely to fire an action potential.<sup>2</sup>] [As Kevin practises, glutamate works to strengthen the neural pathways representing his learning of how to play the flute.<sup>3</sup>]

- I have identified glutamate as the primary excitatory neurotransmitter responsible for processes of learning how to play the flute.<sup>1</sup>
- 
- I have explained glutamate's excitatory role.<sup>2</sup>
- 
- I have explained the role of glutamate in Kevin's learning, with reference to its excitatory role in promoting the neural transmission of information.<sup>3</sup>
- 
- I have referred to the character's name in my response (Kevin), and to the scenario.
- 
- c [Adrenaline is a neurohormone that plays a role in the consolidation of emotionally arousing memories.<sup>1</sup> During a stress response, adrenaline is released into the bloodstream and aids in the encoding of the stressful event.<sup>2</sup> The crashing of the drum-kit triggered Kevin's stress response and the release of adrenaline, which resulted in the heightened consolidation of the event, meaning Kevin was able to recall his music lesson in greater detail than other lessons.<sup>3</sup>]
- 
- I have stated that adrenaline is a neurohormone with a role in consolidating emotionally arousing experiences.<sup>1</sup>
- 
- I have stated that adrenaline is released during a stress response.<sup>2</sup>
- 
- I have explained that the release of adrenaline during Kevin's stress response aided in his encoding of the event, allowing for more detailed recall.<sup>3</sup>
- 
- I have referred to the character's name in my response (Kevin), and to the scenario.
- 

- 13 [Both neurotransmitters and neurohormones are chemical messages released by neurons.<sup>1</sup> However, while neurotransmitters are released by a presynaptic neuron into the synaptic gap, neurohormones are released into the bloodstream.<sup>2</sup>]

- 
- I have outlined one similarity between neurotransmitters and neurohormones.<sup>1</sup>
- 
- I have outlined one difference between neurotransmitters and neurohormones.<sup>2</sup>
- 
- I have used an appropriate distinguishing word, such as 'however'.
- 

Other acceptable responses could include:

Similarities:

- Both neurotransmitters and neurohormones convey information and have an effect on functioning.

Differences:

- Because neurotransmitters bind directly to a postsynaptic neuron, they can have a more immediate effect than neurohormones released into the bloodstream.
- Neurotransmitters' actions are short-lived while neurohormones act for longer periods of time.
- Neurotransmitters can be excitatory or inhibitory, while neurohormones do not experience this distinction in function.

### Key science skills questions

- 14 a [Matched-participants experimental design was used.<sup>1</sup> One benefit of this design is that it helps control for individual participant differences, such as in cognition and memory.<sup>2</sup>]
- 
- I have identified matched-participants as the research design used.<sup>1</sup>
- 
- I have stated a benefit of this research design.<sup>2</sup>
- 
- b [Dr Wylie used convenience sampling,<sup>1</sup> acquiring readily available participants through an advertisement.<sup>2</sup> A limitation of this method is that the study's sample may not be representative of the research population.<sup>3</sup>]
- 
- I have identified that convenience sampling was used.<sup>1</sup>
- 
- I have described how convenience sampling was used, with reference to the scenario.<sup>2</sup>
- 
- I have identified a possible limitation of convenience sampling.<sup>3</sup>
- 
- I have referred to the character's name in my response (Dr Wylie), and to the scenario.
- 
- c [Adrenaline has a role in the consolidation of emotionally-arousing memories. Participants who were exposed to low-level electric shock treatment were put under stress and experienced the release of adrenaline due to their state of high arousal.<sup>1</sup> The presence of adrenaline during learning heightened their consolidation, allowing these participants to demonstrate greater recall the next day as compared to participants not exposed to the experimental condition.<sup>2</sup>]
- 
- I have stated that participants in the experimental group experienced the release of adrenaline, due to their state of high arousal.<sup>1</sup>
- 
- I have explained that the presence of adrenaline likely aided memory consolidation, allowing participants in the experimental condition to display greater recall than the control condition.<sup>2</sup>
- 
- I have referred to the experiment scenario in my response.
- 
- d [A possible confounding variable was the use of convenience sampling.<sup>1</sup> Through selecting the most readily available participants, Dr Wylie may not have obtained a representative sample, limiting the generalisability of the study's results to the research population.<sup>2</sup>]
- 
- I have stated a possible confounding variable.<sup>1</sup>
- 
- I have explained the possible impact of this confounding variable on the study's results.<sup>2</sup>
- 
- I have referred to the character's name in my response (Dr Wylie), and to the scenario.
- 
- Other acceptable responses could include:
- Experimenter bias: Dr Wylie may have unintentionally influenced the study's results through their personal bias or experimenter expectations.

- Other potential confounding variables, so long as they were relevant to and justified in line with the scenario.
- e [Internal validity refers to whether or not a study measures what it claims to measure, that is, the effect of the independent variable (IV) on the dependent variable (DV). Dr Wylie's study demonstrated internal validity<sup>1</sup> through controlling for extraneous variables, such as individual participant differences, meaning changes to the DV were more likely to be a result of the IV only.<sup>2</sup>]

I have described internal validity and stated whether the results of Dr Wylie's experiment are internally valid or not.<sup>1</sup>

I have provided a justification for my response.<sup>2</sup>

I have referred to the character's name in my response (Dr Wylie), and to the scenario.

Other acceptable responses could include:

- It may be argued that Dr Wylie's experiment did not demonstrate internal validity given appropriate justification. For example, the presence of extraneous variables such as individual participants differences and non-standardised procedures.

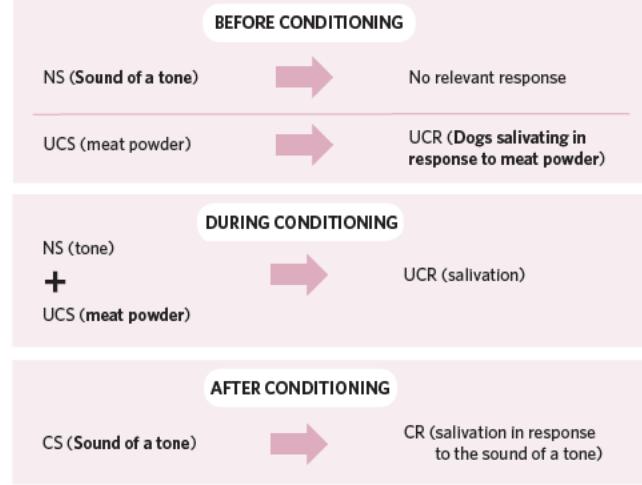
## 5A Classical conditioning

### Theory review questions

- 1 a Classical conditioning      b Extinction  
 c Unconditioned stimulus      d Unconditioned response  
 e Neutral stimulus      f Acquisition  
 g Conditioned stimulus      h Stimulus generalisation  
 i Conditioned response      j Stimulus discrimination  
 k Spontaneous recovery
- 2 C. W - Before conditioning; X - Unconditioned response;  
 Y - Unconditioned stimulus; Z - Conditioned response
- 3 B. X - Acquisition; Y - Extinction; Z - Spontaneous recovery

4 Stage	Steps
Before conditioning	1. Pavlov checked to see that the sound of the tone did not make the dogs salivate. 2. Pavlov checked to see that the meat powder did cause the dogs to salivate.
During conditioning	3. Pavlov presented the meat powder and the sound of the tone together several times, each time the dogs would salivate in response.
After conditioning	4. The sound of the tone alone caused the dogs to salivate.

5



### Exam-style questions

#### Remember and understand

- 6 B. the stimulus that gives no relevant response.  
 7 D. stimuli similar to the conditioned stimulus also elicit the conditioned response.  
 8 C. spontaneous recovery occurring.  
 9 B. conditioned response.  
 10 a [Katherine's dog didn't come to her when she used the new whistle due to stimulus discrimination.]  
 b [If Katherine's dog had responded to the sound of the new whistle that he wasn't trained with, this would be an example of stimulus generalisation.]

- I have correctly named stimulus discrimination as the relevant process of classical conditioning.  
  I have referred to the character's name in my response (Katherine), and to the scenario.

- b [If Katherine's dog had responded to the sound of the new whistle that he wasn't trained with, this would be an example of stimulus generalisation.]

I have correctly named stimulus generalisation as the relevant process of classical conditioning.

I have referred to the character's name in my response (Katherine), and to the scenario.

### Apply and analyse

- 11 D. the response is involuntary.  
 12 [Extinction is the decrease in the conditioned response until the conditioned stimulus no longer produces the conditioned response.]  
 [If Dr Chanto presents the apple (conditioned stimulus) without striking the iron bar (unconditioned stimulus) for a period of time,  
 [the association will decrease and the monkey will become less fearful of the apple (conditioned response) until eventually, the apple does not produce a fear response anymore.]
- I have defined extinction.
- I have outlined that in order for extinction to occur, the CS should be presented without the UCS over repeated trials.
- I have explained that this would cause a decrease in the likelihood of the CR occurring.
- I have used the language of classical conditioning, by referring to the CR, CS, and UCS.
- I have referred to the character's name in my response (Dr Chanto), and to the scenario.
- 13 a [The short amount of time (about half a second) between the presentation of the unconditioned stimulus (UCS) and neutral stimulus (NS) is important because it allows for a strong association to be formed.]  
 [If there is a long period of time between the presentation of the two in Pavlov's experiment, the association wouldn't be as immediate or strong, making it less likely for conditioning to occur.]
- I have outlined that the timing of the presentation of the stimuli affects the strength of the association formed.
- I have given a reason for why this timing is important.
- I have used the language of classical conditioning, by referring to the UCS and NS.
- I have referred to the scenario in my response, by referring to Pavlov's experiment.
- b [The neutral stimulus (NS) must be presented before the unconditioned stimulus (UCS) because if not, the dogs might not pay attention to the neutral stimulus (NS) and therefore not make the association between the two stimuli.]
- I have explained the role of the learner's attention in regards to the order of the presentation of stimuli.
- I have used the language of classical conditioning, by referring to the UCS and NS.
- I have referred to the scenario in my response, by referring to the dogs in Pavlov's experiment.

### Questions from multiple lessons

**14** B. adrenaline

**15** [Long-term potentiation is the strengthening of the connection between neurons following their repeated co-activation. This occurs during learning.<sup>1</sup>] [Each time Hannah was bitten by the bull ant, the neurons that are associated with seeing the bull ant and those associated with the pain she felt from the bite repeatedly fire together and became strengthened, causing her to learn to fear bull ants.<sup>2</sup>]

I have defined long-term potentiation.<sup>1</sup>

I have outlined how long-term potentiation occurs in this scenario.<sup>2</sup>

I have referred to the character's name in my response (Hannah), and to the scenario.

**16** [Liam developed a fear of clowns through classical conditioning, as he associated the fear he experienced in response to the sound of the balloons popping and seeing the clown.<sup>1</sup>] [Adrenaline is a neurohormone that is involved in the consolidation of emotional memories.<sup>2</sup>] [When Liam was scared by the sound of the balloons popping, adrenaline was released and it helped to consolidate this memory that led to his fear of clowns.<sup>3</sup>]

I have outlined the development of Liam's fear of clowns through the process of classical conditioning.<sup>1</sup>

I have outlined that adrenaline is involved in the consolidation of emotional memories.<sup>2</sup>

I have explained how adrenaline is involved in the development of Liam's conditioned fear response.<sup>3</sup>

I have referred to the character's name in my response (Liam), and to the scenario.

**17** [Cej should be cautious about generalising her results because the sample size of her experiment is too small (only one cat) and may not be representative of all cats.<sup>1</sup>]

I have identified a reason Cej should be careful generalising her results.<sup>1</sup>

I have referred to the character's name in my response (Cej), and to the scenario.

Other acceptable responses could include:

- The sample is not representative of the population
- The results might not be statistically significant
- The influence of confounding variables on the results

**18** **a** [Independent variable: the type of neutral stimulus<sup>1</sup>]

[Dependent variable: number of students who acquired the conditioned response.<sup>2</sup>]

I have correctly identified the independent variable.<sup>1</sup>

I have correctly identified the dependent variable.<sup>2</sup>

**b** [Quentin could have used stratified sampling to conduct his experiment.<sup>1</sup>] [In order to do this he could have divided the school population into strata, such as year levels, and taken a sample from each stratum that was representative of the population.<sup>2</sup>]

I have identified another type of sampling method (other than convenience).<sup>1</sup>

I have described this sampling method.<sup>2</sup>

I have referred to the character's name in my response (Quentin), and to the scenario.

Other acceptable responses could include:

- Random sampling

**c** [Stimulus generalisation<sup>1</sup>] [occurs when a stimulus similar to the conditioned stimulus also produces the conditioned response.<sup>2</sup>] [The seven students in class 7A flinched when they were presented with the picture of the penguin because of stimulus generalisation. Their conditioned stimulus (the picture of the crow) is similar to the picture of the penguin as both pictures are of birds, are likely dark in colour and with feathers.<sup>3</sup>] [As such, the students demonstrated the conditioned response of flinching despite being presented with a stimulus slightly different to the original stimulus present during conditioning (picture of a crow rather than penguin) associated with the screeching sound (UCS).<sup>4</sup>]

I have identified the key term stimulus generalisation.<sup>1</sup>

I have described the process of stimulus generalisation.<sup>2</sup>

I have identified that the stimuli used in the experiment were similar.<sup>3</sup>

I have outlined why stimulus generalisation occurred in this scenario.<sup>4</sup>

I have used the language of classical conditioning, by referring to the NS, UCS, UCR, CS, CR.

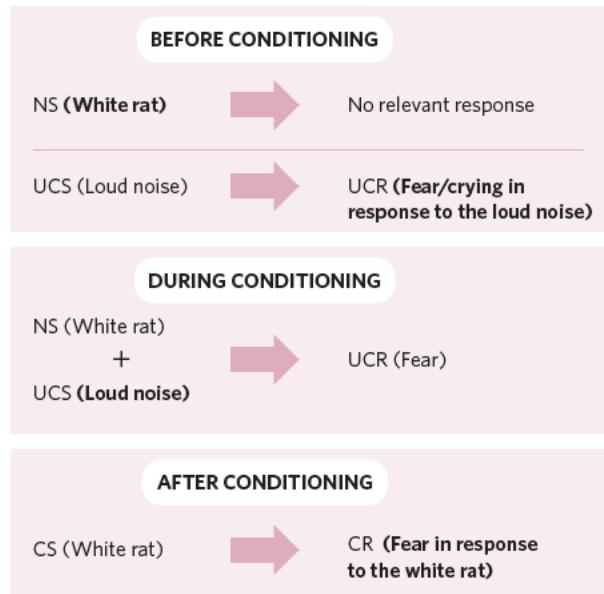
I have referred to the scenario in my response, by referring to the experiment.

## 5B The Little Albert experiment

### Theory review questions

- |          |                           |                            |
|----------|---------------------------|----------------------------|
| <b>1</b> | <b>a</b> Informed consent | <b>b</b> Withdrawal rights |
| <b>c</b> | Debriefing/deconditioning | <b>d</b> No-harm principle |
| <b>e</b> | Beneficence               |                            |

2

**Exam-style questions**

- 3 A. Withdrawal rights when Little Albert demonstrated severe distress.  
 4 C. fear in response to the loud noise of the hammer striking the metal bar.  
 5 A. the white rat.  
 6 [One ethical standard that was not observed in the Little Albert experiment was the no-harm principle.<sup>1</sup>] During the experiment, Little Albert showed great psychological distress. Further, he was not deconditioned at the end of the study, meaning that there could have been ongoing psychological harm experienced.<sup>2</sup>

- I have identified one relevant ethical standard that was not observed.<sup>1</sup>  
  I have explained how this ethical standard was not observed in the experiment.<sup>2</sup>  
  I have referred specifically to elements of the Little Albert experiment.

Other acceptable responses could include:

- Withdrawal rights
- Beneficence
- Confidentiality
- Informed consent
- Debriefing/deconditioning

**Questions from multiple lessons**

- 7 B. Adrenaline  
 8 [Little Albert's sympathetic nervous system was dominant when he was scared of the white rat.<sup>1</sup>]

- I have identified that the sympathetic nervous system was dominant.<sup>1</sup>

- 9 [Little Albert's pupils would have dilated,<sup>1</sup>] and his heart rate would have increased when he saw the white rat after conditioning.<sup>2</sup>

- I have listed one nervous system change.<sup>1</sup>

- I have listed a second nervous system change.<sup>2</sup>

Other acceptable responses could include:

- Other nervous system changes due to sympathetic nervous system activation
- 10 a [Long-term depression occurs when there is repeated low intensity stimulation of the postsynaptic neurons involved in the neural pathway representing the learned fear response.<sup>1</sup>] Over time, if the white rat (conditioned stimulus) is repeatedly presented without the unconditioned stimulus (loud sound), then the memory pathway of this learned response would weaken until the response is no longer exhibited.<sup>2</sup>]

- I have explained that long-term depression is caused by the repeated low intensity stimulation of the postsynaptic neurons.<sup>1</sup>
- I have explained how long-term depression is involved in the extinction of a learned response.<sup>2</sup>
- I have referred specifically to elements of the Little Albert experiment.
- b [Following a period of extinction, Little Albert may respond with fear again to the conditioned stimulus (the white rat), this would demonstrate spontaneous recovery of the learned response.<sup>1</sup>]
- I have outlined that Little Albert may demonstrate the conditioned fear response again, following a period of extinction.<sup>1</sup>
- I have referred specifically to elements of the Little Albert experiment.

**Key science skills**

- 11 [One limitation of the Little Albert experiment is that there was only one participant.<sup>1</sup>] As such, it is difficult to be able to generalise these results to a wider population.<sup>2</sup>

- I have identified one relevant limitation of the Little Albert experiment.<sup>1</sup>
- I have provided an explanation to justify my response.<sup>2</sup>
- I have referred specifically to elements of the Little Albert experiment.

Other acceptable responses could include:

- Only subjective data was recorded

- 12 [Watson and Rayner writing down their observations is an example of subjective qualitative data.<sup>1</sup>] One limitation of subjective qualitative data is that they are subjective, and therefore open to experimenter bias.<sup>2</sup>

- I have identified that the data is an example of subjective qualitative data.<sup>1</sup>
- I have outlined one limitation of subjective qualitative data.<sup>2</sup>

- 13 [Internal validity is the extent to which an experiment accurately measures the effect of an independent variable on a dependent variable.<sup>1</sup>] The Little Albert experiment showed medium to high internal validity,<sup>2</sup> as it was conducted in a controlled environment and using scientific methods.<sup>3</sup> External validity is the extent to which the experiment's results can be generalised to the whole population.<sup>4</sup> The Little Albert experiment showed low external validity<sup>5</sup> as the sample size was too small and unlikely to be representative of the whole population.<sup>6</sup>

- I have defined internal validity.<sup>1</sup>
  - I have identified that the Little Albert experiment has medium/high internal validity.<sup>2</sup>
  - I have provided a reason to justify my response.<sup>3</sup>
  - I have defined external validity.<sup>4</sup>
  - I have identified that the Little Albert experiment has low external validity.<sup>5</sup>
  - I have provided a reason to justify my response.<sup>6</sup>

# 5C Operant conditioning

## Theory review questions

- 1** **a** Operant conditioning      **b** Antecedent  
**c** Behaviour      **d** Consequence  
**e** Active and voluntary      **f** Reinforcement  
**g** Positive reinforcement      **h** Negative reinforcement  
**i** Punishment      **j** Response cost  
**k** Stimulus discrimination      **l** Stimulus generalisation  
**m** Extinction      **n** Spontaneous recovery  
**o** Passive and involuntary      **p** Positive punishment

**2** C. antecedent, behaviour, consequence.

**3** C. W – positive reinforcement; X – response cost; Y – reinforcement

## **Exam-style questions**

## **Remember and understand**

- 4 A. the response is not followed by the consequence previously associated with it.

5 A. voluntary, active

6 [In order for spontaneous recovery to occur in operant conditioning the behaviour must first be extinguished.<sup>1</sup>] [Once extinction has been achieved and a period of time has passed, the learner can unexpectedly show the conditioned behaviour in response to the antecedent.<sup>2</sup>]

---

I have identified that extinction comes before spontaneous recovery.<sup>1</sup>

---

I have outlined how spontaneous recovery occurs.<sup>2</sup>

---

I have used the language of operant conditioning, by referring to the antecedent, behaviour and consequence.

## Apply and analyse

- 7 D. stimulus discrimination

8 B. Megan crying.

9 A. giving Megan a chocolate.

10 D. negative reinforcement.

11 [The key difference between reinforcement and punishment is that reinforcement increases the likelihood of the behaviour being performed,<sup>1</sup>] [whereas punishment decreases the likelihood of the behaviour being performed.<sup>2</sup>] [An example of reinforcement is giving a dog a treat (positive reinforcement).<sup>3</sup>] [An example of punishment is scolding a child (positive punis  
4]

- I have described that reinforcement increases the likelihood of a behaviour occurring again.<sup>1</sup>
  - I have described that punishment decreases the likelihood of a behaviour occurring again.<sup>2</sup>
  - I have provided a clear example of either positive or negative reinforcement.<sup>3</sup>
  - I have provided a clear example of punishment or response cost.<sup>4</sup>
  - I have used an appropriate distinguishing word, such as 'whereas'.

- 12 [Phase 1: Antecedent.<sup>1</sup>][In this scenario Ginny could use the command 'speak' as the antecedent.<sup>2</sup>]

[Phase 2: Behaviour.<sup>3</sup>][In this scenario the behaviour would be Red squawking to Ginny's command.<sup>4</sup>]

[Phase 3: Consequence.<sup>5</sup>][Ginny can reinforce Red's behaviour, making him more likely to repeat it the next time she says 'speak', by giving him a cracker for squawking.<sup>6</sup>]

---

I have correctly identified the first phase as antecedent.<sup>1</sup>

---

I have identified a relevant antecedent.<sup>2</sup>

---

I have correctly identified the second phase as behaviour.<sup>3</sup>

---

I have identified the behaviour as Red squawking.<sup>4</sup>

---

I have correctly identified the third phase as consequence.<sup>5</sup>

---

I have suggested an appropriate consequence to reinforce the behaviour of squawking.<sup>6</sup>

---

I have used the language of operant conditioning, by referring to the antecedent, behaviour, consequence and reinforcement.

---

I have referred to the character's name in my response (Ginny).

- 13** [This is an example of operant conditioning where the learner, Jeremy, is being positively reinforced for using his lucky gold pen<sup>1</sup> [and is therefore more likely to repeat this behaviour the next time he is faced with the same antecedent.<sup>2</sup> [In this scenario the antecedent is competing in a high level maths competition, the behaviour is Jeremy using his lucky gold pen and the consequence is winning the competition.<sup>3</sup> ]]

---

  I have identified that positive reinforcement is occurring in this scenario.<sup>1</sup>

---

  I have outlined that due to this positive reinforcement, the learner is more likely to exhibit the behaviour again (using his gold pen).<sup>2</sup>

---

  I have outlined the antecedent, behaviour and consequence relevant to this scenario.<sup>3</sup>

---

  I have used the language of operant conditioning, by referring to the antecedent, behaviour, consequence and reinforcement.

---

  I have referred to the character's name in my response (Jeremy), and to the scenario.

**Questions from multiple lessons**

- 14** A. classical conditioning, operant conditioning
- 15** B. is an involuntary response, whereas running indoors is a voluntary response.
- 16** a [When Judd is feeling stressed, his sympathetic nervous system is activated making his heartbeat race and his palms feel sweaty.<sup>1</sup>] [When he meditates, Judd is engaging his parasympathetic nervous system which counteracts his sympathetic nervous system, slowing down his heart rate and making him feel calmer.<sup>2</sup>]
- I have identified that Judd's sympathetic nervous system is active when he is feeling stressed.<sup>1</sup>
- I have explained that when Judd meditates, he is engaging in his parasympathetic nervous system which makes him feel calm.<sup>2</sup>
- I have referred to the character's name in my response (Judd), and to the scenario.
- b** [Judd's consequence is an example of negative reinforcement,<sup>1</sup>] [as it is removing his feeling of stress and makes him more likely to engage in the behaviour again.<sup>2</sup>]
- I have identified that the type of consequence is negative reinforcement.<sup>1</sup>
- I have given a reason to justify my response.<sup>2</sup>
- I have referred to the character's name in my response (Judd), and to the scenario.
- 17** [When Dylan was teaching Simba how to jump through the hoop, he used the principles of operant conditioning.<sup>1</sup>] [The antecedent is the hoop, the behaviour is Simba walking through the hoop then jumping through the hoop, and the consequence was Dylan giving Simba positive reinforcement in the form of a treat.<sup>2</sup>] [Principles of classical conditioning can also be seen in the scenario as Simba now excitedly runs around when he anticipates that Dylan will go get the hoop.<sup>3</sup>] [The hoop was originally a neutral stimulus that has become a conditioned stimulus through pairings with the treat (an unconditioned stimulus). The treat originally produced an unconditioned response of excitement. Now Simba demonstrates the conditioned response of excitement to the conditioned stimulus of the hoop.<sup>4</sup>]
- I have identified that operant conditioning is occurring in this scenario.<sup>1</sup>
- I have correctly identified the antecedent, behaviour and consequence in the scenario.<sup>2</sup>
- I have identified that classical conditioning is occurring in the scenario.<sup>3</sup>
- I have correctly identified processes of classical conditioning that are occurring, by referring to the NS, UCS, UCR, CS and CR.<sup>4</sup>
- I have referred to the character's names in my response (Dylan and Simba), and to the scenario.

**Key science skills**

- 18** a [Independent variable: type of reinforcement, whether positive (receiving a lolly) or negative (being let out of class 1 minute early).<sup>1</sup>] [Dependent variable: how long the behaviour change lasts.<sup>2</sup>]
- I have correctly identified the independent variable.<sup>1</sup>
- I have correctly identified the dependent variable.<sup>2</sup>
- b** [It is hypothesised<sup>1</sup>] [that changing a person's behaviour through positive reinforcement (giving them a lolly) will have a more sustained change than through use of negative reinforcement (letting them out of class one minute early).<sup>2</sup>]
- I have started my hypothesis with 'It is hypothesised that'.<sup>1</sup>
- I have included the independent and dependent variables.<sup>2</sup>
- I have stated the direction of my hypothesis.
- c** [Independent groups design<sup>1</sup>]
- I have correctly identified the experiment design.<sup>1</sup>
- Other acceptable responses could include:
- Between groups design
- d** [A repeated measures experiment design involves using the same group of participants for both conditions.<sup>1</sup>] [For Kurt's experiment, this would mean that participants have already been reinforced in one condition to produce a particular behaviour (either using positive or negative reinforcement first) when exposed to the second condition.<sup>2</sup>] [This impacts the duration of participants' behaviour change (dependent variable) in the second condition as participants have already been reinforced to produce this behaviour over time, therefore not working for Kurt's experiment.<sup>3</sup>]
- I have described that a repeated measure design involves using the same participants in either condition.<sup>1</sup>
- I have explained how repeated measures would operate in this experiment.<sup>2</sup>
- I have explained why this would be problematic.<sup>3</sup>
- I have referred to the character's name in my response (Kurt), and to the scenario.

## 5D Observational learning

**Theory review questions**

- |          |                          |                 |              |            |               |
|----------|--------------------------|-----------------|--------------|------------|---------------|
| <b>1</b> | a Attention              | b Reinforcement |              |            |               |
|          | c Reproduction           | d Motivation    |              |            |               |
|          | e Retention              | f Model         |              |            |               |
|          | g Social learning theory |                 |              |            |               |
| <b>2</b> | ATTENTION                | RETENTION       | REPRODUCTION | MOTIVATION | REINFORCEMENT |
|          | 1                        | 2               | 3            | 4          | 5             |

## Exam-style questions

### Remember and understand

- 3 D. the learner having the physical and mental ability to perform the behaviour.
- 4 A. the model is more similar to themselves.
- 5 [Retention occurs when the learner forms a mental representation of what they have just observed.<sup>1</sup>] [This is important in observational learning, because the learner must remember what they have seen in order to reproduce the behaviour.<sup>2</sup>]

I have described retention as the learner forming a mental representation of their observations.<sup>1</sup>

I have described the role of retention.<sup>2</sup>

### Apply and analyse

- 6 B. reproduction as she had the physical and mental ability to sing.
- 7 B. attention, retention, motivation, reinforcement
- 8 A. attention and retention
- 9 a [Cairo must pay close attention to detail while watching the ladies knit. This is the first step he must complete in order to successfully learn through observation.<sup>1</sup>] [In terms of reproduction, Cairo must be mentally and physically able to knit in order to learn. For example, he must have the dexterity in his hands and fingers to be able to hold the knitting needles correctly.<sup>2</sup>]

I have outlined the stage of attention, with reference to the scenario.<sup>1</sup>

I have outlined the stage of reproduction, with reference to the scenario.<sup>2</sup>

I have referred to the character's name in my response (Cairo), and to the scenario.

- b [Vicarious reinforcement occurs when the learner sees a model being reinforced for behaviour and also wants to perform the behaviour, even though they didn't receive the reinforcement directly.<sup>1</sup>] [In this example, Cairo might have seen the positive reinforcement of praise when one of the ladies successfully completed a knitted piece. He might have experienced this reinforcement vicariously (indirectly) and therefore wanted to reproduce the behaviour of knitting also.<sup>2</sup>]

I have described that vicarious reinforcement.<sup>1</sup>

I have explained how vicarious reinforcement could have occurred, with reference to the scenario.<sup>2</sup>

I have referred to the character's name in my response (Cairo), and to the scenario.

### Questions from multiple lessons

- 10 A. positive reinforcement
- 11 D. observational learning and operant conditioning.
- 12 C. vicarious reinforcement.
- 13 [Reinforcement plays a role in both operant conditioning and social learning theory.<sup>1</sup>] [In operant conditioning the learner experiences the reinforcement directly and in social learning theory the learner might experience reinforcement indirectly through vicarious reinforcement. Both forms of reinforcement increase the likelihood of the learner demonstrating the behaviour again.<sup>2</sup>]

I have identified a similarity between operant conditioning and social learning theory.<sup>1</sup>

I have described this similarity.<sup>2</sup>

Other acceptable responses could include:

- The learner is active in both operant conditioning and social learning theory
- The behaviour of the learner is voluntary in both operant conditioning and social learning theory

### Key science skills

- 14 a [The purpose of a control group in an experiment is to serve as a baseline for comparison, in order to establish a causal relationship between the dependent variable and the independent variable.<sup>1</sup>]

I have described the purpose of a control group.<sup>1</sup>

- b [The results show that children in groups A and B were exposed to more aggressive behaviours than the children in group C representing the control group.<sup>1</sup>] [The researcher might conclude that children who are exposed to a model displaying aggressive behaviours are more likely to demonstrate these behaviours than children not exposed to an aggressive model.<sup>2</sup>]

I have provided a description of the results.<sup>1</sup>

I have outlined a conclusion a researcher might come to.<sup>2</sup>

I have referred to the experiment in my response.

- c [Children are more likely to learn through observational learning if they identify with the model as this increases their motivation.<sup>1</sup>] [In this case Group A were exposed to a well-known sports star who they might look up to, whereas Group B were exposed to an adult unknown to them.<sup>2</sup>] [Children in Group A would have been more likely to learn from the model they were exposed to than Group B, and therefore Group A displayed more aggressive acts than Group B.<sup>3</sup>]

I have explained that children are more likely to learn with models that they identify with because it increases their motivation.<sup>1</sup>

I have identified that Group A were exposed to a model the children would have more likely identified with than Group B.<sup>2</sup>

I have explained the effect of this on the results.<sup>3</sup>

I have referred to the experiment in my response.

- 15 a [In order for fish to learn through observational learning, they would first need to actively focus their attention on the models (the cleaner fish in the video).<sup>1</sup>] [They would need to retain this information by forming a mental representation of what they had just seen, storing it as a memory.<sup>2</sup>] [They would also need to have the mental and physical capabilities to reproduce this behaviour, that is, they must be able to actually 'clean' the salmon in the same way as the fish in the videos.<sup>3</sup>]

- I have outlined the role of attention, stating that the fish would need to actively focus.<sup>1</sup>
- I have outlined the role of retention, stating that the fish would need to be able to form a mental representation.<sup>2</sup>
- I have outlined the role of reproduction, stating that the fish would need to have the physical and mental capabilities to reproduce the behaviour.<sup>3</sup>
- I have referred to the scenario in my response.
- b** [It is hypothesised that<sup>1</sup>] [cleaner fish that are exposed to a video modelling cleaning behaviour are more likely to demonstrate this behaviour than cleaner fish that are not.<sup>2</sup>]
- I have started my hypothesis with "It is hypothesised that".<sup>1</sup>
- I have included the independent and dependent variables.<sup>2</sup>
- I have stated the direction of my hypothesis.
- c** [Independent groups design<sup>1</sup>]
- I have correctly identified the experimental design as an independent groups design.<sup>1</sup>
- Other acceptable responses could include:
- Between-groups design
- d** [One advantage of an independent group design is that there aren't any order effects, which would be when the sequence in which the fish took part in the conditions has an effect on the outcome of the study.<sup>1</sup>]
- I have correctly described one advantage.<sup>1</sup>

- Other acceptable responses could include:
- Less time and/or money spent sourcing participants, such as in a matched-participants design
  - The experiment can be conducted at a faster rate through running both conditions at the same time, in contrast to a repeated-measures design
  - Participants can be randomly selected and do not require matching, allowing a greater sample size to be used and promoting greater external validity

## Chapter 5 test

### Multiple choice questions

- 1** D. punishment
- 2** B. the learner is active, while in classical conditioning they are passive.
- 3** B. Observational learning
- 4** B. Retention, because he was unable to remember all of the steps involved in folding an origami swan
- 5** A. the learner is active in both models of learning, and the behaviour is voluntary.
- 6** D. response cost, positive reinforcement
- 7** A. Little Albert's fear of white rats was not deconditioned.
- 8** A. positive reinforcement

- 9** B. the sound of the hammer striking the metal bar; fear of the white rat.
- 10** D. Little Albert showed the fear response when presented with a white mask.

### Short answer questions

- 11** [Extinction is when the conditioned stimulus no longer produces the conditioned response.<sup>1</sup>] [This could occur over time when the conditioned stimulus is presented without the unconditioned stimulus. The strength of the conditioned response would decrease until it is no longer produced.<sup>2</sup>]
- I have defined extinction.<sup>1</sup>
- I have explained how extinction occurs.<sup>2</sup>
- I have used the language of classical conditioning, by referring to the CS and UCS.
- 12** [The amygdala is involved in the encoding of emotional memories, particularly fear,<sup>1</sup>] [as in the Little Albert experiment when Little Albert learned to fear a white rat.<sup>2</sup>]
- I have identified the brain structure as the amygdala.<sup>1</sup>
- I have described the role of the amygdala in the acquisition of a conditioned fear response.<sup>2</sup>
- I have referred to the Little Albert experiment in my response.
- 13** [Bridie reacted to the beetle by screaming and kicking her leg out because of stimulus generalisation.<sup>1</sup>] [Stimulus generalisation is when stimuli that are similar to the conditioned stimulus (CS) also produce the conditioned response (CR).<sup>2</sup>] [She has developed a fear response (conditioned response) to the bee (conditioned stimulus) and has reacted in the same way to a similar stimulus (the beetle).<sup>3</sup>]
- I have identified the reason why Bridie reacted this way is due to stimulus generalisation.<sup>1</sup>
- I have defined stimulus generalisation.<sup>2</sup>
- I have explained why Bridie reacted this way.<sup>3</sup>
- I have used the language of classical conditioning, by referring to the CS and CR.
- I have referred to the character's name in my response (Bridie), and to the scenario.
- 14** [When Shaylee is asked to groom the dog by her parents (the antecedent)<sup>1</sup>] [and she does so correctly (the behaviour),<sup>2</sup>] [her parents can reward her with verbal praise (positive reinforcement) in order to encourage her to continue to properly groom the dog in the future.<sup>3</sup>]
- I have identified a relevant antecedent.<sup>1</sup>
- I have identified the behaviour as Shaylee grooming the dog.<sup>2</sup>
- I have identified a relevant example of reinforcement.<sup>3</sup>
- I have referred to the character's name in my response (Shaylee), and to the scenario.
- 15** [The role of a consequence in operant conditioning is to make the learner more or less likely to repeat the behaviour the next time they are faced with the same antecedent.<sup>1</sup>]

I have correctly outlined the role of consequence.<sup>1</sup>

- 16 [In both operant conditioning and observational learning reinforcement increases the likelihood of the learner demonstrating the behaviour again.<sup>1</sup>] However, in operant conditioning, the learner directly experiences the reinforcement, whereas in observational learning the learner doesn't need to experience it directly, but can learn through vicarious reinforcement.<sup>2</sup>]

I have outlined one similarity of reinforcement between operant conditioning and observational learning.<sup>1</sup>

I have outlined one difference of reinforcement between operant conditioning and observational learning.<sup>2</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

- 17 [David did not successfully retain the information that he observed in the retention stage of observational learning.<sup>1</sup>] Although he paid active attention and focussed on the videos of the people baking cake, he didn't form an accurate mental representation of all of the ingredients required and forgot to add sugar.<sup>2</sup>]

I have identified that David did not succeed in the retention stage of observational learning.<sup>1</sup>

I have used an example from the scenario to explain this.<sup>2</sup>

I have used the language of observational learning, referring to the retention stage.

I have referred to the character's name in my response (David), and to the scenario.

Other acceptable responses could include:

- David did not pay adequate attention to the whole video and hence missed the portion of the video that spoke about adding sugar to the cake.

### Key science skills questions

- 18 a [Convenience sampling.<sup>1</sup>]

I have identified that convenience sampling was used.<sup>1</sup>

- b [One confounding variable in this study is that students may already know how to tie their shoelaces,<sup>1</sup>] therefore they didn't actually learn this behaviour through either operant conditioning or observational learning.<sup>2</sup>]

I have identified a relevant confounding variable.<sup>1</sup>

I have explained how this confounding variable might affect results.<sup>2</sup>

I have referred to the experiment in my response.

Other acceptable responses could include:

- Other relevant individual participant differences.

- c [The results of this experiment are not valid<sup>1</sup>] because learning how to tie shoelaces may not be indicative of learning other skills through these methods of operant conditioning or observational learning.<sup>2</sup>]

I have identified that the results are not valid.<sup>1</sup>

I have provided a reason to justify my response.<sup>2</sup>

Other acceptable responses could include:

- The use of convenience sampling means that the sample is not representative of the population of children.



  I have explained a reason as to why the results could not be generalised.<sup>2</sup>

Other acceptable responses could include:

- The use of a small sample size
- The presence of confounding variables e.g. individual participant differences

d [The memory store is echoic memory,<sup>1</sup> which has a duration of three to four seconds.<sup>2</sup>]

  I have correctly identified the memory store as echoic memory.<sup>1</sup>

  I have correctly identified the duration of echoic memory as three to four seconds.<sup>2</sup>

Other acceptable responses could include:

- Sensory memory with a duration of 0.2 to 4 seconds

## 6B Memory and the brain

### Theory review questions

- |                     |                                  |
|---------------------|----------------------------------|
| 1 a Explicit memory | b Cerebellum                     |
| c Cerebral cortex   | d Episodic memory                |
| e Implicit memory   | f Hippocampus                    |
| g Amygdala          | h Procedural memory              |
| i Semantic memory   | j Classically conditioned memory |

### Exam-style questions

#### Remember and understand

- 2 D. semantic memory  
 3 A. Knowing how to read the information on this page  
 4 C. cerebellum  
 5 [Explicit memory is consciously retrieved<sup>1</sup>] whereas implicit memory is retrieved without conscious awareness.<sup>2</sup>

  I have outlined a feature of explicit memory.<sup>1</sup>

  I have outlined a feature of implicit memory.<sup>2</sup>

  I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses could include:

- That explicit memory is declarative whereas implicit memory is non-declarative
- That explicit memory is retrieved voluntarily whereas implicit memory is involuntarily

6 [A role of the hippocampus is to encode explicit memory,<sup>1</sup> and a role of the cerebellum is to encode implicit memories.<sup>2</sup>]

  I have outlined a role of the hippocampus in relation to memory.<sup>1</sup>

  I have outlined a role of the cerebellum in relation to memory.<sup>2</sup>

### Apply and analyse

7 B. procedural memory.

8 D. procedural memory, semantic memory.

9 a [The type of memory which allowed Theodore to remember facts about the Russian revolution is explicit memory.<sup>1</sup>]

  I have identified that explicit memory is the type of memory involved.<sup>1</sup>

Other acceptable responses could include:

- Semantic memory

b [Theodore's knowledge of key dates and facts is the memory type of explicit memory, in particular, semantic memory.<sup>1</sup>] [Therefore, the hippocampus would have been involved in encoding Theodore's explicit memory of facts about the Russian revolution.<sup>2</sup>]

  I have identified that knowledge of the Russian revolution is explicit memory.<sup>1</sup>

  I have explained that the hippocampus would be involved in Theodore encoding this memory.<sup>2</sup>

  I have referred to the character's name in my response (Theodore), and to the scenario.

c [The explicit memory would have been stored in Theodore's cerebral cortex.<sup>1</sup>]

  I have identified that the memory would have been stored in the cerebral cortex.<sup>1</sup>

### Questions from multiple lessons

10 B. classical conditioning.

11 B. episodic memory.

12 C. hippocampus

13 [Little Albert's conditioned emotional fear response is an example of an implicit long-term memory.<sup>1</sup>]

  I have identified that conditioned emotional responses are implicit long-term memories.<sup>1</sup>

14 [The amygdala is the brain structure that is involved in the encoding of emotionally charged memories, such as fear.<sup>1</sup>] [The cerebral cortex is the storage site of long-term memories, such as these conditioned emotional memories.<sup>2</sup>]

  I have identified the role of the amygdala in the encoding of conditioned emotional responses.<sup>1</sup>

  I have identified the role of the cerebral cortex as the storage site of conditioned emotional responses.<sup>2</sup>

15 a [The type of long-term memory involved in learning how to perform a dance routine is procedural memory.<sup>1</sup>]

  I have identified that the type of long-term memory is procedural memory.<sup>1</sup>

Other acceptable responses could include:

- Implicit memory

**b** [Millie has achieved the stage of attention.<sup>1</sup>][this can be seen through her actively focussing on her mum teach the dance routine.<sup>2</sup>][Millie has also achieved the stage of retention.<sup>3</sup>][as seen through her storing the steps of the routine as a mental representation, demonstrated by her ability to remember the steps.<sup>4</sup>][However, Millie has not achieved reproduction.<sup>5</sup>][This could be due to her physical incapabilities to perform the routine due to the dance being for an advanced class, leading to her being unable to perform the routine.<sup>6</sup>]

I have identified that Millie achieved the stage of attention.<sup>1</sup>

I have explained attention, using an example from the scenario.<sup>2</sup>

I have identified that Millie achieved the stage of retention.<sup>3</sup>

I have explained retention, using an example from the scenario.<sup>4</sup>

I have identified that Millie has not achieved the stage of reproduction.<sup>5</sup>

I have explained reproduction, using an example from the scenario.<sup>6</sup>

I have referred to the character's name in my response (Millie), and to the scenario.

#### Key science skills

**16 a** [Dr Carey would have recorded subjective qualitative data.<sup>1</sup>]

I have identified that Dr Carey would have recorded subjective qualitative data.<sup>1</sup>

**b** [The type of long-term memory that would be impacted by damage to the hippocampus is explicit memory.<sup>1</sup>][This is because the hippocampus encodes explicit memory.<sup>2</sup>]

I have outlined that explicit memory would be impacted by damage to the hippocampus.<sup>1</sup>

I have justified my response by referring to the hippocampus as being the structure involved in encoding explicit memory.<sup>2</sup>

**c** [Dr Carey would have violated the no-harm principle.<sup>1</sup>][This is seen in her desire to produce brain trauma in her participants by damaging their hippocampus, which may harm them both psychologically and physiologically. This would violate the no-harm principle which safeguards participants from harm.<sup>2</sup>]

I have identified an ethical principle which Dr Carey violated.<sup>1</sup>

I have justified my response by referring to the scenario.<sup>2</sup>

I have referred to the character's name in my response (Dr Carey), and to the scenario.

## Chapter 6 test

### Multiple choice questions

- 1 C. The limited capacity of short-term memory.
- 2 B. a declarative episodic and declarative semantic memory, respectively.
- 3 D. has a potentially unlimited capacity and a relatively permanent duration.
- 4 B. unlimited and 0.2-4 seconds, respectively.
- 5 D. encodes explicit declarative memory and consolidates short-term memory into long-term storage.
- 6 B. will not move to short-term memory and into conscious awareness.
- 7 C. A memory store where information is consciously manipulated, with a capacity of  $7 \pm 2$  items, and a duration of 18-30 seconds.
- 8 A. knowing the capital city of Russia and knowing how to play the piano.
- 9 D. how to throw a netball to score in a game
- 10 C. implicit memory and the amygdala, respectively.

### Short answer questions

**11** [Echoic sensory memory has a duration of 3-4 seconds.<sup>1</sup>][Sarisha did not initially pay attention to the teacher's question, meaning this information was not in her conscious awareness.<sup>2</sup>][Once she realised a question had been asked, she attended to this information temporarily stored in her sensory memory, moving it into conscious awareness in her short-term memory.<sup>3</sup>][Once the information was in her conscious awareness, Sarisha was able to respond to her teacher's question.<sup>4</sup>]

I have stated the duration of echoic sensory memory.<sup>1</sup>

I have explained that Sarisha did not initially pay attention to the teacher's question, meaning this information was not in her conscious awareness.<sup>2</sup>

I have explained that Sarisha transferred the information in her echoic memory store to her short-term memory store through attending to this information.<sup>3</sup>

I have explained that Sarisha was able to respond to the teacher's question because it was brought into her conscious awareness.<sup>4</sup>

I have referred to the character's name in my response (Sarisha), and to the scenario.

**12** [Semantic long-term memory refers to declarative memory of general knowledge, including facts, words and numbers. By contrast, episodic long-term memory refers to declarative memory relating to autobiographical events and personal experiences.<sup>1</sup>][An example of semantic memory is knowing the name of a country's capital city,<sup>2</sup>][while an example of episodic memory is remembering a birthday dinner of a friend.<sup>3</sup>]

I have described a difference between semantic and episodic long term memory.<sup>1</sup>

I have provided an example of a semantic memory.<sup>2</sup>

I have provided an example of an episodic memory.<sup>3</sup>

I have used an appropriate distinguishing phrase, such as 'by contrast'.

- 13 a** [The fight-flight-freeze response is an automatic sympathetic nervous system response to a stressor intended to promote survival, in which the organism either chooses to fight the stressor, run away from the stressor, or freeze.<sup>1</sup>] [In reacting to the stressor of the large dog, Tadhg displayed the flight aspect of this response, evident through his decision to run away.<sup>2</sup>]

I have described the fight-flight-freeze response.<sup>1</sup>

I have identified which response Tadhg displayed and explained how this occurred.<sup>2</sup>

I have referred to the character's name in my response (Tadhg), and to the scenario.

- b** [As he ran away from the large dog, Tadhg was in the alarm reaction (counter shock) stage of the General Adaptation Syndrome.<sup>1</sup>] [During this stage, adrenaline is released into the bloodstream to prepare the body to respond to a stressor, helping Tadhg to run faster than he normally could.<sup>2</sup>]

I have identified that Tadhg was in the alarm reaction (counter shock) stage of the General Adaptation Syndrome.<sup>1</sup>

I have explained that adrenaline is released during this stage, meaning Tadhg was able to run faster than usual.<sup>2</sup>

I have referred to the character's name in my response (Tadhg), and to the scenario.

- c** [The type of consequence Tadhg received was positive punishment, as choosing a different route resulted in the addition of an unwanted stimulus.<sup>1</sup>] [Following the consequence of positive punishment, Tadhg is less likely to repeat the behaviour of walking along a different route.<sup>2</sup>]

I have identified positive punishment as the type of consequence received.<sup>1</sup>

I have stated that positive punishment makes Tadhg less likely to repeat his behaviour.<sup>2</sup>

I have referred to the character's name in my response (Tadhg), and to the scenario.

- d** [The amygdala was responsible for Tadhg's encoding of his experience as fearful.<sup>1</sup>] [Tadhg's experience represents an episodic long-term memory,<sup>2</sup>] [as it involves an autobiographical event relating to a time and place that can be consciously declared.<sup>3</sup>]

I have identified that the amygdala was responsible for Tadhg's encoding of the event as fearful.<sup>1</sup>

I have stated that the type of long-term memory represented by Tadhg's experience is episodic.<sup>2</sup>

I have justified my response by referring to the autobiographical nature of the memory.<sup>3</sup>

I have referred to the character's name in my response (Tadhg), and to the scenario.

- 14** [In the storage of long-term memory, the hippocampus encodes declarative information held in short-term memory to be consolidated and stored in long-term memory.<sup>1</sup>] [Once consolidated, this information is stored in the cerebral cortex.<sup>2</sup>]

I have described the role of the hippocampus in consolidating information in short-term memory to long-term memory.<sup>1</sup>

I have described the role of the cerebral cortex in the storage of long-term declarative memory.<sup>2</sup>

- 15** [The cerebellum is the primary structure responsible for the storage of long-term implicit procedural memory.<sup>1</sup>]

I have described the role of the cerebellum in the storage of long-term implicit procedural memory.<sup>1</sup>

### Key science skills questions

- 16 a** [It was hypothesised that<sup>1</sup>] [participants who did not have to count down from 100 will be more likely to recall this information than participants who had to count down from 100.<sup>2</sup>]

I have started my hypothesis with "It was hypothesised that".<sup>1</sup>

I have included the independent and dependent variables.<sup>2</sup>

I have stated the direction of my hypothesis.

Other acceptable responses could include:

- People who are permitted to rehearse information in their short-term memory will be more likely to recall this information than participants who are not permitted to rehearse this information.
- Other hypotheses identifying the correct IV and DV, but stating the opposite direction are also accepted.

- b** [Random allocation is used.<sup>1</sup>] [An advantage of using a random allocation is that all members of the sample have an equal chance of being assigned to either the experimental or control condition, thereby reducing the likelihood of a confounding variable due to individual participant differences.<sup>2</sup>]

I have identified that random allocation was used.<sup>1</sup>

I have stated an advantage of using a random allocation procedure.<sup>2</sup>

- c** [The independent variable was the task completed during the 30 second period following the recording.<sup>1</sup>] [This was operationalised as whether or not participants counted down aloud from 100 or not during the 30 second period following the recording.<sup>2</sup>] [The dependent variable was participant performance in short-term memory recall.<sup>3</sup>] [This was operationalised as a score out of 20, representing the number of nonsense items correctly recalled.<sup>4</sup>]

I have identified the experiment's independent variable.<sup>1</sup>

I have operationalised the independent variable.<sup>2</sup>

I have identified the experiment's dependent variable.<sup>3</sup>

I have operationalised the dependent variable.<sup>4</sup>

Other acceptable responses could include:

- The IV being the presence of rehearsal, operationalised as whether or not participants were permitted to rehearse the 20 nonsense items in the 30 second period following the recording.

## 7A Brain trauma and neurodegenerative disease

### Theory review questions

- 1** a Alzheimer's disease      b Brain trauma  
 c Anterograde amnesia      d Neurodegenerative disease  
 e Brain surgery

### Exam-style questions

#### Remember and understand

- 2** B. consolidation of emotionally arousing memories.  
**3** B. hippocampus.  
**4** B. a neurodegenerative disease characterised by progressive memory loss.  
**5** [Anterograde amnesia is a condition where new explicit memories cannot be effectively consolidated, resulting in an inability to remember events that occur after the brain trauma.<sup>1</sup>] [Anterograde amnesia can result from damage to the hippocampus.<sup>2</sup>]

I have described how anterograde amnesia involves being unable to remember events after the brain trauma occurred.<sup>1</sup>

I have described how anterograde amnesia occurs due to damage to the hippocampus.<sup>2</sup>

- 6** [One neurological difference from normal neural functioning that characterises Alzheimer's disease is neurofibrillary tangles, which are a build-up of the protein tau.<sup>1</sup>] [Another neurological difference from normal neural functioning that characterises Alzheimer's disease is amyloid plaques, which are fragments of beta-amyloid that form insoluble plaques.<sup>2</sup>]

I have described tangles as a neurological difference from normal neural functioning that characterises Alzheimer's disease.<sup>1</sup>

I have described plaques as a neurological difference from normal neural functioning that characterises Alzheimer's disease.<sup>2</sup>

#### Apply and analyse

- 7** C. anterograde amnesia.  
**8** A. remember his bike route from home to work.  
**9** [Kalvin will not be able to ride his bike.<sup>1</sup>] [This is because riding a bike is an example of an implicit procedural memory, which Kalvin will not be able to process given the surgery to his cerebellum.<sup>2</sup>]

I have identified that Kalvin will not be able to ride his bike.<sup>1</sup>

I have provided an appropriate justification, with reference to riding a bike being an implicit memory which is processed in the cerebellum.<sup>2</sup>

I have referred to the character's name in my response (Kalvin), and to the scenario.

- 10** [A doctor would suspect that Felix has Alzheimer's disease.<sup>1</sup>] [This is evident because Felix's brain has reduced in mass, with neural degeneration occurring mostly in the hippocampus, which is typical of Alzheimer's disease.<sup>2</sup>]

I have identified that a doctor would suspect that Felix has Alzheimer's disease.<sup>1</sup>

I have provided an appropriate justification with reference to Felix's MRI results displaying reduced brain mass and neural degeneration in the hippocampus.<sup>2</sup>

I have referred to the character's name in my response (Felix), and to the scenario.

Other acceptable responses could include:

- A doctor suspecting that Felix has Alzheimer's disease on the basis of his memory impairments, as demonstrated through asking his family members the same question repeatedly

#### Questions from multiple lessons

- 11** C. long-term memory.  
**12** [Ashley's new explicit memories cannot reach the long-term memory store.<sup>1</sup>]  
  I have identified that Ashley's new explicit memories cannot reach the long-term memory store.<sup>1</sup>

#### Key science skills

- 13** C. case studies can provide ideas for further research into brain injury.  
**14** a [Dr Pierre used convenience sampling.<sup>1</sup>]

I have identified that Dr Pierre used convenience sampling.<sup>1</sup>

- b [Dr Pierre was unable to generalise his results because the sample of elderly patients at a hospital is not representative of all people with Alzheimer's disease.<sup>1</sup>]

I have explained how the sample of elderly hospital patients could not be extended to those with Alzheimer's disease.<sup>1</sup>

I have referred to the character's name in my response (Dr Pierre), and to the experiment scenario.

Other acceptable responses could include:

- Dr Pierre cannot generalise his results due to confounding variables, such as the age of patients or other illnesses that patients could have been diagnosed with.
  - Dr Pierre cannot generalise his results due to the sample size.
- c [The earliest stages of Alzheimer's disease involves a reduction of hippocampal volume due to neurofibrillary tangles and amyloid plaques, impacting short-term and episodic memory.<sup>1</sup>] [The effects of the medication in Dr Pierre's investigation suggests that it could protect against this decline in hippocampal volume.<sup>2</sup>] [Therefore, researchers may be interested in how the use of this medication could act as a protective factor against the development of Alzheimer's disease.<sup>3</sup>]

I have explained how Alzheimer's disease involves a reduction in hippocampal volume.<sup>1</sup>

I have explained how the findings of Dr Pierre's experiment suggest that the medication could protect against the decline of hippocampal volume associated with Alzheimer's disease.<sup>2</sup>

- I have explained why researchers would be interested in using this medication in the protection against its development.<sup>3</sup>

---

I have referred to the character's name in my response (Dr Pierre), and to the experiment scenario.

# 7B Factors affecting memories

## Theory review questions

- 1**   **a** Maintenance rehearsal      **b** Retrieval cue  
**c** Serial position effect      **d** Context dependent cues  
**e** Primacy effect      **f** State dependent cues  
**g** Recency effect      **h** Elaborative rehearsal

**2** B. Y - Primacy effect; Z - Recency effect

## **Exam-style questions**

### **Remember and understand**

- 3 B. recall of items towards the beginning and end of the list are the highest.
  - 4 D. maintenance rehearsal.
  - 5 [Maintenance rehearsal involves holding information in short-term memory for as long as possible<sup>1</sup>] [whereas elaborative rehearsal involves linking new information to long-term memories that are already established.<sup>2</sup>]

- I have identified that maintenance rehearsal involves holding information in short-term memory for as long as possible.<sup>1</sup>
  - 
  - I have identified that maintenance rehearsal involves linking information to long-term memories.<sup>2</sup>
  - 
  - I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses could include:

- That elaborative rehearsal is a more effective method of memory encoding than maintenance rehearsal.

6 [Context dependent cues refer to stimuli in the physical environment where a memory is recalled that match stimuli in the environment when the memory was first formed.<sup>1</sup>] [For example, remembering the lines of a song that you often listen to in the shower when you get into the shower, with the shower acting as a context dependent cue.<sup>2</sup>] [On the other hand, state dependent cues refer to aspects of an individual's psychological and physiological state at the time of forming a memory that act as a prompt to retrieving memories formed in that same state.<sup>3</sup> [For example, watching a film that makes you feel upset and cry and then remembering another movie that you watched that also made you feel upset and cry while in that state.<sup>4</sup>]

- I have described context dependent cues.<sup>1</sup>
  - I provided an example of context dependent cues.<sup>2</sup>

---

  - I have described state dependent cues.<sup>3</sup>

- I have provided an example of state dependent cues.<sup>4</sup>

---

I have used an appropriate distinguishing phrase, such as 'on the other hand'.

## Apply and analyse

- 7 B. state dependent cues

8 D. the first and last items read to him

9 [State dependent cues are aspects of an individual's psychological and physiological state at the time of forming a memory that act as a prompt to retrieving memories formed in that same state.<sup>1</sup>] [The psychological and physiological state that Donovan was in when preparing for his boat license test (relaxed and positive mood) did not match with his state when he was taking the test (sweaty hands and increased heart rate).<sup>2</sup>] [Therefore, Donovan was unable to use state dependent cues to help access the information that he learned when preparing for the boat test, contributing to him forgetting this information.<sup>3</sup>]

- I have demonstrated an understanding of state dependent cues.<sup>1</sup>
  - I have explained how Donovan's psychological and physiological state when preparing for the boat test did not match with his state when he sat the test.<sup>2</sup>
  - I have explained how Donovan was unable to use state dependent cues.<sup>3</sup>
  - I have referred to the character's name in my response (Donovan), and to the scenario.

- 10** [Elaborative rehearsal involves linking new information to previously learned information to strengthen the consolidation of long-term memories.<sup>1</sup>] Given that Raheem had already learned about the economics information presented by his lecturer, he was able to link this information that was just presented to him to long-term memories that had already been established.<sup>2</sup> [In doing so, Raheem was able to strengthen the encoding of this information into long-term memory.<sup>3</sup>]

- I have demonstrated an understanding of elaborative rehearsals.<sup>1</sup>
  - I have described how Raheem was able to link the new economics information to long-term memories that have already been established.<sup>2</sup>
  - I have described how Raheem strengthened the consolidation of the new economics information into long-term memory.<sup>3</sup>
  - I referred to the character's name in my response (Raheem), and to the scenario.

## Questions from multiple lessons

- 11** A. sympathetic nervous system

**12** D. state dependent cues.

**13** **a** [Irene uses elaborative rehearsal.<sup>1</sup>]

  I have identified that Irene uses elaborative rehearsal in year 12.<sup>1</sup>

- b** [Irene's strategy for preparing for tests in year 12 does demonstrate context-specific effectiveness.<sup>1</sup>][This is because Irene finds that linking new information to what she already knows is an appropriate way to revise given the large amount of information she needs to learn for year 12.<sup>2</sup>]

I have identified that Irene's strategy for preparing for tests in year 12 does demonstrate context-specific effectiveness.<sup>1</sup>

I have provided an appropriate justification, with reference to how elaborative rehearsal best matches the demand of increased information to learn during year 12.<sup>2</sup>

I have referred to the character's name in my response (Irene), and to the scenario.

- c** [Coping flexibility refers to the ability to adjust or change the coping strategy that is used according to the changing demands of a stressor.<sup>1</sup>[Irene therefore demonstrated coping flexibility by changing from her use of maintenance rehearsal during year 11 to elaborative rehearsal in year 12 when she had increased amounts of information to learn.<sup>2</sup>]

I have described coping flexibility.<sup>1</sup>

I have described how Irene demonstrated coping flexibility.<sup>2</sup>

I have referred to the character's name in my response (Irene), and to the scenario.

#### Key science skills

- 14 a** [Time between being read the list of words and recall.<sup>1</sup>]

I have identified that the independent variable is the time between being read the list of words and recall.<sup>1</sup>

- b** [Ms Kean used repeated measures.<sup>1</sup>][This is because the same participants (the class) recalled the 20 words both immediately after their presentation and after a 30 second delay, therefore experiencing both conditions.<sup>2</sup>]

I have identified that Ms Kean used repeated measures.<sup>1</sup>

I have provided an appropriate justification, with reference to how the class experienced both conditions.<sup>2</sup>

I have referred to the experiment scenario.

- c** [The words at the beginning of the list receive the most rehearsal and are therefore most likely to be transferred to long-term memory.<sup>1</sup>[Therefore, the 30 second delay in the second trial did not impact the recall of these words because of the unlimited duration of long-term memory.<sup>2</sup>]

I have explained that the words at the beginning of the list are most likely to reach long term memory.<sup>1</sup>

I have explained that the words at the beginning of the list were not impacted in the second trial given that long-term memory is not impacted by the delayed recall.<sup>2</sup>

I have referred to the experiment scenario.

- d** [The class demonstrated the primacy effect by displaying high levels of recall for words at the beginning of the list.<sup>1</sup>][This is because these items were most likely to be rehearsed and reach long-term memory and be available for retrieval when recall began.<sup>2</sup>][The class also demonstrated the recency effect by displaying high levels of recall for words at the end of the list.<sup>3</sup>][Given the first trial involved students immediately recalling the words after hearing them, the items at the end of the list were within the 18-30 second duration of short-term memory meaning they were still in conscious awareness during recall.<sup>4</sup>]

I have demonstrated an understanding of the primacy effect.<sup>1</sup>

I have explained why the class demonstrated the primacy effect.<sup>2</sup>

I have demonstrated an understanding of the recency effect.<sup>3</sup>

I have explained why the class demonstrated the recency effect.<sup>4</sup>

I have referred to the experiment scenario.

## 7C Memory retrieval

### Theory review questions

- |            |                |          |             |
|------------|----------------|----------|-------------|
| <b>1 a</b> | Free recall    | <b>b</b> | Recognition |
| <b>c</b>   | Reconstruction | <b>d</b> | Recall      |
| <b>e</b>   | Cued recall    | <b>f</b> | Relearning  |
| <b>g</b>   | Serial recall  |          |             |

### Exam-style questions

#### Remember and understand

- 2** C. W - Retrieving information from memory in no order and without a prompt; X - Cued recall ; Y - Identifying information from memory within a group of other items; Z - Reconstruction
- 3** B. cued recall
- 4** B. retrieving information in no particular order, whereas serial recall involves retrieving information in a specific order.
- 5** [Relearning involves learning information that has already been learned previously another time.<sup>1</sup>][The time saved when learning something again demonstrates that there was information already in long-term memory that did not need time to be re-encoded.<sup>2</sup>]

I have described what is involved in relearning.<sup>1</sup>

I have described how the time saved through relearning demonstrates the existence of information in memory.<sup>2</sup>

- 6** [Recognition involves identifying information from memory within a range of alternatives.<sup>1</sup>][The presence of the originally-learned information within this range acts as a cue for accessing that information from memory, therefore retrieving information from memory.<sup>2</sup>]

- I have identified what is involved in recognition.<sup>1</sup>
- I have explained how the presence of information from memory within a list acts as a cue to retrieve information from memory.<sup>2</sup>

### Apply and analyse

- 7 C. serial recall.
- 8 D. cued recall and free recall.
- 9 D. reconstruction
- 10 a [Ms Nam used recognition.<sup>1</sup>] [This is because her test had the correct information (divisions of the nervous system) appear within a group of other items to determine if students had this information in their memory.<sup>2</sup>]
- I have identified that Ms Nam used recognition.<sup>1</sup>
- I have provided an appropriate justification, with reference to how the test had students identify the divisions of the nervous system within a list of other items.<sup>2</sup>
- I have referred to the character's name in my response (Ms Nam), and to the scenario.
- b [Ms Nam used free recall when testing her students after finishing the unit.<sup>1</sup>] [By having students write down all of the different divisions of the nervous system in any order and to describe their function, they were not provided with any cues or order to retrieve this information from their memory, therefore using free recall.<sup>2</sup>]
- I have identified when Ms Nam used free recall.<sup>1</sup>
- I have provided an appropriate justification, with reference to how students didn't use a cue or order when recalling the divisions of the nervous system.<sup>2</sup>
- I have referred to the character's name in my response (Ms Nam), and to the scenario.
- c [Ms Nam could have used cued recall by giving her students a test that provides students with retrieval cues that would help them identify the different divisions of the nervous system.<sup>1</sup>] [For example, by providing students with the first letter of each division of the nervous system.<sup>2</sup>]
- I have explained how Ms Nam could use cued recall.<sup>1</sup>
- I have provided an example of how Ms Nam could use cued recall with her class.<sup>2</sup>
- I have referred to the character's name in my response (Ms Nam), and to the scenario.

### Questions from multiple lessons

- 11 C. long-term potentiation.
- 12 A. relearning.
- 13 a [Wanda uses recall when completing short-answer questions.<sup>1</sup>]
- I have identified that Wanda uses recall when completing short-answer questions.<sup>1</sup>

- b [In the presence of the antecedent of short-answer questions,<sup>1</sup> [Wanda displayed the behaviour of answering the questions and handing them in to her teacher.<sup>2</sup>] [The consequence is Wanda's teacher giving her a chocolate bar,<sup>3</sup>] [which acts as positive reinforcement and increases the likelihood of Wanda giving her teacher more short-answer questions.<sup>4</sup>]

- I have identified that the antecedent is short-answer questions.<sup>1</sup>
- I have identified that the behaviour is Wanda answering and handing in short-answer questions to her teacher.<sup>2</sup>
- I have identified that consequence is Wanda's teacher giving her a chocolate bar.<sup>3</sup>
- I have identified that the consequence is positive reinforcement and increases the likelihood of Wanda giving her teacher more short-answer questions.<sup>4</sup>
- I have used the language of operant conditioning, referring to antecedent, behaviour, consequence and positive reinforcement.
- I have referred to the character's name in my response (Wanda), and to the scenario.

### Key science skills

- 14 a [Dr Berntsen is using quantitative data.<sup>1</sup>] [This is because the measure of how long someone takes to learn to play a song is objective as it is expressed as a number, reflecting a quantity.<sup>2</sup>]
- I have identified that Dr Berntsen is using quantitative data.<sup>1</sup>
- I have provided an appropriate justification, with reference to how the time taken to learn a song is a measure of quantity.<sup>2</sup>
- I have referred to the character's name (Dr Berntsen), and to the scenario.
- b [Learning speed,<sup>1</sup>] [operationalised as how long it takes participants to learn the basic piano songs.<sup>2</sup>]
- I have identified that learning speed is the dependent variable.<sup>1</sup>
- I have operationalised the dependent variable as how long it takes participants to learn the basic piano songs the second time round.<sup>2</sup>
- I have referred to the experiment scenario.

## 7D Reconstruction in Loftus' research

### Theory review questions

- 1 a Eye-witness testimony      b Leading question

### Exam-style questions

#### Remember and understand

- 2 A. eye-witness testimonies are reconstructions of events that can be manipulated by information that is given after the event.

- 3** [Leading questions are questions that contain misleading information or imply a desired response.<sup>1</sup>] [The information that is included or implied in a leading question is added to other information during an eye-witness' retrieval, impacting their reconstruction of the memory to potentially include details that were not actually witnessed.<sup>2</sup>]

I have described leading questions.<sup>1</sup>

I have described how leading questions can affect memory reconstruction during eye-witness testimonies.<sup>2</sup>

### Apply and analyse

- 4** C. How tall was the young man who stole the wallet?

- 5** [Ashkan's reliability could be questioned because of his exposure to the news reporters' leading questions that included potentially misleading information.<sup>1</sup>] [For example, the news reporters' questions suggested that the masked intruders were armed and were boys.<sup>2</sup>] [Defence lawyers could question whether Ashkan actually remembered that the masked intruders were armed, or whether his memory was reconstructed to include this information given that it was suggested by the reporters' leading questions.<sup>3</sup>]

I have explained that Ashkan's description could be questioned due to being asked leading questions.<sup>1</sup>

I have provided examples from the scenario of the use of leading questions.<sup>2</sup>

I have explained how Ashkan's memory could have been reconstructed to include the information suggested by the leading questions.<sup>3</sup>

I have referred to the character's name in my response (Ashkan), and to the scenario.

### Questions from multiple lessons

- 6** B. sympathetic

- 7 a** [The accuracy of Kai's description could be questioned.<sup>1</sup>] [This is because the journalists asked Kai leading questions.<sup>2</sup>] [Kai could have reconstructed his memory to include that the intruders were masked because this was introduced in the reporters' leading question, not because he actually recalled them being masked.<sup>3</sup>]

I have identified that the accuracy of Kai's description could be questioned.<sup>1</sup>

I have identified that the accuracy can be questioned due to leading questions.<sup>2</sup>

I have explained how the leading questions could cause Kai to add inaccurate information during reconstruction.<sup>3</sup>

I have referred to the character's name in my response (Kai), and to the scenario.

- b** [Context dependent cues are stimuli in the physical environment where a memory is recalled that act as a prompt to retrieve memories formed in that environment.<sup>1</sup>] [Context dependent cues could be used by interviewing Kai at his home.<sup>2</sup>] [This is the physical environment where his memory of the home intrusion occurred, so being in this same environment will act as a cue to retrieve more details to the police.<sup>3</sup>]

I have described context dependent cues.<sup>1</sup>

I have identified that context dependent cues could be used by interviewing Kai at his home.<sup>2</sup>

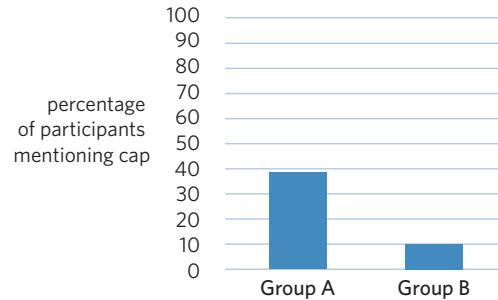
I have described that being where the house intrusion occurred will act as a cue to retrieve more details to the police.<sup>3</sup>

I have referred to the character's name in my response (Kai), and to the scenario.

### Key science skills

- 8** D. the use of leading or non-leading questions  
**9** B. independent groups.  
**10** A. memory retrieval is a reconstructive process and can be updated with false information.

- 11** A.



- 12** [Dr Franco's experiment does demonstrate reliability.<sup>1</sup>] [This is because their experiment obtained similar results to Loftus' original experiment under the same research conditions.<sup>2</sup>]

I have identified that Dr Franco's experiment does demonstrate reliability.<sup>1</sup>

I have provided an appropriate justification, with reference to how Dr Franco's results obtained similar results to Loftus' original experiment using the same research conditions.<sup>2</sup>

## Chapter 7 test

### Multiple choice questions

- 1** C. recognition.
- 2** A. recognition has a higher sensitivity as a method of retrieving information than recall.
- 3** D. context dependent cues
- 4** B. hippocampus
- 5** D. anterograde amnesia.
- 6** B. the reconstructive nature of memory.
- 7** B. state dependent cues.
- 8** C. information presented at the start and end of a list will be the most recalled.
- 9** D. eye-witness memories are reconstructions of events that can be manipulated and aren't always reliable as evidence in court.
- 10** A. consolidating emotionally arousing memories.

## Short answer questions

11 [Context dependent cues are stimuli in the physical environment where a memory was originally formed that can aid retrieval if the individual is placed within that environment again.<sup>1</sup> Whereas state dependent cues are aspects of an individuals' psychological or physiological state when a memory was formed that can aid retrieval when the individual is in that psychological or physiological state once again.<sup>2</sup>]

I have described that context dependent cues are features of the physical environment where a memory was formed present again during retrieval.<sup>1</sup>

I have described that state dependent cues are features of an individual's psychological or physiological state when a memory was formed present again during retrieval.<sup>2</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

12 [The reliability of Gerda's description could be questioned due to the reporter's inclusion of potentially misleading information in their questions.<sup>1</sup> For example, by suggesting that the robbers were young men who were armed.<sup>2</sup> Gerda may not have actually remembered the robbers as being young men and armed, or this memory could have been reconstructed to include the information suggested by the reporter's leading questions.<sup>3</sup>]

I have explained that Gerda's description could be questioned due to being asked leading questions.<sup>1</sup>

I have provided examples from the scenario of the use of leading questions.<sup>2</sup>

I have explained how Gerda's memory could have been reconstructed to include the information suggested by the leading questions.<sup>3</sup>

I have referred to the character's name in my response (Gerda), and to the scenario.

13 [Maintenance rehearsal involves repeating information over and over again in an attempt to keep information in short-term memory for as long as possible.<sup>1</sup> For example, reading a definition over and over again right before a test.<sup>2</sup> Elaborative rehearsal involves linking new information with previously learned information to transfer it to long-term memory.<sup>3</sup> For example, linking new content learned in a subject to information you already learned in another subject.<sup>4</sup>]

I have described maintenance rehearsal.<sup>1</sup>

I have provided an appropriate example of maintenance rehearsal.<sup>2</sup>

I have described elaborative rehearsal.<sup>3</sup>

I have provided an appropriate example of elaborative rehearsal.<sup>4</sup>

14 [Multiple choice questions are answered through recognition.<sup>1</sup> Short answer questions require recall.<sup>2</sup> Recognition is a more sensitive method of retrieval than recall, so students are likely to score better on multiple choice questions than on short answer questions.<sup>3</sup>]

I have identified that multiple choice questions are answered through recognition.<sup>1</sup>

I have identified that short answer questions are answered through recall.<sup>2</sup>

I have identified that recognition is a more sensitive method of retrieval than recall.<sup>3</sup>

Other acceptable responses could include:

- Students are more likely to score better on multiple choice questions than on short answer questions because recognition provides more revival cues than recall.

15 [Students will be most likely to recall the words at the beginning (primacy effect) and end of the list (recency effect).<sup>1</sup> and forget the words presented in the middle of the list.<sup>2</sup> This demonstrates the serial position effect.<sup>3</sup> Words at the beginning of the list are most likely to be rehearsed and transferred into long-term memory<sup>4</sup> and words at the end of the list are likely to still be in short-term memory during retrieval.<sup>5</sup>]

I have identified that students are most likely to recall words at the beginning and end of the list.<sup>1</sup>

I have identified that students are most likely to forget words in the middle of the list.<sup>2</sup>

I have referred to the serial position effect.<sup>3</sup>

I have explained why the primacy effect occurs in terms of the serial position effect, with reference to memory stores.<sup>4</sup>

I have explained why the recency effect occurs in terms of the serial position effect, with reference to memory stores.<sup>5</sup>

I have referred to the experiment scenario in my response.

## Key science skills questions

16 a [The independent variable is the place of recall,<sup>1</sup> operationalised as whether participants recall the words in the same place as where the consolidation of memory occurred (outside), or a different place (in the classroom).<sup>2</sup>]

I have identified the independent variable as the place of recall.<sup>1</sup>

I have operationalised the independent variable, with reference to whether participants recall the words outside or inside.<sup>2</sup>

b [Participants who recall the words outside will recall more words than participants who recall the words inside in Camilo's practical investigation.<sup>1</sup> This is because participants who recall the words outside will be able to use context dependent cues.<sup>2</sup> This increases their chance at accurate recall, as there are more matched elements between the context of the retrieval of the words and the context of the original encoding of the words, thereby enhancing memory.<sup>3</sup>]

I have identified that participants recalling the words outside will recall more words than participants recalling the words inside.<sup>1</sup>

I have identified that increased recall for participants recalling the words outside is due to context dependent cues.<sup>2</sup>

- I have identified that being outside during recall will aid retrieval due to the matching of the physical environment where the memory was formed to the environment of recall.<sup>3</sup>
- I have referred to the character's name in my response (Camilo), and to the scenario.

### Extended response

- 17 Students need to demonstrate that they have a thorough and holistic understanding of reliability of memory. This question tested students' understanding of Alzheimer's disease and the factors affecting memory, including context and state dependent cues and maintenance and elaborative rehearsal.

For the outline of Alzheimer's disease, including its neurological differences from normal neural functioning, students could have mentioned the following points:

- Alzheimer's disease is a neurodegenerative disease.
- Alzheimer's disease involves memory impairments, such as being unable to consolidate any new long-term memories.
- Death of neurons initially occurs most significantly in the hippocampus, but then also the cerebral cortex.
- Amyloid plaques are one neurological difference from normal neural functioning, where fragments of the protein beta amyloid accumulate into insoluble plaques around the neurons, inhibiting communication between neurons.
- Neurofibrillary tangles are another neurological difference from normal neural functioning, where the protein tau accumulates into insoluble tangles within neurons, inhibiting the transport of essential substances throughout the neuron and eventually killing it entirely.
- There is no way Vedad's doctor can definitively diagnose or cure his Alzheimer's disease.

For the description of how damage to the brain regions involved in Alzheimer's disease will impact Vedad's memory, students could have made the following points:

- The most significant brain structure for memory that is commonly affected by Alzheimer's disease is the hippocampus. This may result in Vedad having difficulties consolidating explicit long-term memories.
- Neuronal death can progress to the cerebral cortex. This may disrupt the long-term storage of Vedad's past explicit memories and his ability to process new short-term memories.

For the analysis of how context and state dependent cues could be used to increase Vedad's ability to remember information for his daily life, students could have mentioned the following points:

- Context dependent cues are stimuli in the physical environment where a memory was formed that help retrieve the memory formed in that situation.
- It could be useful for Vedad to be in the same physical location where he formed a memory to help recall information for this daily life that he may otherwise forget. For example, if Vedad forgets something that he thought about while in an outdoor location, such as his garden, then returning to this location could help him to remember this information again.
- State dependent cues are aspects of an individual's psychological and physiological state at the time of forming a memory that act as a prompt to retrieving memories formed in that same state.

- It could be useful for Vedad to be in the same psychological or physiological state when he formed a memory to help recall information for his daily life that he may otherwise forget. For example, if Vedad forgets something he thought about while doing a task that made him relaxed, such as watching television, then doing this task again to get back into the psychological and physiological state of relaxation could help him to remember this information again.

For the analysis of how maintenance and elaborative rehearsal could be used to increase Vedad's ability to remember information for his daily life, students could have mentioned the following points:

- Maintenance rehearsal involves repeating new information over and over again to keep it in short-term memory for as long as possible.
- Given that maintenance rehearsal focuses on extending the duration of short-term memory, not strengthening the consolidation of long-term memories, it will not be an effective method for Vedad to remember information for his daily life.
- Elaborative rehearsal involves linking new information to previously learned information to form long-term memories.
- Given the death of neurons occurring in Vedad's hippocampus, disrupting the consolidation of new explicit long-term memories, it could be helpful for Vedad to link new information to already established long-term memories to strengthen the chance that it will be encoded in long-term memory.

## 8A States of consciousness

### Theory review questions

- 1** **a** Psychological construct      **b** Altered state of consciousness  
**c** Induced ASC      **d** Consciousness  
**e** Normal waking consciousness      **f** Consciousness continuum  
**g** Naturally occurring ASC
- 2** Least aware to most aware:  
 • Vegetative state  
 • Hypnotised  
 • Dreaming  
 • Alcohol-induced  
 • Meditation  
 • Daydreaming  
 • Normal waking consciousness  
 • Focussed attention

### Exam-style questions

#### Remember and understand

- 3** C. meditation  
**4** B. dreaming  
**5** D. focussing on a crossword puzzle → daydreaming → asleep  
     → under anesthesia

#### Apply and analyse

- 6** A. normal waking consciousness  
**7** B. Uisce – induced altered state of consciousness; Andrew – normal waking consciousness; Jaimee – naturally occurring altered state of consciousness  
**8** [Kaitlyn: alcohol induced ASC<sup>1</sup>][Michael: normal waking consciousness<sup>2</sup>]

I have identified that Kaitlyn is experiencing an induced ASC, or specifically an alcohol-induced ASC.<sup>1</sup>

I have identified that Michael is experiencing NWC.<sup>2</sup>

- 9** [Rachel is likely in normal waking consciousness.<sup>1</sup>] This is because she is aware of both external, such as her teacher, and internal stimuli, such as her feeling hungry, without any apparent distortions.<sup>2</sup>

I have correctly identified that Rachel is experiencing NWC.<sup>1</sup>

I have explained that this using examples from the scenario.<sup>2</sup>

I have referred to the character's name in my response (Rachel), and to the scenario.

## 8B Features of states of consciousness

### Theory review questions

- 1** **a** Self-control      **b** Levels of awareness  
**c** Controlled processes      **d** Perceptual and cognitive distortions  
**e** Emotional awareness      **f** Content limitations  
**g** Automatic processes      **h** Time orientation
- 2** **Levels of processing** refer to how much focus and concentration is required to understand information or complete a task. **Automatic processes** require **lower** levels of concentration and mental effort, and may be completed alongside other tasks. On the other hand, **controlled processes** require **higher** levels of concentration and mental effort, only being able to be completed one at a time.

### Exam-style questions

#### Remember and understand

- 3** B. listening to music  
**4** D. decreased content limitations, in which they have less control of their thoughts.  
**5** [A person's self-control in an altered state of consciousness may be reduced compared to normal waking consciousness,<sup>1</sup>] and their time orientation may be less accurate in an altered state of consciousness compared to normal waking consciousness.<sup>2</sup>]

I have identified how self-control might differ in an altered state of consciousness to normal waking consciousness.<sup>1</sup>

I have identified how time orientation might differ in an altered state of consciousness to normal waking consciousness.<sup>2</sup>

#### Apply and analyse

- 6** C. perceptual and cognitive distortions, decreased emotional awareness.  
**7** A. seemed to be limiting the content of his thoughts and speech less than usual.  
**8** [Karen might also be experiencing a distorted sense of time,<sup>1</sup>] causing her to feel as though time is going much faster or slower than it is in reality while she has the fever.<sup>2</sup>

I have identified a possible perceptual/cognitive distortion that Karen might be experiencing (time orientation).<sup>1</sup>

I have explained how this distortion might occur in the given scenario.<sup>2</sup>

I have referred the character's name in my response (Karen), and to the scenario.

Other acceptable responses could include:

- Other types or perceptual and cognitive distortions such as an inability to think clearly and logically

- 9 [An automatic process would be listening to music<sup>1</sup> whereas a controlled process would be learning to drive a car.<sup>2</sup>] [Automatic processing occurs when tasks can be completed with little mental effort, whereas controlled processing occurs when tasks require more mental effort.<sup>3</sup>] [Another difference is that multiple automatic processes tasks can be completed at the same time, whereas a controlled process task can usually only be completed one at a time.<sup>4</sup>]

I have provided an example of an automatic process.<sup>1</sup>

I have provided an example of a controlled process.<sup>2</sup>

I have identified one difference is that automatic process requires little mental effort, whereas controlled processes requires more mental effort.<sup>3</sup>

I have identified a second difference that multiple automatic process tasks can be done at the same time, whereas controlled processes can only be done one at a time.<sup>4</sup>

- 10 a [Logithan studying for the exam is a controlled process<sup>1</sup>] [because he can only do that task, as it requires high mental effort,<sup>2</sup>] [whereas making a coffee is an automatic process<sup>3</sup>] [because it can be done at the same time as other tasks and requires little mental effort.<sup>4</sup>]

I have identified studying as a controlled process.<sup>1</sup>

I have described why studying is a controlled process.<sup>2</sup>

I have identified making coffee as an automatic process.<sup>3</sup>

I have described why making coffee is an automatic process.<sup>4</sup>

I have referred to the character's name in my response (Logithan), and to the scenario.

- b [Logithan would likely have experienced a change in his levels of awareness,<sup>1</sup>] [going from less to more aware after he drank the coffee.<sup>2</sup>]

I have identified change in levels of awareness as a change to Logithan's psychological state.<sup>1</sup>

I have described how this feature of consciousness would have likely changed after he drank the coffee.<sup>2</sup>

I have referred to the character's name in my response (Logithan), and to the scenario.

#### Questions from multiple lessons

- 11 C. decreased emotional awareness
- 12 B. anterograde amnesia, caused by trauma to his hippocampi
- 13 [Tina likely has reduced levels of awareness<sup>1</sup>] [meaning that her ability to pay attention in observational learning<sup>2</sup>] [to her brother's demonstration is reduced, and so she could not store an accurate mental representation of the process of making coffee.<sup>3</sup>] [Tina likely also has reduced self-control,<sup>4</sup>] [meaning her reproduction<sup>5</sup>] [of making the coffee would likely be poor.<sup>6</sup>]

I have identified one likely change (reduced awareness) to Tina's psychological state.<sup>1</sup>

I have identified an element of observational learning (attention) this likely affected.<sup>2</sup>

I have explained how this would have affected Tina's ability to learn how to make coffee.<sup>3</sup>

I have identified another likely change (reduced self-control) to Tina's psychological state.<sup>4</sup>

I have identified another element of observational learning this likely affected (reproduction).<sup>5</sup>

I have explained how this would have affected Tina's ability to make coffee.<sup>6</sup>

I have used the language of features of states of consciousness, referring to levels of awareness and self-control.

I have used the language of observational learning, referring to attention and reproduction stages.

I have referred to the character's name in my response (Tina), and to the scenario.

Other acceptable responses could include:

- Other changes to Tina's psychological state, such as the inability to perform controlled processes
- Other elements of observational learning, such as retention

#### Key science skills

- 14 a [The experimental design used was repeated measures.<sup>1</sup>]

I have correctly identified the research design as repeated measures.<sup>1</sup>

- b [There was a confounding variable in this study.<sup>1</sup>] [Factors like the setting and comfort due to familiarity with the researcher<sup>2</sup>] [were identified as affecting the dependent variable of content limitations measured by openness, not just the independent variable of being in an induced altered state of consciousness.<sup>3</sup>]

I have correctly identified that there was a confounding variable.<sup>1</sup>

I have identified the confounding variable in the scenario as the setting and comfort with the researcher.<sup>2</sup>

I have explained why these were confounding variables, acknowledging that they did have an effect on the dependent variable.<sup>3</sup>

## 8C Measuring consciousness

#### Theory review questions

- |                    |                        |
|--------------------|------------------------|
| 1 a Speed          | b Subjective reporting |
| c EEG              | d Cognitive tasks      |
| e Video monitoring | f EMG                  |
| g EOG              | h Sleep diaries        |
| i Accuracy         |                        |

	Objective data	Subjective data
<b>Physiological data</b>	EEGs, EMGs, EOGs	
<b>Behavioural and psychological data</b>	Cognitive tasks - speed and accuracy	Sleep diaries Video monitoring

### Exam-style questions

#### Remember and understand

- 3 D. detecting, amplifying and recording electrical activity of the muscles surrounding the eyes.
- 4 [One physiological measure would be to use an EMG<sup>1</sup>][to detect, amplify and record the electrical activity of the body's muscles.<sup>2</sup>]

I have named one physiological measure of consciousness (EMG).<sup>1</sup>

I have explained how this measure is used to measure consciousness.<sup>2</sup>

I have used the language of physiological measures of consciousness, referring to 'detect, amplify and record electrical activity'.

Other acceptable responses could include:

- EEGs
- EOGs
- Provided you have given the correct explanation of how they measure consciousness

#### Apply and analyse

- 5 C. EOG - a physiological measure, recording eye muscle movement; Video monitoring - a behavioural measure, recording observable movement and sound.
- 6 A. the use of a sleep diary.
- 7 [The psychiatrist could give Chris cognitive tasks of speed and accuracy<sup>1</sup>][which would give an indication about his consciousness and concentration levels. The psychiatrist should run the same test before and after the trial, and if Chris has improved speed and accuracy after trialling the medication compared to before, the medication may have been effective.<sup>2</sup>]

I have identified measurement of speed and accuracy on cognitive tasks as a psychological measure appropriate for the scenario.<sup>1</sup>

I have explained how this test might show the effect of medication on Chris's concentration.<sup>2</sup>

I have referred to the character's name in my response (Chris), and to the scenario.

- 8 [A psychologist might conclude that Gian Luca is at least somewhat aware<sup>1</sup>][because his eye muscle movement indicates that he is awake and looking around<sup>2</sup>][and his muscle movement indicates that he is active, which usually requires awareness.<sup>3</sup>]

I have correctly identified that a psychologist might infer that Gian Luca is fairly aware.<sup>1</sup>

I have described how the EOG reading might indicate an aware state.<sup>2</sup>

I have described how the EMG reading might indicate an aware state.<sup>3</sup>

I have referred to the character's name in my response (Gian Luca), and to the scenario.

- 9 [1: An EEG<sup>1</sup>][would detect, amplify and record the electrical activity of the brain in brain waves<sup>2</sup>]  
[2: An EOG<sup>3</sup>][would detect, amplify and record the electrical activity of the muscles surrounding the eyes.<sup>4</sup>]  
[3: An EMG<sup>5</sup>][would detect, amplify and record the electrical activity of the body's muscles.<sup>6</sup>]

I have correctly identified EEG as the equipment used at point 1.<sup>1</sup>

I have explained how this measure is used to take a measure of consciousness.<sup>2</sup>

I have correctly identified EOG as the equipment used at point 2.<sup>3</sup>

I have explained how this measure is used to take a measure of consciousness.<sup>4</sup>

I have correctly identified EMG as the equipment used at point 3.<sup>5</sup>

I have explained how this measure is used to take a measure of consciousness.<sup>6</sup>

I have used the language of physiological measures of consciousness, referring to 'detect, amplify and record electrical activity'.

#### Questions from multiple lessons

- 10 a [An EEG detects, amplifies and records the electrical activity of the brain.<sup>1</sup>][Jessa's psychologist likely conducted an EEG recording to examine her state of consciousness, as this might be responsible for her results on the cognitive test.<sup>2</sup>]

I have correctly identified the role of an EEG, explaining that it detects, amplifies and records the electrical activity of the brain.<sup>1</sup>

I have provided a reason as to why the psychologist might have used an EEG.<sup>2</sup>

I have referred to the character's name in my response (Jessa), and to the scenario.

- b [Anterograde amnesia is usually caused by damage to the hippocampus.<sup>1</sup>][As this is the site for encoding long term memories,<sup>2</sup>][this may explain Jessa's reduced mathematical ability as she was unable to consolidate any new memories.<sup>3</sup>]

I have identified the hippocampus as the structure involved in anterograde amnesia.<sup>1</sup>

I have explained the role of the hippocampus in relation to memory.<sup>2</sup>

- I have linked anterograde amnesia to Jessa's maths struggles.<sup>3</sup>
- I have referred to the character's name in my response (Jessa), and to the scenario.
- 11 a [The response the doctor was testing with a tap on the knee is the spinal reflex.<sup>1</sup>]
- I have correctly identified the response being tested as a spinal reflex.<sup>1</sup>
- b [When the doctor tapped Rufus's knee, the sensory receptors of Rufus's knee would have felt the tap<sup>1</sup> and sent sensory messages to the spinal cord,<sup>2</sup> which via interneurons would immediately relay the motor message to withdraw the knee.<sup>3</sup>]
- I have explained that Rufus's sensory receptors would first register the tap.<sup>1</sup>
- I have explained sensory messages would be sent to the spinal cord.<sup>2</sup>
- I have explained that via interneurons, motor messages would signal to withdraw the knee.<sup>3</sup>
- I have referred to the character's name in my response (Rufus), and to the scenario.
- c [Rufus's speed<sup>1</sup> and accuracy on cognitive tasks was being tested.<sup>2</sup>]
- I have correctly identified speed on cognitive tasks as one element being tested.<sup>1</sup>
- I have correctly identified accuracy on cognitive tasks as one element being tested.<sup>2</sup>
- I have referred to the character's name in my response (Rufus), and to the scenario.

#### Key science skills

- 12 C. objective quantitative data, subjective qualitative data.
- 13 [An EEG reading is objective data because it does not vary based on an individual's opinion.<sup>1</sup>] It is quantitative data because it is measurable.<sup>2</sup>
- I have correctly identified that EEGs are an objective measure because they are not based on subjective opinion.<sup>1</sup>
- I have correctly identified that it is quantitative data because it is numerically measurable.<sup>2</sup>

## 8D Alertness, brain wave patterns and drug-induced ASCs

#### Theory review questions

- |                 |               |
|-----------------|---------------|
| 1 a Alpha waves | b Frequency   |
| c Delta waves   | d Brain waves |
| e Depressants   | f Beta waves  |
| g Theta waves   | h Amplitude   |
| i Stimulants    |               |

2	Brain wave name	Frequency	Amplitude	Image
	Beta	Highest	Lowest	
	Alpha	Medium-High	Low-Medium	
	Theta	Low-Medium	Medium-High	
	Delta	Lowest	Highest	

3	Drug classification	Effect on frequency	Effect on amplitude	Example/s	Effect on level of alertness
	Stimulant	Increases	Decreases	Caffeine	Increases
	Depressant	Decreases	Increases	Benzodiazepines	Decreases

#### Exam-style questions

##### Remember and understand

- 4 A. increased amplitude, decreased frequency.
- 5 A. more alert, with high-frequency, low-amplitude waves.
- 6 C. beta, alpha, theta, delta.
- 7 [A person given a higher dose of a stimulant would likely show higher frequency and lower amplitude waves with more beta brain waves<sup>1</sup> than a person given a lower dose.<sup>2</sup>]

- I have correctly identified that a higher dose of a stimulant would give someone higher frequency, lower amplitude and more beta waves.<sup>1</sup>
- I have compared this to a person given a lower dose of a stimulant.<sup>2</sup>

##### Apply and analyse

- 8 A. Point 1 – Caffeine having greatest effect. Higher frequency, lower amplitude brain waves; Point 2 – Caffeine wearing off. Lower frequency, higher amplitude brain waves.
- 9 C. medium-high frequency, low-medium amplitude waves.
- 10 A. Sita – Drug-induced ASC (stimulant); Declan – Drug-induced ASC (depressant); Lee – Normal waking consciousness
- 11 Amplitude: [higher waves, or increased amplitude<sup>1</sup>]  
Frequency: [slower waves, or decreased frequency<sup>2</sup>]
- I have correctly identified that amplitude would likely increase.<sup>1</sup>
- I have correctly identified that frequency would likely decrease.<sup>2</sup>
- 12 [Joseph would likely show no changes to the brain wave patterns after he consumed sparkling water.<sup>1</sup>] Ryan would likely have an increase in frequency and decrease in amplitude after consuming the iced coffee.<sup>2</sup> [Michelle would likely have a decrease in frequency and increase in amplitude after consuming the wine.<sup>3</sup>]

- I have correctly predicted Joseph as showing no change in brain wave patterns.<sup>1</sup>
- I have correctly predicted Ryan's brain wave patterns in response to a stimulant.<sup>2</sup>
- I have correctly predicted Michelle's brain wave patterns in response to a depressant.<sup>3</sup>
- I have referred to the character's name in my response (Joseph, Ryan, Michelle), and to the scenario.

### Questions from multiple lessons

- 13 C. Frequency - decrease; Amplitude - increase
- 14 D. studying for a SAC is a controlled process requiring greater mental effort, while drinking tea is an automatic process requiring less mental effort.
- 15 Similarity: [Both may induce cognitive or perceptual distortions.]<sup>1</sup>

- I have correctly identified one psychological effect similarity between stimulants and depressants.<sup>1</sup>

Other acceptable responses could include:

- Both may cause time orientation distortions
- Both may induce unlimited content
- Both may affect emotional awareness
- Both may alter self control

- 16 a [An EEG would likely show mostly alpha waves,<sup>1</sup> involving reduced frequency and increased amplitude.<sup>2</sup>]

- I have correctly identified the name of the potential brain wave as alpha-like.<sup>1</sup>

- I have correctly described the frequency and amplitude levels.<sup>2</sup>

- b [By engaging the parasympathetic nervous system through slow and controlled breath like in yoga,<sup>1</sup> one relaxes and reduces levels of alertness.<sup>2</sup> This can help with stress reduction, relieving the body and brain of more sympathetic responses like fast breathing, increased heart rate etc when it has to be alert or prepared to 'fight'.<sup>3</sup>]

- I have explained that slow or deep breath uses the parasympathetic nervous system.<sup>1</sup>

- I have linked parasympathetic nervous system engagement to reduced levels of alertness and relaxation.<sup>2</sup>

- I have linked this process to stress reduction, explaining that it makes the body feel calmer or less on edge by relieving sympathetic responses.<sup>3</sup>

- 17 a [Ruben likely appraised the stressor immediately as irrelevant<sup>1</sup> because he was not at all fazed by the message of needing to bring a date as he already had one.<sup>2</sup>] [Tess likely appraised the stressor as 'stressful - threat'<sup>3</sup>] [as she worried about potential damage not bringing a date could have on her reputation.<sup>4</sup>]

- I have correctly identified Ruben's appraisal as irrelevant.<sup>1</sup>
- I have explained why Ruben would have appraised the stressor as irrelevant.<sup>2</sup>
- I have correctly identified Tess's appraisal as threat.<sup>3</sup>
- I have explained why Tess would have appraised the stressor as threat.<sup>4</sup>
- I have used the language of the Transactional model, by referring to irrelevant, stressful and threat.
- I have referred to the character's name in my response (Ruben, Tess), and to the scenario.
- b [Because Ruben was unfazed by the message and continued to perform tasks that required low levels of awareness (eating)<sup>1</sup> [he likely had lower frequency, higher amplitude brain wave patterns.<sup>2</sup>] [On the other hand, Tess's anxiety and subsequent compiling of lists and organising her diary<sup>3</sup>] [meant that she likely had increased frequency and decreased amplitude brain wave patterns.<sup>4</sup>]]
- I have identified a contributing factor to Ruben's state of consciousness.<sup>1</sup>
- I have correctly identified Ruben's likely brain wave patterns.<sup>2</sup>
- I have identified a contributing factor to Tess's state of consciousness.<sup>3</sup>
- I have correctly identified Tess's likely brain wave patterns.<sup>4</sup>
- I have referred to the character's name in my response (Ruben, Tess), and to the scenario
- 18 a [Ishmael practicing his lines is an example of controlled processing,<sup>1</sup> [requiring high levels of awareness,<sup>2</sup>] [whereas taking a shower is an automatic process<sup>3</sup>] [requiring low levels of awareness.<sup>4</sup>]]
- I have correctly identified practicing lines as a controlled process.<sup>1</sup>
- I have correctly identified practicing lines as requiring high levels of awareness.<sup>2</sup>
- I have correctly identified taking a shower as an automatic process.<sup>3</sup>
- I have correctly identified taking a shower as requiring low levels of awareness.<sup>4</sup>
- I have referred to the character's name in my response (Ishmael), and to the scenario.
- b [Ishmael's brain waves would likely be somewhat higher in frequency and lower in amplitude when performing on stage compared to practicing in the shower.<sup>1</sup>] [This is because although both require high levels of awareness, performing on stage would require complete and higher levels of awareness compared to rehearsing alone.<sup>2</sup>]

- I have identified the likely difference in brain wave patterns, referring to the frequency and amplitude.<sup>1</sup>
- I have justified why there would be this difference.<sup>2</sup>
- I have referred to the character's name in my response (Ishmael), and to the scenario.
- c [In order to create a context-dependent cue,<sup>1</sup> it might help Ishmael to imagine himself in the shower in order to replicate the conditions of the environment similar to the place he originally memorised his lines, making access to his original memory of the lines more efficient.<sup>2</sup>]
- I have correctly identified a type of dependent cue.<sup>1</sup>
- I have correctly explained why this type of memory cue might help Ishmael.<sup>2</sup>
- I have referred to the character's name in my response (Ishmael), and to the scenario.
- Other acceptable responses could include:
- State dependent cues - by picturing himself in the shower it could help him to feel relaxed as he was when he learned the lines, therefore aiding retrieval
- ## Chapter 8 test
- ### Multiple choice questions
- 1 C. a physiological measure of consciousness that measures brain waves.
  - 2 C. an altered state of consciousness.
  - 3 B. self-control.
  - 4 B. EMG - Increased activity; EEG - an increase in frequency and a decrease in amplitude
  - 5 B. An induced altered state of consciousness, in which his brain waves show decreased frequency and increased amplitude.
  - 6 A. more difficulty performing two tasks at once.
  - 7 B. life events
  - 8 C. have more beta, and less alpha, theta and delta.
  - 9 B. avoidance coping.
  - 10 B. a controlled process requiring high levels of mental effort, an automatic process requiring low levels of mental effort.
- ### Short answer questions
- 11 [As a person's awareness lowers, they likely demonstrate a decrease in frequency and increase in amplitude in their brain wave patterns,<sup>1</sup> with more alpha, theta and delta waves and less beta waves.<sup>2</sup>]
- I have identified the likely changes as a decrease in frequency and an increase in amplitude.<sup>1</sup>
- I have identified the likely change to brain wave types.<sup>2</sup>
- 12 [Brain wave two would show higher levels of alertness than one<sup>1</sup> because it shows higher frequency and lower amplitude than brain wave one.<sup>2</sup>]
- I have correctly identified that brain wave two shows higher levels of alertness.<sup>1</sup>
- I have explained how the frequency and amplitude shows this higher alertness in brain wave two than brain wave one.<sup>2</sup>
- 13 a [An EEG would likely show an increase in beta waves, with high frequency, low amplitude waves.<sup>1</sup>]
- I have correctly identified the likely EEG reading as an increase in beta waves.<sup>1</sup>
- b [Phoebe would most likely be in the 'counter shock' stage of alarm reaction in Selye's GAS,<sup>1</sup> as she would be highly aroused sympathetically from the fright of the stressor, which is clear in that she felt the 'rush' that was most likely adrenaline released after the 'shock' stage to engage her flight-fight-freeze response.<sup>2</sup>]
- I have correctly identified that Phoebe would be in the 'counter shock' stage of the GAS.<sup>1</sup>
- I have provided evidence from the scenario to support the selected GAS stage.<sup>2</sup>
- I have referred to the character's name in my response (Phoebe), and to the scenario.
- c [Both stimulants and a stressor like that in Phoebe's situation would increase beta brain waves,<sup>1</sup> increasing the frequency and decreasing the amplitude of brain waves.<sup>2</sup>]
- I have identified a similarity between the effects of a stressor and stimulants on brain wave patterns.<sup>1</sup>
- I have described the similarity of brain wave patterns, referring to the amplitude and frequency of the brainwave pattern.<sup>2</sup>
- I have referred to the character's name in my response (Phoebe), and to the scenario.
- 14 a [As a teenager, playing guitar would have become an automatic process for Yusef<sup>1</sup> whereas as an adult it would have changed to a controlled process.<sup>2</sup>]
- I have correctly identified that playing guitar was an automatic process for Yusef as a teenager.<sup>1</sup>
- I have correctly identified that playing guitar was a controlled process for Yusef as an adult.<sup>2</sup>
- I have referred to the character's name in my response (Yusef), and to the scenario.
- b [Long term depression is responsible.<sup>1</sup>] Yusef's long break from guitar would have meant there was a repeated low intensity stimulation of the postsynaptic neurons involved in playing guitar, leading to the weakening of the pathways and memory trace responsible for playing guitar with ease,<sup>2</sup> changing it to a controlled process requiring lots of concentration.<sup>3</sup>]

- I have correctly identified long term depression as the process responsible.<sup>1</sup>
- I have explained long term depression is caused by the repeated low intensity stimulation of postsynaptic neurons, responsible for weakening a memory trace/pathway.<sup>2</sup>
- I have explained that long term depression would have changed the guitar playing to a controlled process.<sup>3</sup>
- I have referred to the character's name in my response (Yusef), and to the scenario.
- 15 a** [As caffeine is a stimulant, it is likely to increase frequency<sup>1</sup> and decrease amplitude in brain wave patterns.<sup>2</sup>]
- I have correctly identified an increase in frequency as a change in brain waves.<sup>1</sup>
- I have correctly identified a decrease in amplitude as a change in brain waves.<sup>2</sup>
- b** [Caffeine might become addictive due to its rewarding effects on the brain. If feeling tired is the antecedent<sup>1</sup> and consuming caffeine is the behaviour,<sup>2</sup> the consequence of feeling awake might be a form of negative reinforcement that people come to rely on.<sup>3</sup>]
- I have identified a potential antecedent.<sup>1</sup>
- I have identified a potential behaviour.<sup>2</sup>
- I have identified a potential consequence, specifying the type.<sup>3</sup>
- I have used the language of operant conditioning, referring to antecedent, behaviour, consequence and negative reinforcement.

### Key science skills questions

- 16** B. internal validity means that the IV affected the DV, whereas external validity means the results can be generalised to other people, time and settings.

- 17 a** Group one: [would be experiencing mostly beta waves.<sup>1</sup>] [This is because they just consumed a stimulant, increasing their awareness and making frequency increase while amplitude decrease in their brain wave patterns.<sup>2</sup>]

Group two: [would be experiencing mostly beta and alpha waves.<sup>3</sup>] [This is because it's the morning and so participants would be quite alert and awake, creating mostly high frequency, low amplitude waves.<sup>4</sup>]

- I have identified the likely brain wave pattern of group one as beta waves.<sup>1</sup>
- I have provided a relevant justification for this based on the experiment scenario.<sup>2</sup>

- I have identified the likely brain wave pattern of group two as beta and alpha waves.<sup>3</sup>
- I have provided a relevant justification for this based on the experiment scenario.<sup>4</sup>
- b** [The purpose is to reduce experimenter bias,<sup>1</sup> which may occur if the person conducting the investigation had an expectation about the results of the experiment.<sup>2</sup>] [Having a double-blind procedure means that the EEG readings and the treatment of participants in either group is likely to be unbiased.<sup>3</sup>]
- I have identified the extraneous variable of experimenter bias/the experimenter effect.<sup>1</sup>
- I have described the experimenter effect.<sup>2</sup>
- I have referred to the experiment in my response.<sup>3</sup>
- c** [One potential extraneous variable may be the testing conditions the investigation was carried out in, specifically the time of day.<sup>1</sup>] [Because it was the morning, participants were likely quite alert and awake, influencing brain wave patterns to be more prominently beta than compared to other times of the day.<sup>2</sup>] [This may be responsible for participants' brain waves as well as the stimulant, making it unclear whether the effects on the dependent variable were truly caused by the independent variable alone.<sup>3</sup>]
- I have identified an extraneous variable in this investigation.<sup>1</sup>
- I have explained how this may apply to the current investigation.<sup>2</sup>
- I have demonstrated knowledge of extraneous variables, explaining that they may affect the dependent variable as well as or instead of the independent variable.<sup>3</sup>

Other acceptable responses could include:

- Individual participant differences in response to caffeine, and the effect this has on the DV
- The amount of sleep participants had the night before, and the effect this has on the DV
- Other extraneous variables are accepted, as long as appropriate justification is provided

### Extended response

- 18** Students need to demonstrate that they have a thorough and holistic understanding of consciousness, how it can be tested, and the different theories about it that are relevant to the scenario. Given Adem was hit in the head, a discussion of the following theories would be awarded/relevant:

- Altered states of consciousness and normal waking consciousness
- Discussion of the consciousness continuum and where Adem might be placed
- Consciousness as a psychological construct and how this relates to testing procedures
- Induced versus naturally occurring altered states of consciousness

You also should have commented on some or all of the following ways to test Adem's psychological state:

- Investigate his time orientation. Someone could ask Adem how long it has been since he hit his head, or what the current date is. If Adem's response is inaccurate, he is likely to be in an altered state of consciousness due to something like concussion and so will need to receive relevant treatment.
- Investigate his content limitations
- Investigate his ability to perform controlled and/or automatic processes
- Investigate his self-control
- Investigate his emotional awareness
- Investigate whether he is experiencing any cognitive and perceptual distortions
- Investigate his levels of awareness

More marks would be awarded for 1) identifying the feature of consciousness to be investigated; 2) explaining how it could be tested and; 3) explaining what testing this feature might reveal about Adem's state. The first example is done for you. In terms of tests that doctors and nurses could run, you should have commented on some or all of the following:

- Physiological measures of consciousness including:
  - EEGs (including a discussion of what specific brain waves might reveal about Adem's level of alertness)
  - EMGs
  - EOGs
- Cognitive tasks of speed and accuracy

Again, more marks would be awarded for explaining how they test consciousness and what the specific test might reveal about someone's consciousness. In your explanation to Adem's mother about why a variety of tests are needed to investigate consciousness, you may have commented on:

- Ideas of reliability and/or validity in relation to testing consciousness
- Consciousness as a psychological construct

## 9A Sleep rhythms

### Theory review questions

- 1** a Sleep cycle  
c REM sleep  
e NREM sleep  
g Ultradian rhythm
- b Sleep-wake cycle  
d Circadian rhythm  
f Sleep  
h Sleep episode
- 2** D. W – Circadian rhythm; X – 24-hour cycle spent sleeping and being awake/alert; Y – Changes in physiological function as part of a cycle which occurs within 24 hours; Z – A sleep cycle
- 3** B. W – The complete duration of our time spent sleeping each day; X – A sleep cycle; Y – REM sleep; Z – NREM sleep

### Exam-style questions

#### Remember and understand

- 4** A. 4,1  
**5** D. 75–80, 20–25  
**6** B. decrease, while the chances of being in REM sleep increases.  
**7** [Rapid eye movement (REM) sleep makes up around 20–25% of a typical sleep episode, whereas non rapid eye movement (NREM) sleep makes up around 75–80% of a typical sleep episode.<sup>1</sup>] [Also, REM is one singular stage of sleep, whereas NREM sleep contains four stages.<sup>2</sup>]

I have correctly identified a difference.<sup>1</sup>

I have correctly identified a second difference.<sup>2</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses could include:

- Rapid eye movement (REM) sleep involves sporadic eye movement, whereas non-rapid eye movement sleep does not involve any sporadic eye movement
- Rapid eye movement (REM) involves the sleeper being paralyzed, whereas muscle movement is possible during non-rapid eye movement (NREM) sleep

- 8** [Circadian rhythms are a recurring physiological cycle lasting around 24 hours, whereas ultradian rhythms are physiological cycles that occur within 24 hours.<sup>1</sup>] [For example, the human sleep-wake cycle is a circadian rhythm<sup>2</sup>] [and a sleep cycle, comprising of distinct stages of non-rapid eye movement (NREM) and rapid eye movement (REM) sleep, is an ultradian rhythm.<sup>3</sup>]

I have identified that sleep circadian rhythms last around 24 hours whereas ultradian rhythms occur within 24 hours.<sup>1</sup>

I have identified the human sleep-wake cycle as an example of a circadian rhythm.<sup>2</sup>

I have identified a sleep cycle as an example of an ultradian rhythm.<sup>3</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

### Apply and analyse

- 9** C. rapid eye movement (REM) sleep.

- 10** [Fredrick is most likely in REM sleep.<sup>1</sup>] [This is because Fredrick is completely motionless meaning that he is likely experiencing sleep paralysis, a feature of REM sleep.<sup>2</sup>]

I have identified that Fredrick is in REM sleep.<sup>1</sup>

I have justified that Fredrick is likely experiencing sleep paralysis which is characteristic of REM sleep.<sup>2</sup>

I have referred to the character's name in my response (Fredrick), and to the scenario.

#### Questions from multiple lessons

- 11** [The sympathetic nervous system is responsible for these physiological changes.<sup>1</sup>]

I have correctly identified that the sympathetic nervous system is responsible for these physiological changes.<sup>1</sup>

- 12** [An altered state of consciousness refers to any state of consciousness that is different to normal waking consciousness in terms of our level of alertness and responsiveness to internal and external stimuli.<sup>1</sup>] [Sleep is considered an altered state of consciousness given that it involves perceptual disengagement to the world around us, where we no longer maintain a sense of time and place.<sup>2</sup>]

I have demonstrated an understanding of ASCs by referring to a feature of consciousness.<sup>1</sup>

I have justified why sleep is an altered state of consciousness.<sup>2</sup>

#### Key science skills

- 13** a [Dr Higgins used convenience sampling.<sup>1</sup>] [This is evident as he used his own class of university students for his experiment as they were most easily accessible.<sup>2</sup>]

I have correctly identified that Dr Higgins has used convenience sampling.<sup>1</sup>

I have correctly justified why Dr Higgins used convenience sampling.<sup>2</sup>

I have referred to the character's name in my response (Dr Higgins), and to the scenario.

- b** [Dr Higgins used a repeated measures research design.<sup>1</sup>] [An advantage of using a repeated measures research design is that it minimises individual participant differences as an extraneous variable.<sup>2</sup>]

I have correctly identified that Dr Higgins used the repeated measures experimental research design.<sup>1</sup>

I have provided an appropriate advantage of using repeated measures.<sup>2</sup>

I have referred to the character's name in my response (Dr Higgins), and to the scenario.

Other acceptable responses could include:

- An advantage of using a repeated measures research design is that it is more resourceful as it requires less participants

- c** [One relevant extraneous variable in Dr Higgins' experiment is

order effects, due to the use of a repeated measures research design.<sup>1</sup> To minimise order effects, Dr Higgins could have used counterbalancing, which involves alternating the order that the experiment and control group are exposed to the independent variable.<sup>2</sup> This would involve Dr Higgins having half his students record sleep-onset while having a week of exams first and then a week with no exams second and then the other half recording sleep-onset while having a week without exams first and then a week with exams second.<sup>3</sup>

I have correctly identified that order effects are a relevant extraneous variable.<sup>1</sup>

I have correctly identified that order effects can be minimised by Dr Higgins using counterbalancing.<sup>2</sup>

I have explained what it would involve for Dr Higgins to use counterbalancing in his experiment.<sup>3</sup>

I have referred to the character's name in my response (Dr Higgins), and to the scenario.

d [Dr Higgins cannot generalise his results.<sup>1</sup>] This is because of his use of convenience sampling, where his sample of students just at his university is not representative of the entire population of research interest, being all university students.<sup>2</sup>

I have correctly identified that Dr Higgins cannot generalise his results.<sup>1</sup>

I have correctly explained why Dr Higgins cannot generalise his results.<sup>2</sup>

I have referred to the character's name in my response (Dr Higgins), and to the scenario.

Other acceptable responses could include:

- Dr Higgins cannot generalise his results due to confounding variables
  - Dr Higgins cannot generalise his results due to an unknown sample size
- e [These similar results suggest that Dr Higgins' experiment had high reliability.<sup>1</sup>]

I have correctly interpreted these similar results as indicating high reliability.<sup>1</sup>

4 D. There is no explanation for why less active individuals experience the same amount of NREM sleep as active individuals.

5 [There is limited evidence to support both the evolutionary theory and the restoration theory of sleep.<sup>1</sup> Also, neither theory accounts for the benefits of sleep on mental health.<sup>2</sup>]

I have identified that there is limited evidence to support both the restoration theory and the evolutionary theory.<sup>1</sup>

I have identified that neither the restoration theory or evolutionary theory accounts for the benefit of sleep on mental health.<sup>2</sup>

6 [The evolutionary theory of sleep proposes that sleep has an adaptive quality and has evolved to meet various survival needs.<sup>1</sup> For example, humans sleep at night time so that survival activities such as searching for food and water can be completed during the day when there is light.<sup>2</sup> Whereas, the restoration theory of sleep proposes that NREM and REM sleep have specific effects on repairing and restoring psychological and physiological processes.<sup>3</sup> For example, during NREM sleep damaged muscle tissue is repaired.<sup>4</sup>]

I have described the purpose of sleep according to the evolutionary theory of sleep.<sup>1</sup>

I have provided an example that demonstrates the evolutionary theory of sleep.<sup>2</sup>

I have described the purpose of sleep according to the restoration theory of sleep.<sup>3</sup>

I have provided an example that demonstrates the restoration theory of sleep.<sup>4</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

### Apply and analyse

- 7 A. rapid eye movement (REM) sleep.  
 8 D. non-rapid eye movement (NREM) sleep.  
 9 C. briefly revise her vocabulary and get as much sleep as possible.  
 10 [The theory of sleep that accounts for Stacey being sore the following morning is the restoration theory of sleep.<sup>1</sup> According to this theory, NREM sleep is the type of sleep that is responsible for repairing damaged cells and tissues, so a lack of NREM sleep can result in Stacey's arm muscles being unprepared and sore.<sup>2</sup>]

I have correctly identified that the restoration theory of sleep is accountable for Stacey being sore.<sup>1</sup>

I have correctly identified that a lack of NREM sleep is responsible for Stacey being sore.<sup>2</sup>

I have referred to the character's name in my response (Stacey), and to the scenario.

### Questions from multiple lessons

- 11 [This concept is neural plasticity.<sup>1</sup>]

I have correctly identified that the concept that relates to changes in neural pathways across the lifespan is neural plasticity.<sup>1</sup>

## 9B The purpose and function of sleep

### Theory review questions

- 1 a Restoration theory of sleep  
 b Evolutionary theory of sleep  
 2 C. W - Evolutionary theory; X - Restoration theory; Y - Includes the example of sleeping at night because light is needed to search for food; Z - No reference to the circadian nature of sleep and its value

### Exam-style questions

#### Remember and understand

- 3 C. Inactivity at night is adaptive to survival.

- 12** [One change in a person's psychological state during sleep is decreased awareness.<sup>1</sup>] [This means that an organism is unable to register a potential threat, such as a predator, and evade or confront the predator if it's approached.<sup>2</sup>]

I have correctly identified a change in a person's psychological state.<sup>1</sup>

I have explained how this change in a person's psychological state could increase vulnerability to a predator during sleep.<sup>2</sup>

- 13 a** [Jose evaluated the psychology SAC as stressful, but a challenge<sup>1</sup>] [as he sees it as an opportunity to demonstrate his current knowledge to his teacher.<sup>2</sup>] [In contrast, Hiroshi evaluated the psychology SAC as stressful, but also a threat<sup>3</sup>] [as he is concerned that a lower SAC performance will impact his future psychology score.<sup>4</sup>]

I have correctly identified that Jose has evaluated the SAC as stressful and a challenge.<sup>1</sup>

I have drawn on evidence in the scenario to explain why Jose evaluated the SAC as stressful and a challenge.<sup>2</sup>

I have correctly identified that Hiroshi evaluated the SAC as stressful and a threat.<sup>3</sup>

I have drawn on evidence in the scenario to explain why Hiroshi evaluated the SAC as stressful and a threat.<sup>4</sup>

I have used the language of the Transactional model, referring to irrelevant, benign-positive and stressful, and harm/loss, threat or challenge.

I have referred to the characters' name in my response (Jose and Hiroshi).

- b** [The restorative theory of sleep argues that REM sleep has restorative effects such as enhancing learning and memory.<sup>1</sup>] [Jose's increased sleep duration means that he is more likely to spend a greater period of time in REM sleep, therefore enhancing his neural pathways representing the psychology content for the SAC.<sup>2</sup>] [In contrast, Hiroshi's strategy of staying up late cramming means he is less likely to experience the restorative effects of REM sleep, impairing his learning and memory of the psychology content before the SAC, making Hiroshi's coping strategy less effective.<sup>3</sup>]

I have identified a restorative effect of REM sleep.<sup>1</sup>

I have linked Jose's increased duration of REM sleep with enhanced learning and memory for the psychology SAC.<sup>2</sup>

I have linked Hiroshi's decreased duration of REM sleep with impaired learning and memory for the psychology SAC.<sup>3</sup>

I have referred to the characters' name in my response (Jose and Hiroshi), and to the scenario.

### Key science skills

- 14 a** [A repeated measures design involves participants being part of both the control and experimental groups.<sup>1</sup>] [Given that Dr Lee is using patients that are ill in the experimental group, these patients cannot also be part of the control group as healthy patients are required to provide a baseline of results for comparison.<sup>2</sup>]

I have correctly identified that a repeated measures design involves participants being part of both the control and experimental group.<sup>1</sup>

I have identified that Dr Lee's experimental group is ill patients and they cannot be part of the control group as healthy participants are required.<sup>2</sup>

I have referred to the character's name in my response (Dr Lee), and to the scenario.

- b** [Dr Lee could have considered the age of participants.<sup>1</sup>] [Varying ages amongst participants from both groups could cause differences in the proportion of REM and NREM sleep (dependent variable) as opposed to whether or not participants are ill (independent variable), which is what the experiment is testing.<sup>2</sup>]

I have correctly identified one relevant extraneous variable.<sup>1</sup>

I have justified why this extraneous variable could have been considered.<sup>2</sup>

I have referred to the character's name in my response (Dr Lee), and to the scenario.

Other acceptable responses could include:

- The type of illness within the experimental group
- If participants had an existing sleep disorder

- c** [Patients with a muscle injury are likely to show an increased proportion of NREM sleep in comparison to healthy patients.<sup>1</sup>] [This is because NREM sleep has the restorative function of repairing damaged muscle tissue.<sup>2</sup>]

I have correctly identified that patients with a muscle injury will experience increased NREM sleep.<sup>1</sup>

I have correctly identified that this increase in NREM sleep is to have the restorative function of repairing the body.<sup>2</sup>

- d** [Dr Lee's colleague is referring to the evolutionary theory of sleep.<sup>1</sup>] [One weakness of the evolutionary theory is that it does not explain our actual need to sleep, but rather explains why we sleep at particular times.<sup>2</sup>] [Another weakness of the evolutionary theory is that it does not account for how sleeping can put an organism at greater risk due to loss of awareness.<sup>3</sup>]

I have correctly identified that Dr Lee's colleague is referencing the evolutionary theory of sleep.<sup>1</sup>

I have correctly identified one weakness.<sup>2</sup>

I have correctly identified a second weakness.<sup>3</sup>

I have referred to the character's name in my response (Dr Lee's colleague), and to the scenario.

Other acceptable responses could include:

- The evolutionary theory of sleep does not account for the benefits of sleep on mental health
- There is limited evidence to support the evolutionary theory of sleep

## 9C Sleep across the lifespan

### Theory review questions

- 1** a Neonatal                    b Children                    c Infant  
       d Adolescent                e Old age                    f Adult
- 2** a Neonatal/newborn baby  
       b Adolescence, adulthood and old age  
       c Childhood
- 3** Age group: Adolescence

### Exam-style questions

#### Remember and understand

- 4** B. equal to the proportion of REM sleep.
- 5** D. Elderly people typically have shorter sleep duration than adolescents.
- 6** [A hypnogram of an infant would show a higher proportion of REM sleep.<sup>1</sup>] [and lower proportion of NREM sleep than a hypnogram of healthy adult.<sup>2</sup>]

I have identified that a hypnogram of an infant would have a higher proportion of REM sleep than a hypnogram of a healthy adult.<sup>1</sup>

I have identified that a hypnogram of an infant would show a lower proportion of NREM sleep than a hypnogram of a healthy adult.<sup>2</sup>

#### Apply and analyse

- 7** C. Joseph – IV; Gabby – I
- 8** A. is normal for a newborn baby.
- 9** a [The time spent in REM sleep increases as the sleep episode progresses, whereas the time spent in NREM sleep decreases as the sleep episode progresses.<sup>1</sup>] [Also, there is a greater total amount of time spent in NREM sleep compared to in REM sleep.<sup>2</sup>]

I have outlined one difference between REM and NREM sleep in the hypnogram.<sup>1</sup>

I have outlined a second difference between REM and NREM sleep in the hypnogram.<sup>2</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses could include:

- NREM stages 3–4 are generally evident only in the first couple of cycles, whereas REM occurs throughout the night.
  - NREM sleep has four stages and REM has one.
- b [The hypnogram of an infant would show a sleep duration approximately 16 hours, whereas the hypnogram of a healthy adolescent only shows around 9 hours of sleep duration.<sup>1</sup>] [The hypnogram of an infant would also show that approximately 50% of the sleep episode would be in REM sleep, whereas the hypnogram of the healthy adolescent only shows approximately 20% REM sleep.<sup>2</sup>]

I have outlined one difference between the hypnogram of an infant and the hypnogram of an adolescent.<sup>1</sup>

I have outlined a second difference between the hypnogram of an infant and the hypnogram of an adolescent.<sup>2</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses could include:

- The hypnogram of an infant would show that approximately 50% of the sleep episode was in NREM sleep, whereas the hypnogram of an adolescent shows approximately 80% NREM sleep

#### Questions from multiple lessons

- 10** C. an increase in neural plasticity.
- 11** D. Duration of sleep cycle (minutes) – 90–120; Number of complete sleep cycles – 4 or 5
- 12** [According to the restoration theory of sleep, REM sleep promotes the development of the brain, such as restoring adequate neurotransmitter levels.<sup>1</sup>] [Newborn babies therefore spend more time in REM sleep than other age groups as they require greater neural development in order to learn new processes such as speech and language.<sup>2</sup>]

I have demonstrated an understanding of the effect of REM sleep according to the restoration theory.<sup>1</sup>

I have explained why newborn babies require greater amounts of REM sleep compared to other age groups.<sup>2</sup>

#### Key science skills

- 13** a [Dr Arain used a cross-sectional study.<sup>1</sup>]  
  I have identified that Dr Arain used a cross-sectional study.<sup>1</sup>
- b [Infants do not yet have the capacity to fill in their own sleep diary.<sup>1</sup>] [This could be controlled for by having the guardians of the infants filling out their sleep diary on their behalf.<sup>2</sup>]  
  I have correctly identified one relevant extraneous variable related to obtaining data from the infant age group.<sup>1</sup>
- I have explained how this extraneous variable could be controlled.<sup>2</sup>
- I have referred to the character's name (Dr Arain), and to the scenario.

Other acceptable responses could include:

- Infants can't record their own data so would need a caregiver to record the data, which might be inaccurate as they can't have this communicated to them. Dr Arain could amend this by monitoring the infants' sleep in a sleep laboratory with objective physiological measures.
- The identification of other relevant extraneous variables and appropriate ways to control can also be accepted.

- c [Dr Arain will not be able to determine the participants' proportion of REM and NREM sleep.<sup>1</sup>][This is because Dr Arain is using a sleep diary, which does not record the physiological responses required to determine REM and NREM sleep within a sleep episode.<sup>2</sup>]

I have identified that Dr Arain will not be able to determine participants' proportion of REM and NREM sleep.<sup>1</sup>

I have justified that this is due to sleep diaries not being a physiological measure of consciousness.<sup>2</sup>

I have referred to the character's name (Dr Arain), and to the scenario.

- d [A limitation of using sleep diaries is that they are a subjective measure of consciousness and can therefore be impacted by personal bias.<sup>1</sup>]

I have identified the limitation of sleep diaries being a subjective measure of consciousness.<sup>1</sup>

- e [The results from the child age group will show increased sleep duration compared to the results from the elderly age group.<sup>1</sup>]

I have identified the difference that the child age group will have an increased sleep duration compared to the elderly age group.<sup>1</sup>

## Chapter 9 test

### Multiple choice questions

- 1 B. a physiological cycle lasting around 24 hours.
- 2 A. high levels of movement of the muscles surrounding the eyes.
- 3 D. restores the body during periods of general fatigue.
- 4 D. Limitation of evolutionary theory - Does not account for the benefit of sleep on mental health; Strength of restoration theory - Addresses our specific need to sleep
- 5 C. Theory of sleep - Restoration; Type of sleep - NREM
- 6 C. Aapo has a greater proportion of NREM sleep as an adolescent.
- 7 C. sleep duration is higher for the adolescent and both have a similar proportion of REM and NREM sleep.
- 8 A. Theory of sleep - Evolutionary; Strength of theory - Accounts for the significance of the circadian nature of sleep
- 9 D. has sufficient evidence to entirely support its claims.
- 10 D. sleep duration and the proportion of REM sleep is significantly higher for the newborn baby.

### Short answer questions

- 11 [Sleep duration will decrease from approximately 8.5 hours during adolescence to approximately 7.75 hours during adulthood.<sup>1</sup>][Also, the proportion of REM sleep will remain at around 20% and the proportion of NREM sleep will remain at around 80%.<sup>2</sup>]

I have described how sleep duration will decrease from adolescence to adulthood.<sup>1</sup>

I have described how the proportion of REM and NREM sleep will not significantly change from adolescence to adulthood.<sup>2</sup>

- 12 [Hypnogram 1 displays an elderly person's sleep episode.<sup>1</sup>][This is because hypnogram 1 shows a sleep duration that is around 6 hours, which is characteristic of an elderly person's sleep episode.<sup>2</sup>]

I have identified that hypnogram 1 displays an elderly person's sleep episode.<sup>1</sup>

I have provided an appropriate justification with reference to a feature of hypnogram 1.<sup>2</sup>

Other acceptable responses could include:

- Hypnogram 1 shows that the sleeper experienced a significant amount of brief awakenings, which is characteristic of an elderly person's sleep episode
- Hypnogram 1 shows less time in deep NREM 3 and 4 sleep, which is characteristic of an elderly person's sleep episode

- 13 [Sleep cycles are a proportion of a sleep episode in which the sleeper progresses through stages of REM and NREM sleep, lasting around 90 minutes.<sup>1</sup>][Sleep cycles are therefore an example of an ultradian rhythm because they occur within 24 hours (90 minutes) and involve physiological changes throughout as the sleeper changes between REM and NREM sleep.<sup>2</sup>]

I have defined sleep cycles.<sup>1</sup>

I have described why sleep cycles are an example of an ultradian rhythm.<sup>2</sup>

- 14 [REM sleep involves rapid movement of the muscles surrounding the eyes, whereas NREM sleep involves no rapid eye movement.<sup>1</sup>][According to the restoration theory of sleep, REM sleep maintains neural pathways through stimulation<sup>2</sup>][whereas NREM sleep helps recover from general fatigue.<sup>3</sup>]

I have identified a difference between REM sleep and NREM sleep.<sup>1</sup>

I have identified an effect of REM sleep according to the restoration theory.<sup>2</sup>

I have identified an effect of NREM sleep according to the restoration theory.<sup>3</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses for the difference between REM and NREM could include:

- REM sleep involves sleep paralysis, whereas muscle movement is possible during NREM sleep
- REM sleep makes up around 20% of the sleep episode whereas NREM sleep makes up around 80% of the sleep episode from childhood onwards
- REM sleep is only one stage of sleep, whereas NREM sleep is subdivided into 4 different stages
- Dreams are frequently recalled if woken during REM sleep, whereas dreams are not frequently recalled if woken during NREM sleep

Other acceptable responses for the effect of REM sleep according to the restoration theory could include:

- REM sleep restores adequate neurotransmitter levels
- REM sleep enhances learning
- REM sleep promotes memory consolidation

Other acceptable responses for the effect of NREM sleep according to the restoration theory could include:

- NREM sleep repairs damaged cells and tissues
- NREM sleep detoxifies muscles
- NREM removes waste products from muscles
- NREM sleep enables physical growth

- 15** [Circadian rhythms are changes to biological activity that occur as part of a 24-hour cycle.<sup>1</sup>][The human sleep-wake cycle is an example of a circadian rhythm.<sup>2</sup>][According to the evolutionary theory, the sleep-wake cycle being a circadian rhythm is significant because it ensures that humans sleep during the night as daylight is required to complete survival activities such as searching for food or hiding from predators.<sup>3</sup>]

I have described circadian rhythms.<sup>1</sup>

I have provided the sleep-wake cycle as an example of a circadian rhythm.<sup>2</sup>

I have explained the significance of the sleep-wake cycle being a circadian rhythm according to the evolutionary theory of sleep.<sup>3</sup>

- c** [The newborn babies are likely to have a sleep duration of approximately 16 hours,<sup>1</sup>][In contrast, adolescents are likely to have a sleep duration of approximately 8.5 hours.<sup>2</sup>]

I have identified that the group with newborn babies are likely to have a sleep duration of approximately 16 hours.<sup>1</sup>

I have identified that the group with adolescents are likely to have a sleep duration of approximately 8.5 hours.<sup>2</sup>

- d** [Dr Bilmore cannot generalise her results.<sup>1</sup>][This is because of Dr Bilmore's use of convenience sampling, meaning that participants are just sourced from one hospital and therefore do not represent the characteristics of the entire population of newborns and adolescents.<sup>2</sup>]

I have correctly identified that Dr Bilmore cannot generalise her results.<sup>1</sup>

I have correctly explained why Dr Bilmore cannot generalise her results.<sup>2</sup>

I have referred to the character's name in my response (Dr Bilmore), and to the scenario.

Other acceptable responses could include:

- Dr Bilmore cannot generalise her results due to confounding variables
- Dr Bilmore cannot generalise her results due to an unknown sample size

### Key science skills questions

- 16 a** [A repeated measures experimental research design involves participants being a part of both the control and the experimental group.<sup>1</sup>][Given that the independent variable in Dr Bilmore's experiment is the age of participants, this will not work because participants in each group need to be a different age and therefore cannot be a part of both groups.<sup>2</sup>]

I have described what is involved in a repeated measures experimental research design.<sup>1</sup>

I have explained that participants in each group need to be of a different age and cannot be part of both groups.<sup>2</sup>

I have referred to the character's name in my response (Dr Bilmore), and to the scenario.

- b** [Dr Bilmore used convenience sampling.<sup>1</sup>][This is because she sourced participants from the hospital where she works, who are easily accessible.<sup>2</sup>]

I have correctly identified that Dr Bilmore used convenience sampling.<sup>1</sup>

I have correctly explained that this is because Dr Bilmore sourced her participants from the hospital where she works.<sup>2</sup>

I have referred to the character's name in my response (Dr Bilmore), and to the scenario.

### Extended response

- 17** Students need to demonstrate that they have a solid and holistic understanding of the importance of sleep, including sleep rhythms, theories for the purpose and function of sleep and changes in sleep across the human lifespan.

For the description of the relevance of **circadian rhythms** in this scenario, students should have mentioned the following points:

- Essie's sleep-wake cycle is a prime example of circadian rhythms.
- Essie's sleep-wake cycle is made up of her time spent sleeping and completing activities during the day such as her rowing and school.

For the description of the relevance of **ultradian rhythms** in this scenario, the following points need to be mentioned in order for students to be awarded marks:

- Essie's sleep cycles are a prime example of ultradian rhythms
- Essie's sleep cycles are made up of periods of REM and NREM sleep and last for approximately 90 minutes.

For the description of the relevance of the **restoration theory of sleep**, students should have made the following points:

- Essie's parents' statement about how Essie will be sore from sport and not be able to remember what she was taught at school if she doesn't get adequate sleep relates to the restoration theory of sleep.
- NREM sleep is responsible for repairing damaged cells and tissue after Essie rowing and repairing her muscles.
- REM sleep is responsible for restoring neurotransmitter levels and promoting memory consolidation for Essie to remember all of the content that she is taught at school.

For the **comparison of sleep between adolescents and adults**, students should have drawn on the following material from the scenario and made the following points:

- Essie's parents' statement about how she shouldn't complain about being tired because they sleep far less and still feel fine relates to the concept of sleep across the lifespan.
- This statement is unfair as Ellie requires a sleep duration of around 8.5 hours at her age.
- By contrast, her parents have experienced a natural decline in sleep duration to around 6 hours without any negative consequences on physical and psychological functioning.



14 [Automatic processing involves completing tasks with little mental effort such as simple tasks,<sup>1</sup>] whereas controlled processing involves completing tasks with more mental effort, which are often complex tasks.<sup>2</sup> [Sleep-deprived individuals are still able to focus mental effort on complex tasks due to controlled processing, therefore performing better when compared to simple tasks,<sup>3</sup>] whereas, due to automatic-processing, they are likely to perform worse on simple tasks due to not directing mental effort towards the task.<sup>4</sup>]

I have outlined automatic processing.<sup>1</sup>

I have outlined controlled processing.<sup>2</sup>

I have explained why a sleep deprived individual performs better on complex tasks when compared to simple tasks, referring to controlled processes.<sup>3</sup>

I have explained why a sleep deprived individual performs worse on simple tasks, referring to automatic processing.<sup>4</sup>

#### Key science skills

15 a [Dr Lee used convenience sampling for her experiment.<sup>1</sup>]

I have correctly identified that convenience sampling was used.<sup>1</sup>

I have referred to the character's name in my response (Dr Lee), and to the experiment scenario.

b [It is hypothesised that students<sup>1</sup> [who slept more than seven hours a night<sup>2</sup>] performed better on cognitive tasks than students who slept less than seven hours a night.<sup>3</sup>]

I have correctly identified the population in my hypothesis (students).<sup>1</sup>

I have referred to the IV in my hypothesis (sleep duration).<sup>2</sup>

I have referred to the DV in my hypothesis (performance on cognitive tasks).<sup>3</sup>

I have stated the direction of my hypothesis.

c [Dr Lee should consider confidentiality in her experiment.<sup>1</sup> This means that data from each participant should be de-identified and their details should remain confidential.<sup>2</sup> [Another consideration could be withdrawal rights,<sup>3</sup> allowing participants to leave the experiment at any stage if they wish.<sup>4</sup>]

I have outlined one ethical consideration.<sup>1</sup>

I have described how this relates to the experiment.<sup>2</sup>

I have outlined a second ethical consideration.<sup>3</sup>

I have described how this second consideration relates to the experiment.<sup>4</sup>

I have referred to the character's name in my response (Dr Lee), and to the experiment scenario.

Other acceptable responses could include:

- Voluntary participation
- Informed consent
- Appropriate debriefing

d [Dr Lee would likely find that there is a relationship between the number of hours of sleep duration and performance on cognitive tasks, as measured by the number of errors made in these tasks.<sup>1</sup> [This relationship could be that as the hours of sleep duration increases, the number of errors on the cognitive tasks would likely decrease.<sup>2</sup>]

I have predicted that there would be a relationship.<sup>1</sup>

I have explained this relationship, referencing both the IV (number of hours of sleep duration) and DV (performance on cognitive tasks, as measured by the number of errors made).<sup>2</sup>

I have referred to the character's name in my response (Dr Lee), and to the scenario.

## 10B Sleep deprivation and blood alcohol concentrations

#### Theory review questions

1 a Cognition

b Blood alcohol concentration (BAC)

c Concentration

d Mood

#### Exam-style questions

##### Remember and understand

2 C. a BAC of 0.10.

3 A. about equally affected by one night of sleep deprivation and a BAC level of 0.10.

4 B. a greater sensitivity in mood.

5 [A person who has had a full night of sleep deprivation would likely have worse cognitive abilities than when they have a BAC of 0.05,<sup>1</sup> as a person with a full night of sleep deprivation has more comparable cognitive abilities to a person with a higher BAC of 0.10.<sup>2</sup>]

I have correctly identified that they would not have the same effect.<sup>1</sup>

I have justified this by explaining that one night of full sleep deprivation has the equivalent effect of a BAC of 0.10 on cognition.<sup>2</sup>

6 [While condition A would impair cognition,<sup>1</sup> [for example affecting the ability to make decisions,<sup>2</sup>] condition B would impair cognition to a greater extent than condition A.<sup>3</sup>]

I have identified A would impair cognition.<sup>1</sup>

I have provided an example of impaired cognition.<sup>2</sup>

I have identified B would impair cognition to an even greater extent.<sup>3</sup>

#### Apply and analyse

7 B. Terry would have a greater ability to concentrate on the test than Solomon.

8 [A road safety person can suggest that having an illegal BAC of 0.05 or above negatively affects consciousness in the same way as partial sleep deprivation (17 hours).<sup>1</sup> [In terms of cognition, they both reduce

cognitive ability, resulting in things like reduced ability to make quick decisions.<sup>2</sup> They both reduce concentration ability, resulting in decreased awareness,<sup>3</sup> and they can both impact mood such that it might distract someone from the road.<sup>4</sup>

- I have identified that an illegal BAC of 0.05 or above affects consciousness similarly to sleep deprivation of 17 hours.<sup>1</sup>
  - I have described how they both may affect cognition with an example relative to driving.<sup>2</sup>
  - I have described how they both may affect concentration with an example relative to driving.<sup>3</sup>
  - I have described how they both may affect mood with an example relative to driving.<sup>4</sup>
  - I have referred to the scenario in my response.

## Questions from multiple lessons

- 9 D. reduced concentration.

10 a [Alcohol can decrease the frequency and increase the amplitude of brain wave patterns<sup>1</sup>] [and reduce levels of alertness.<sup>2</sup>] [This in turn reduces concentration and cognitive ability when driving.<sup>3</sup>]

- I have correctly described alcohol's effect on brain wave patterns, identifying a decrease in frequency and increase in amplitude.<sup>1</sup>

---

I have identified that this reduces levels of alertness.<sup>2</sup>

---

I have explained that this would reduce concentration and cognition when driving.<sup>3</sup>

---

b [A BAC of 0.10 likely distorts someone's time orientation<sup>1</sup>][which could be dangerous for driving as it might lead to slowed reaction times or lead to inaccurate responses.<sup>2</sup>]

---

I have identified that a BAC of 0.10 might distort one's time orientation.<sup>1</sup>

---

I have described how this might be dangerous for driving.<sup>2</sup>

Other acceptable responses could include:

- Other ways time orientation could be dangerous for driving e.g. distorted perception of the speed of things happening on the road (whether faster or slower) could cause a crash.

- 11 a [An EEG could be used<sup>1</sup>][to measure their consciousness, by detecting, amplifying and recording George and his friends' brain waves.<sup>2</sup>][A comparison of their frequencies and amplitudes would reveal who was more alert.<sup>3</sup>]

- I have identified one physiological measure (EEG).<sup>1</sup>
  - I have explained that the EEG would detect, amplify and record brain waves.<sup>2</sup>
  - I have indicated what comparing these results would reveal about consciousness.<sup>3</sup>
  - I have referred to the characters' names in my response (George and his friends), and to the scenario.

Other acceptable responses could include:

- Other physiological measures of consciousness (EMG, EOG) if applied correctly to the scenario.

- b** [It would be about equally unsafe for either George or his friends to drive<sup>1</sup>][as a BAC of 0.10 and 24 hours sleep deprivation<sup>2</sup>][have similar effects on consciousness, reducing one's concentration and cognition and affecting mood in a way that is dangerous for driving.<sup>3</sup>

- I have correctly identified that it would be equally unsafe for George or his friends to drive.<sup>1</sup>
  - I have identified that a BAC of 0.10 and 24 hours of no sleep as the relevant point of comparison.<sup>2</sup>
  - I have explained that both these factors have a negative effect on consciousness that is dangerous for driving.<sup>3</sup>
  - I have referred to the characters' names in my response (George and his friends), and to the scenario.

## **Key science skills**

- 12 a [Repeated measures.<sup>1</sup>]

---

✓ ✗ I have correctly identified the experimental design as repeated measures.<sup>1</sup>

---

b [Computer simulated tasks use a specific kind of concentration like looking at the screen and concentrating on that one task<sup>1</sup>][whereas real life concentration like driving a car might involve a different kind, like focussing on several things at once and having to block out more distractors,<sup>2</sup>][and so these results might be difficult to generalise as the settings are quite different.<sup>3</sup>]

---

✓ ✗ I have identified one comparable difference of concentrating on computer simulated tasks.<sup>1</sup>

---

✓ ✗ I have contrasted this with concentrating when driving a car.<sup>2</sup>

---

✓ ✗ I have explained that this difference in setting might be a problem for generalisability.<sup>3</sup>

---

c [By measuring the average (mean) number of errors made by participants on the cognitive tasks in either condition<sup>1</sup>]  
[a comparison could be drawn between the effects of either condition on the concentration and cognition of participants.<sup>2</sup>]

---

✓ ✗ I have described what the mean measures in this experiment.<sup>1</sup>

---

✓ ✗ I have explained how this might have informed results in relation to the given experiment.<sup>2</sup>

## 10C Circadian phase disorders

## Theory review questions



## **Exam-style questions**

## **Remember and understand**

- 2** D. Adolescent sleep-wake cycle shift
  - 3** B. crossing into a timezone that a person's sleep-wake cycle is not aligned with

- 4 [Jet lag can negatively impact an individual's sleep-wake cycle<sup>1</sup>][as it involves a mismatch between an individual's internal circadian rhythm and the time of their environment. This may lead to them being unable to sleep at night and feeling sleepy during the day.<sup>2</sup>]

I have identified that the jet lag negatively impacts an individual's sleep-wake cycle.<sup>1</sup>

I have explained how jet lag impacts an individual's sleep-wake cycle.<sup>2</sup>

### Apply and analyse

- 5 D. no effect on her sleep-wake cycle.

- 6 C. a circadian phase disorder.

- 7 [As Koko is a year 12 student, she is also an adolescent and is experiencing the adolescent sleep-wake cycle shift.<sup>1</sup>][Her brother Connor is not experiencing the adolescent sleep-wake shift as he is an adult.<sup>2</sup>][Therefore, melatonin would be released around two hours later for Koko than for her older brother Connor, leading to Koko falling asleep later than Connor.<sup>3</sup>]

I have identified that Koko is experiencing the adolescent sleep-wake cycle shift.<sup>1</sup>

I have identified that Connor is not experiencing the adolescent sleep-wake cycle shift.<sup>2</sup>

I have explained the biological reason as to why Koko falls asleep later, referring to the delayed release of melatonin.<sup>3</sup>

I have referred to the character's name in my response (Koko and Connor), and to the scenario.

- 8 [Adolescents like Morgan find it hard to get up for school in the morning due to the sleep-wake cycle shift in adolescence.<sup>1</sup>][This involves a delayed sleep-onset where Morgan and other adolescents fall asleep and wake later due to the delayed release of melatonin, finding it hard to get up at a regular time in the morning.<sup>2</sup>]

I have identified that Morgan is experiencing the adolescent sleep-wake cycle shift.<sup>1</sup>

I have referred to Morgan experiencing delayed sleep-onset, and therefore finding it hard to get up in the morning.<sup>2</sup>

I have referred to the character's name in my response (Morgan), and to the scenario.

### Questions from multiple lessons

- 9 C. Decreased frequency, increased amplitude.

- 10 a [Mustafa is experiencing the adolescent sleep-wake cycle shift.<sup>1</sup>]

I have correctly identified that Mustafa is experiencing the adolescent sleep-wake cycle shift.<sup>1</sup>

- b [Mustafa will experience greater levels of fatigue in the day, compared to his mum.<sup>1</sup>][This is due to the requirements of sleep across the lifespan, as Mustafa requires around 8.5 hours of sleep a night due to being an adolescent, while his mum only requires 6-7 hours.<sup>2</sup>]

I have identified that Mustafa will experience greater levels of fatigue.<sup>1</sup>

I have explained why Mustafa will experience greater levels of fatigue during the day.<sup>2</sup>

I have referred to the character's name in my response (Mustafa), and to the scenario.

- 11 a [The restoration theory of sleep outlines that sleep restores psychological and physiological functions.<sup>1</sup>]

I have described the restoration theory of sleep, referring to the restoration of both psychological and physiological functions.<sup>1</sup>

- b [The experiences of Tahlia's clients supports the restoration theory of sleep.<sup>1</sup>][This is due to Tahlia's clients experiencing extreme fatigue and excessive sleepiness during the day, displaying how their lack of sleep has led to reduced physiological and psychological functioning.<sup>2</sup>]

I have identified that the experiences of Tahlia's clients support the restoration theory of sleep.<sup>1</sup>

I have explained how Tahlia's clients are experiencing reduced physiological and psychological functioning.<sup>2</sup>

I have referred to the character's name in my response (Tahlia), and to the scenario.

- c [Sleep deprivation involves behavioural effects.<sup>1</sup>][This occurs in the scenario due to Tahlia's clients often experiencing reduced motor control, which has led to many of them experiencing an accident at work.<sup>2</sup>]

I have identified an effect of sleep deprivation.<sup>1</sup>

I have explained how this effect is evident in the scenario, referring to examples.<sup>2</sup>

I have referred to the character's name in my response (Tahlia), and to the scenario.

Other acceptable responses could include:

- Slower reaction times
- Microsleeps
- Increased likelihood to engage in risk-taking behaviours
- Other examples could be used as long as they are evident in the scenario.

### Key science skills

- 12 a [One advantage of using a repeated measures design is that it controls for the extraneous variable of individual participant differences between groups, as the same participants are used in both the experimental and control conditions.<sup>1</sup>]

I have correctly identified an advantage of a repeated measures design.<sup>1</sup>

Other acceptable responses could include:

- More resourceful to source fewer participants and therefore more convenient

- b [Dr Mitra could conclude that shift work significantly impacts and reduces cognitive functioning.<sup>1</sup>][This can be seen from the results from the night shift, where the employees had a much higher



## Key science skills

- 14 a** [No this conclusion is not valid.<sup>1</sup>] [This is due to the extraneous variables within the investigation,<sup>2</sup>] [such as the potential unreliability of the results being recorded by self-report. The participants may have been incorrect about how long it had taken them to get to sleep the night before or they may have had to guess how long it had taken them.<sup>3</sup>]

I have correctly identified that the conclusion is not valid.<sup>1</sup>

I have correctly identified a reason as to why the conclusion is not valid, and given an example.<sup>2</sup>

I have explained how the reason I identified would have impacted the results in the scenario.<sup>3</sup>

Other acceptable responses could include:

- Use of convenience sampling due to selecting participants from the local coffee shop

- b** [The use of a placebo may control for extraneous variables,<sup>1</sup>] [such as eliminating participant expectations caused by the placebo effect.<sup>2</sup>] [Without a placebo, participant expectations may arise for the participants who consume 400mg of caffeine, potentially increasing their likelihood of experiencing sleep-onset insomnia as they believe this will happen due to the caffeine. Therefore, the use of a placebo may eliminate this expectation's effect on results.<sup>3</sup>]

I have correctly identified that the placebo will control for extraneous variables.<sup>1</sup>

I have identified that the use of a placebo will control for the extraneous variable of participant expectations (placebo effect).<sup>2</sup>

I have justified how the placebo may control for the extraneous variable.<sup>3</sup>

I have referred to the experiment in my response.

## 10E Sleep disorder interventions

### Theory review questions

- 1 a** Therapy: Bright light therapy; Sleep disorder type: Circadian phase disorders
- b** Therapy: Cognitive behavioural therapy; Sleep disorder type: Insomnia

### Exam-style questions

#### Remember and understand

- 2** A. insomnia, circadian phase disorders.
- 3** B. Discussion of the deep psychological causes behind sleep anxiety.
- 4** [Cognitive behavioural therapy (CBT) uses psychotherapy to practically replace unhealthy thoughts and behaviours with healthy ones.<sup>1</sup>] [When treating insomnia, the cognitive aspect could involve identifying negative thoughts that inhibit sleep, such as that something bad is going to happen during sleep, and replacing them with more realistic thoughts.<sup>2</sup>] [For the behavioural aspect, this could involve avoiding behaviours like taking stimulants before bed that inhibit sleep.<sup>3</sup>]

I have showed my understanding of CBT through definition.<sup>1</sup>

I have outlined how CBT's cognitive component might work to treat insomnia with an example.<sup>2</sup>

I have outlined how CBT's behavioural component might work to treat insomnia with an example.<sup>3</sup>

Other acceptable responses could include:

- Other examples of behavioural and cognitive replacements

### Apply and analyse

- 5** A. conducted in the morning of the days Poppy does not have work.
- 6** D. her circadian rhythms as she is experiencing a circadian phase disorder.
- 7** [Hale should expose herself to a safe bright light for a period of time to reset her circadian rhythm.<sup>1</sup>] [For jet lag, this could involve exposure to the light the first morning she is in Europe and has to be awake to match her sleep-wake cycle to the new timezone.<sup>2</sup>]

I have identified that bright light therapy would involve exposure to light at the right amount of time to adjust a circadian rhythm.<sup>1</sup>

I have explained how bright light therapy could be applied to jet lag.<sup>2</sup>

I have referred to the character's name in my response (Hale), and to the scenario.

Other acceptable responses could include:

- Bright light could have been used before Hale went on the flight in order to keep her awake on the flight. This way, she would adjust her circadian rhythm before arrival so she could sleep the night through before the morning she had to work.

### Questions from multiple lessons

- 8** A. behavioural component that needs to be changed.
- 9** C. Classical conditioning
- 10 a** [Rohan could help himself get up in the morning through the use of light to shift his circadian rhythm.<sup>1</sup>] [This would involve safe exposure to the bright light each morning for at least a few days in a row, causing the body to hormonally induce wakefulness.<sup>2</sup>]

I have identified that bright light therapy would help Rohan shift his circadian rhythm or sleep-wake cycle.<sup>1</sup>

I have explained how bright light therapy would be used in Rohan's situation.<sup>2</sup>

I have referred to the character's name in my response (Rohan), and to the scenario.

**b** [When Rohan is drowsy he would have low alertness and lower frequency, higher amplitude waves such as alpha waves.<sup>1</sup>] [As he becomes alert with exposure to the light, it is likely his brain waves will show increased frequency and reduced amplitude beta waves.<sup>2</sup>]

I have identified Rohan's alertness as lower and brain wave patterns as alpha lower-frequency higher-amplitude waves when he is drowsy.<sup>1</sup>

I have explained that Rohan's alertness would increase and that his brain wave patterns would show increased frequency and decreased amplitude beta waves.<sup>2</sup>

I have referred to the character's name in my response (Rohan), and to the scenario.

- 11 a [Beau is experiencing life events<sup>1</sup>][due to him undergoing a divorce that involves a major adaptation to new circumstances to his life.<sup>2</sup>]

I have correctly identified the type of stress as a life event.<sup>1</sup>

I have justified why it is a life event.<sup>2</sup>

I have referred to the character's name in my response (Beau), and to the scenario.

- b [A psychologist might suggest Beau conduct relaxation or meditation before bed<sup>1</sup> to reduce stress so he is better able to fall asleep.<sup>2</sup>]

I have identified a relevant behavioural strategy of cognitive behavioural therapy.<sup>1</sup>

I have suggested how this might help Beau specifically.<sup>2</sup>

I have referred to the character's name in my response (Beau), and to the scenario.

Other acceptable responses could include:

- Other behavioural strategies so long as they were relevant to insomnia and applicable to Beau's situation.

## Chapter 10 test

### Multiple choice questions

- 1 C. have impaired precision and concentration.
- 2 B. the circadian rhythm being unable to constantly adapt to changing sleep and wake times.
- 3 A. enhanced concentration abilities.
- 4 D. the sleep-wake cycle shift in adolescence.
- 5 A. Take more naps throughout the day.
- 6 B. slower reaction times.
- 7 C. shift work.
- 8 C. Individuals are exposed to bright artificial light to induce feelings of wakefulness.
- 9 B. factors that affect the circadian rhythm.
- 10 D. a slightly better ability to make decisions effectively.

### Short answer questions

- 11 a [Keisha is likely to be experiencing partial sleep deprivation.<sup>1</sup>][This is due to her having an inadequate quantity of sleep as she only slept for 5 hours, however, this is not total sleep deprivation as she still had some sleep within the 24 hours.<sup>2</sup>]

I have correctly identified that Keisha is experiencing partial sleep deprivation.<sup>1</sup>

I have referred to the scenario to justify that Keisha is experiencing partial sleep deprivation.<sup>2</sup>

I have referred to the character's name in my response (Keisha), and to the scenario.

- b [Due to experiencing partial sleep deprivation, Keisha may find it harder to concentrate on the road during her driving test, therefore having reduced cognitive functioning.<sup>1</sup>] Keisha may also experience slower reaction times, making it harder for her to quickly respond to activity on the road. This behavioural effect may increase Keisha's likelihood of making errors or being in a car crash while sleep deprived.<sup>2</sup>]

I have correctly identified an example of how Keisha's cognitive functioning may be impacted.<sup>1</sup>

I have correctly identified an example of how Keisha's behavioural functioning may be impacted.<sup>2</sup>

I have referred to the character's name in my response (Keisha), and to the scenario.

Other acceptable responses could include:

- Cognitive functioning effects such as reduced ability to cope with and make decisions and decreased ability to direct attention
- Behavioural functioning effects such as reduced motor control and increased likelihood of engaging in risk-taking behaviour
- Other effects would be accepted as long as they are appropriate examples for this scenario

- 12 a [Carter is likely suffering from sleep-onset insomnia.<sup>1</sup>]

I have identified sleep-onset insomnia as the sleep disorder Carter is likely to be suffering from.<sup>1</sup>

I have referred to the character's name in my response (Carter), and to the scenario.

Other acceptable responses could include:

- Carter is likely to be suffering from a dyssomnia

- b [Cognitive behavioural therapy (CBT) could be used to help treat Carter's sleep-onset insomnia.<sup>1</sup>] [CBT could help treat Carter's sleep disorder through Carter being asked to challenge his unhealthy thoughts about sleep and replace them with healthy thoughts about sleep, which is an example of the cognitive component of CBT.<sup>2</sup>] [This intervention might also include Carter learning meditation to help promote a feeling of relaxation before sleeping, which is an example of a behavioural component of CBT.<sup>3</sup>]

I have identified cognitive behavioural therapy (CBT) as the sleep disorder intervention to help Carter.<sup>1</sup>

I have outlined how CBT could be used to help Carter by referring to a cognitive component of CBT.<sup>2</sup>

I have outlined how CBT could be used to help Carter by referring to a behavioural component of CBT.<sup>3</sup>

I have referred to the character's names in my response (Carter), and to the scenario.

Other acceptable responses could include:

- Sleep hygiene as a behavioural component for CBT

- Encouraging a consistent sleep-wake cycle as a behavioural component for CBT
- Other strategies would be accepted as long as they are appropriate examples of CBT

c [Yes, Carter's mother's comment is correct.<sup>1</sup>] [This is due to Carter's younger 10 year old sister needing approximately 11 hours of sleep a night due to being a child,<sup>2</sup>] [whereas, Carter and his parents as adults only need around 7 hours of sleep a night to fully function the next day.<sup>3</sup>]

I have identified that Carter's mother's comment is correct.<sup>1</sup>

I have justified my response by outlining Carter's younger sister's need for more sleep as a child.<sup>2</sup>

I have justified my response by outlining Carter's need for less sleep due to being an adult.<sup>3</sup>

I have referred to the character's name in my response (Carter), and to the scenario.

13 a [Damon is experiencing a parasomnia.<sup>1</sup>] [This is due to Damon engaging in abnormal behaviours while sleeping, seen through him engaging in sleep-walking.<sup>2</sup>]

I have correctly identified that Damon is experiencing a parasomnia.<sup>1</sup>

I have justified my response, explaining how Damon is experiencing a parasomnia.<sup>2</sup>

I have referred to the character's name in my response (Damon), and to the scenario.

b [Damon is unlikely to be experiencing a high level of self-control.<sup>1</sup>] [This is due to Damon sleeping and therefore being in an altered state of consciousness, therefore, it is unlikely that Damon would be able to control his own thoughts and actions, showing a low level of self-control.<sup>2</sup>]

I have correctly identified that Damon is unlikely to be experiencing a high level of self-control.<sup>1</sup>

I have explained why Damon is unlikely to be experiencing a high level of self-control.<sup>2</sup>

I have referred to the character's name in my response (Damon), and to the scenario.

### Key science skills questions

14 a [Dr Navi might conclude that Florence is experiencing sleep-walking.<sup>1</sup>]

I have outlined that Dr Navi might conclude that Florence is experiencing sleep-walking.<sup>1</sup>

I have referred to the characters' names in my response (Florence and Dr Navi), and to the scenario.

b [Due to experiencing sleep deprivation from sleep-walking, Florence is likely to experience the cognitive effect of a decreased ability to concentrate on tasks during the day.<sup>1</sup>] [Florence is also likely to experience the affective effect of amplified emotional responses such as increased irritability.<sup>2</sup>]

I have correctly identified an example of a cognitive effect of sleep deprivation Florence may experience.<sup>1</sup>

I have correctly identified an example of an affective effect of sleep deprivation Florence may experience.<sup>2</sup>

I have referred to the character's name in my response (Florence), and to the scenario.

Other acceptable responses for a cognitive effect could include:

- Poorer performance and increased rate of errors on cognitive tasks
- Reduced ability to cope with and make decisions
- Trouble with simple cognitive tasks

Other acceptable responses for an affective effect could include:

- Heightened anxiety
- Inappropriate emotional reactions
- Decreased motivation

c [Dr Navi has not complied with the ethical consideration of voluntary participation<sup>1</sup>] [as Florence did not volunteer to participate in the study. This is due to Dr Navi setting up the camera to record Florence's behaviour at nighttime without her knowledge.<sup>2</sup>]

I have correctly identified an ethical consideration that Dr Navi has not complied with.<sup>1</sup>

I have justified how Dr Navi did not comply with this ethical consideration through the use of an example.<sup>2</sup>

I have referred to the characters' names in my response (Florence and Dr Navi), and to the scenario.

Other acceptable responses could include:

- Informed consent
- Withdrawal rights

### Extended response

15 Students need to demonstrate that they have a solid and holistic understanding of circadian phase disorders, particularly jet lag, as well as sleep deprivation and bright light therapy. Students also needed to refer to the biological rhythms involved in the sleep-wake cycle.

For the description of **circadian phase disorders and biological rhythms in the sleep-wake cycle** in this scenario, students should have mentioned the following points:

- A description of circadian rhythms in reference to the sleep-wake cycle
- A description of jet lag
- A description of the interference on Fabio's sleep-wake cycle due to his experience of jet lag. This could include a description of the mismatch of Fabio's internal biological clock which regulates his sleep-wake cycle and the external environment. This may involve explaining how Fabio's internal biological clock is regulated by the secretion of melatonin to induce feelings of sleepiness, as well as how the presence of light in the environment can contribute to the regulation of Fabio's sleep-wake cycle
- Some symptoms of jet lag that Fabio may be experiencing

For the description of **sleep deprivation** in this scenario, students should have mentioned the following points:

- A description of sleep deprivation
- Explanation as to why Fabio may be experiencing sleep deprivation
- The impact of sleep deprivation on Fabio's functioning
- Some effects of jet lag Fabio may be experiencing, referring to affective, behavioural and cognitive effects

For the description of **bright light therapy** in this scenario, students should have mentioned the following points:

- A description of bright light therapy and its processes
- An explanation of how Fabio could be treated with bright light therapy and why it could be useful for him. For example, Fabio may be exposed to intense, bright artificial light upon arriving in an international country in the morning when it is bright outside. This will help to minimise Fabio's feelings of sleepiness, attempting to match his internal biological clock to the external environment of his location

## 11A Mental health continuum

### Theory review questions

- 1** a Mental health disorder      b Internal factors  
 c Mental health      d Mentally healthy  
 e Mental health continuum      f Mental health problem  
 g External factors
- 2** a Mental health disorder      b Mentally healthy  
 c Mental health problem

### Exam-style questions

#### Remember and understand

- 3** A. displaying a lesser ability to function independently compared to those who are mentally healthy.  
**4** C. A tool which tracks the progression of fluctuations in mental health.  
**5** [A mental health problem temporarily impacts an individual's mental health leading to dysfunction or distress for a short amount of time, whereas a mental health disorder has more long lasting impacts.<sup>1</sup>][The impact of a mental health problem is less profound on an individual's mental health compared to the impact of a mental health disorder which is more profound.<sup>2</sup>]

I have identified one difference between a mental health problem and a mental health disorder.<sup>1</sup>

I have identified a second difference between a mental health problem and a mental health disorder.<sup>2</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

- 6** [Internal factors arise from within the individual and contribute to their mental health,<sup>1</sup>][an example of which is an individual's genetic predisposition,<sup>2</sup>][whereas external factors arise from the environment of an individual,<sup>3</sup>][an example of which is the loss of a significant relationship.<sup>4</sup>]

I have explained internal factors.<sup>1</sup>

I have given an example of an internal factor.<sup>2</sup>

I have explained external factors.<sup>3</sup>

I have given an example of an external factor.<sup>4</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

#### Apply and analyse

- 7** B. external factor.  
**8** C. Rohan is experiencing a mental health problem due to having a reduced level of functioning.  
**9** a [A psychologist would be likely to place Clara at the mentally healthy category on the continuum even though she is somewhat distressed.<sup>1</sup>][This is due to her being able to cope with her stress by seeking social support.<sup>2</sup>]

I have identified that the psychologist would place Clara at the mentally healthy category.<sup>1</sup>

I have justified my response through the use of examples.<sup>2</sup>

I have referred to the character's name in my response (Clara), and to the scenario.

Other acceptable responses could include:

- Clara being placed at the mental health problem category due to finding it difficult to unwind at the end of the day and therefore not coping

- b** [An internal factor which has impacted Clara's mental health is a lack of resilience.<sup>1</sup>][This has impacted Clara's mental health as she is finding it difficult to unwind after being exposed to the stressor of work.<sup>2</sup>]

I have identified an internal factor which has impacted Clara's mental health.<sup>1</sup>

I have justified my response through the use of examples.<sup>2</sup>

I have referred to the character's name in my response (Clara), and to the scenario.

#### Questions from multiple lessons

- 10** C. life event

- 11** D. resilience and an ability to function independently.

- 12** A. avoidance coping

- 13** a [Ethan is more likely to be placed at the mental health problem category on the mental health continuum.<sup>1</sup>][This is due to him temporarily not optimally functioning, as seen through his inability to cope with daily tasks and his inability to maintain positive relationships for the past two weeks.<sup>2</sup>]

I have identified that Ethan is most likely to be placed at the mental health problem category on the continuum.<sup>1</sup>

I have justified my response by referring to examples from the scenario.<sup>2</sup>

I have referred to the character's name in my response (Ethan), and to the scenario.

- b** [Sleep deprivation is an internal factor.<sup>1</sup>][This is due to poor sleep arising from within an individual personally, such as an individual having a sleep disorder or choosing to stay up late.<sup>2</sup>]

I have identified that sleep deprivation is an internal factor.<sup>1</sup>

I have justified my response by referring to arising from within the individual.<sup>2</sup>

## 11B Characteristics of a mentally healthy person

### Theory review questions

- |          |                                     |                              |
|----------|-------------------------------------|------------------------------|
| <b>1</b> | <b>a</b> Resilience                 | <b>b</b> Social wellbeing    |
|          | <b>c</b> High levels of functioning | <b>d</b> Emotional wellbeing |
| <b>2</b> | <b>a</b> Emotional wellbeing        | <b>b</b> Social wellbeing    |
|          | <b>c</b> High levels of functioning | <b>d</b> Resilience          |

### Exam-style questions

#### Remember and understand

- 3** B. strengthening connections with others through strong communication.
- 4** C. Can return to the functioning state that occurred before the presence of a stressor, has high self-esteem and adapts to many types of stressors.
- 5** D. high levels of functioning.
- 6** [High levels of functioning is a typical characteristic of a mentally healthy person which involves being independent and being able to carry out everyday tasks.<sup>1</sup>] [An individual can display high levels of functioning by being able to cook and shop for themselves.<sup>2</sup>] [High levels of functioning is an important characteristic of a mentally healthy person as it allows them to meet their own needs independently, allowing them to feel confident in their abilities.<sup>3</sup>]

I have identified and explained one characteristic of a mentally healthy person.<sup>1</sup>

I have provided examples of this characteristic.<sup>2</sup>

I have explained why this characteristic is an important aspect of a mentally healthy person.<sup>3</sup>

Other acceptable responses could include:

- Social wellbeing, and an appropriate example
- Emotional wellbeing, and an appropriate example
- Resilience, and an appropriate example

#### Apply and analyse

- 7** A. displaying strong social wellbeing.
- 8** [Jimmy is displaying behaviours which indicate that he is not considered to be a mentally healthy person at this time. Jimmy is not experiencing high levels of functioning.<sup>1</sup>] [as seen through him finding it hard to cook for himself, and therefore not being able to independently carry out day to day tasks.<sup>2</sup>] [Jimmy is also not displaying strong social and emotional wellbeing as he is not showing effective communication skills or maintaining positive relationships.<sup>3</sup>] [This is seen through him not wanting to see his family or friends and being disrespectful towards his colleagues.<sup>4</sup>]

I have identified one characteristic of a mentally healthy person.<sup>1</sup>

I have provided examples from the scenario to demonstrate that Jimmy is not displaying this characteristic.<sup>2</sup>

I have identified a second characteristic of a mentally healthy person.<sup>3</sup>

I have provided examples from the scenario to demonstrate that Jimmy is not displaying this second characteristic.<sup>4</sup>

I have referred to the character's name in my response (Jimmy), and to the scenario.

### Questions from multiple lessons

- 9** B. avoidance coping.
- 10** A. Resilience – Adapted to challenges in her environment; Social and emotional wellbeing – Regularly communicated with others in an effective manner; High levels of functioning – Independently completed tasks

- 11** a [Ingrid is exposed to the stressor of being a new mother.<sup>1</sup>]

I have correctly identified the stressor in the scenario.<sup>1</sup>

I have referred to the character's name in my response (Ingrid), and to the scenario.

Other acceptable responses could include:

- The presence of the baby
- Ingrid's sister offering help

- b** [Ingrid is most likely to be interpreting the stressor of a newborn baby as stressful during primary appraisal and consider it to be a threat.<sup>1</sup>] [This is seen through Ingrid feeling as if she is incapable of looking after her daughter which has led to her losing sleep.<sup>2</sup>]

I have correctly identified Ingrid's appraisal as stressful, and more specifically as a threat.<sup>1</sup>

I have given a relevant example from the scenario.<sup>2</sup>

I have referred to the character's name in my response (Ingrid), and to the scenario.

Other acceptable responses could include:

- Ingrid interpreting the stressor as a harm/loss so long as justified in line with the scenario

- c** [Ingrid is not displaying behaviours of a mentally healthy person.<sup>1</sup>] [This is seen through Ingrid not displaying strong social and emotional wellbeing, such as refusing to accept support from her sister Jessica and responding angrily, showing that she is unable to appropriately control and express her emotions.<sup>2</sup>] [Ingrid is also not displaying a high level of functioning, as she is relying on pre-packaged food even though she loves cooking, and is therefore unable to carry out day to day tasks independently.<sup>3</sup>]

I have correctly identified that Ingrid is not displaying behaviours of a mentally healthy person.<sup>1</sup>

I have explained a characteristic Ingrid is not displaying, using examples.<sup>2</sup>

I have explained a second characteristic Ingrid is not displaying, using examples.<sup>3</sup>

I have referred to the characters' names in my response (Ingrid and Jessica), and to the scenario.

**Key science skills**

- 12 a** [The study involves the use of a cross-sectional study.<sup>1</sup>]

I have correctly identified that the investigation is a cross-sectional study.<sup>1</sup>

- b** [Using a self-report to measure levels of resilience within the participants may lead to the development of a confounding participant-related variable.<sup>1</sup>] [This is due to the possibility that the survey responses may be unreliable due to it being a subjective measure. For example, the participants may have responded incorrectly because they were embarrassed.<sup>2</sup>]

I have correctly identified that a limitation of using a self-report is the presence of confounding participant-related variables.<sup>1</sup>

I have justified my response by referring to the study.<sup>2</sup>

**11C Mental health and ethics****Theory review questions**

- 1 a** Informed consent      **b** Placebo  
c Placebo effect

**Exam-style questions****Remember and understand**

- 2** D. some individuals may be unable to give informed consent due to having an impaired cognitive capacity which has stemmed from their mental health disorder.
- 3** [Use of placebo treatments for participants with mental health disorders is sometimes believed to be unethical as it may prevent them from taking other forms of effective treatment, prolonging their condition and preventing recovery.<sup>1</sup>] [The use of deception through placebo treatments on individuals who are already vulnerable may exacerbate their feelings of distress or betrayal.<sup>2</sup>]

I have explained how the use of placebo treatments can prevent recovery and prolong a mental health condition.<sup>1</sup>

I have explained how the use of placebo treatments can increase feelings of distress or betrayal due to the use of deception.<sup>2</sup>

**Apply and analyse**

- 4** B. informed consent
- 5** C. Fletcher's psychologist should gain consent from Fletcher's legal guardian to participate in the study, and ensure that Fletcher understands the nature, purpose and risks of the study to the best of his ability.
- 6** [Yes, the use of a placebo treatment is an ethical concern in relation to this study.<sup>1</sup>] [This is due to a placebo treatment being used for already vulnerable participants with mental health conditions, such as Magnus, meaning that his levels of distress may heighten due to the use of deception in the study, potentially leading to him feeling paranoid or betrayed.<sup>2</sup>]

I have identified that the use of a placebo treatment is an ethical concern.<sup>1</sup>

I have justified my response by referring to placebo treatments exacerbating feelings of distress in individuals who are already vulnerable.<sup>2</sup>

I have referred to the character's name in my response (Magnus), and to the scenario.

Other acceptable responses could include:

- The use of a placebo may prolong his mental health disorder and prevent recovery

**Questions from multiple lessons**

- 7** B. Edwin is likely to be experiencing a mental health disorder due to a prolonged period of significant distress.
- 8** C. deception was used, which may present risks as the participants may feel betrayed.
- 9 a** [The main part of the brain which experiences damage due to Alzheimer's disease is the hippocampus.<sup>1</sup>]

I have identified that the main part of the brain which experiences damage in early stages of Alzheimer's disease is the hippocampus.<sup>1</sup>

- b** [The two abnormal structures in the brain of individuals with Alzheimer's disease are beta-amyloid plaques<sup>1</sup>] [and neuro-fibrillary tangles.<sup>2</sup>]

I have identified that beta-amyloid plaques are abnormal in the brain.<sup>1</sup>

I have identified that neuro-fibrillary tangles are abnormal in the brain.<sup>2</sup>

- c** [Dr Lovell has violated informed consent.<sup>1</sup>] [This is seen through Dr Lovell running a study on ten of her patients without their knowledge, showing that they were unaware of the procedures involved in the study.<sup>2</sup>]

I have identified that Dr Lovell violated informed consent.<sup>1</sup>

I have justified my response by referring to Dr Lovell's patients being unaware of participating in the study.<sup>2</sup>

I have referred to the character's name in my response (Dr Lovell), and to the scenario.

Other acceptable responses could include:

- Dr Lovell may also have breached the no-harm principle, because her patients may suffer from mental or physical harm due to not having their usual medication.
- Dr Lovell may also have breached informed consent due to the use of deception.

**Key science skills**

- 10 a** [The research design used is independent groups design.<sup>1</sup>]

I have identified that independent groups is the research design used.<sup>1</sup>

Other acceptable responses could include:

- Between-groups design

- b** [A double-blind procedure was used.<sup>1</sup>] [This is due to the participants being unaware of which condition they have been assigned to,<sup>2</sup>]

[as well as the researcher being unaware of which condition the participants have been assigned to as only the research assistant was aware of the condition of each participant.<sup>3</sup>]

I have identified that a double-blind procedure was used.<sup>1</sup>

I have justified my response by explaining that the participants were unaware of which condition they have been assigned to.<sup>2</sup>

I have justified my response by explaining that the researcher was unaware of which condition the participants had been assigned to.<sup>3</sup>

- c [An advantage of a double-blind procedure is that it minimises experimenter effects.<sup>1</sup>][This involves the researcher not being biased to report results in a particular way due to their expectations.<sup>2</sup>]

I have identified that minimising experimenter effects is an advantage of a double-blind procedure.<sup>1</sup>

I have described how the experimenter-effect is minimised.<sup>2</sup>

Other acceptable responses could include:

- Participant expectations

## Chapter 11 test

### Multiple choice questions

- 1 C. high levels of functioning, strong social and emotional wellbeing and the ability to overcome stressors.
- 2 B. Is able to set goals towards achieving tasks and is productive.
- 3 A. the researcher being unable to use a single-blind procedure.
- 4 A. All internal factors stem from a psychological or biological source whereas external factors mainly stem from a social or environmental source.
- 5 B. Some participants with mental health disorders do not have the cognitive capacity to give informed consent.
- 6 D. an inhibitory effect on communication between neurons.
- 7 A. the control group.
- 8 D. very high levels of resilience.
- 9 A. internal factor.
- 10 C. Blayne is placed in the mental health problem category on the continuum as he is experiencing temporary distress in response to an event.

### Short answer questions

- 11 [High levels of functioning involves the ability of an individual to function independently and effectively meet the demands of everyday life.<sup>1</sup>][This is an important characteristic of a mentally healthy person as it ensures that individuals can be productive in their life by setting their own goals and taking steps towards achieving them.<sup>2</sup>]

I have described high levels of functioning.<sup>1</sup>

I have provided a reason why this characteristic is important for a mentally healthy person.<sup>2</sup>

- 12 [A mentally healthy individual can function independently within their environment, whereas individuals with a mental health problem display a degree of dysfunction and distress, being unable to function at their optimal level.<sup>1</sup>][One characteristic of a mentally healthy person is the ability to be productive,<sup>2</sup>][while a characteristic of a mental health problem is experiencing high levels of stress for a temporary period of time.<sup>3</sup>]

I have identified a difference between the categories of mentally healthy and mental health problem.<sup>1</sup>

I have provided an example of a characteristic of the mentally healthy category.<sup>2</sup>

I have provided an example of a characteristic of the mental health problem category.<sup>3</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses could include:

- Individuals who are mentally healthy can cope with the stresses of everyday life, whereas individuals with a mental health problem may not be able to.

- 13 a [Giovanni may be considered mentally healthy due to displaying high levels of functioning.<sup>1</sup>][This is seen through Giovanni being productive in achieving tasks and setting goals which he can meet.<sup>2</sup>]

I have outlined that Giovanni would be considered mentally healthy due to displaying high levels of functioning.<sup>1</sup>

I have provided an example of Giovanni displaying high levels of functioning.<sup>2</sup>

I have referred to the character's name in my response (Giovanni), and to the scenario.

- b [Giovanni would not be considered mentally healthy while at university.<sup>1</sup>][This is due to Giovanni not displaying the characteristic social and emotional wellbeing.<sup>2</sup>][This can be seen through Giovanni isolating himself and losing relationships.<sup>3</sup>]

I have outlined that Giovanni would not be considered mentally healthy while at university.<sup>1</sup>

I have referred to Giovanni not displaying the characteristic of social and emotional wellbeing.<sup>2</sup>

I have provided an example to show how Giovanni is not displaying social and emotional wellbeing.<sup>3</sup>

I have referred to the character's name in my response (Giovanni), and to the scenario.

- 14 a [The news of Ginger's grandmother is an external factor.<sup>1</sup>]

I have identified that the news is an external factor.<sup>1</sup>

I have referred to the character's name in my response (Ginger), and to the scenario.

- b [Ginger is most likely to be placed within the mentally healthy category along the mental health continuum.<sup>1</sup>][This is due to Ginger experiencing appropriate emotional reactions and seeking support from her family in a time of need.<sup>2</sup>]

I have identified that Ginger is likely mentally healthy.<sup>1</sup>

I have justified my response by referring to examples of mentally healthy behaviour from the scenario, such as relying on social support.<sup>2</sup>

I have referred to the character's name in my response (Ginger), and to the scenario.

Other acceptable responses could include:

- Mental health problem due to experiencing a temporary level of dysfunction and distress.

c [Ginger is displaying social and emotional wellbeing.<sup>1</sup>] [This is due to Ginger turning to her family for support, as well as expressing an appropriate emotional response of sadness when hearing the news of her grandmother having a stroke.<sup>2</sup>]

I have identified that Ginger is displaying social and emotional wellbeing.<sup>1</sup>

I have provided examples of Ginger displaying social and emotional wellbeing.<sup>2</sup>

I have referred to the character's name in my response (Ginger), and to the scenario.

### Key science skills questions

15 a [Convenience sampling.<sup>1</sup>]

I have identified that convenience sampling was used.<sup>1</sup>

b [Yes, Ms Spase's method of recording the social interactions of her students by observation may be a confounding variable.<sup>1</sup>] [This is due to the potential of her making observational errors, as well as being physically unable to view all the interactions, potentially leading to non-standardised procedures.<sup>2</sup>]

I have identified that Ms Spase's method of recording may be a confounding variable in the study.<sup>1</sup>

I have justified my response by referring to observational errors.<sup>2</sup>

I have referred to the character's name in my response (Ms Spase), and to the scenario.

Other acceptable responses could include:

- Experimenter or researcher bias

c [Ms Spase did not meet the ethical consideration of informed consent.<sup>1</sup>] [This is due to Ms Spase not informing her students with a mental health disorder of the nature, purpose and risks of the study so that they could understand these to the best of their ability. Ms Spase also administered the questionnaire before seeking informed consent.<sup>2</sup>]

I have identified that informed consent was not met.<sup>1</sup>

I have provided an example from the scenario to justify my response.<sup>2</sup>

I have referred to the character's name in my response (Ms Spase), and to the scenario.

### Extended response

16 Students need to demonstrate that they have a thorough and holistic understanding of mental health, the impacts of sleep-onset insomnia and the use of a placebo treatment in mental health research. Students also needed to refer to a treatment of insomnia, characteristics of a mentally healthy person and procedures of an experimental study.

For the description of Ziggy's **mental health**, students should have mentioned the following points:

- A description of Ziggy's placement on the mental health continuum: either as experiencing a mental health disorder due to experiencing high levels of distress and being diagnosed with sleep-onset insomnia, or experiencing a mental health problem due to not functioning at an optimal level for a temporary period of time.
- Ziggy's mental health may have been impacted by the internal factors of poor sleep and stress, potentially contributing to his experience of poor mental health.
- Ziggy's mental health may have been impacted by the external factor of pressure from his workplace, potentially making him more susceptible to a mental health problem or mental health disorder.
- A description of Ziggy's inability to display the characteristics of a mentally healthy person. This may involve referring to his lack of social and emotional wellbeing, due to isolating himself from his friends and family and experiencing poor self-efficacy.

For the description of the **impact of sleep-onset insomnia on Ziggy's daily functioning**, students should have mentioned the following points:

- A description of sleep-onset insomnia, including that it is a sleep disorder involving a consistent difficulty to initiate sleep.
- The impact of sleep-onset insomnia on daily functioning, including negative impacts on daily functioning, referring to Ziggy's inability to concentrate and make decisions.
- The impact of sleep deprivation, referring to possible affective, behavioural and cognitive effects Ziggy may be experiencing. This could include a reference to the cognitive effects of reduced ability to cope with and make decisions under stress, among other effects.
- A description of the possible treatment of sleep-onset insomnia being cognitive behavioural therapy. A description of CBT should include that it encourages individuals to replace unhealthy thoughts and behaviours about sleep with healthier ones.
- Students would be more highly awarded for describing the cognitive and behavioural components of cognitive behavioural therapy and providing examples for each, such as breathing retraining as a behavioural component and challenging the thought that sleep is too hard to initiate as a cognitive component.

For the description of the **procedures involved in an experimental study**, students should have mentioned the following points:

- The use of an independent groups research design, as seen through Ziggy's allocation to the control group.
- The purpose of a control group as providing a baseline comparison to judge the effects of the IV on the experimental group.
- A description of the data recorded. This may have involved referring to the use of a self-report, with the rating scale being quantitative data and the journal entries being qualitative data.
- The use of a single-blind procedure, as seen through Ziggy being unaware that he has been administered with a placebo.

For the description of the **ethical implications of the use of placebo treatment in mental health research**, students should have mentioned the following points:

- A description of a placebo as a procedure or substance with no active treatment, with participants holding the false belief that the treatment has an active effect.
- A description of the placebo effect, in which the false belief of an individual about the placebo treatment leads to changes in their mental or physical state.
- The potential benefits of placebo use in mental health research, such as indicating whether the results of the study are due to the medication or due to the placebo effect.
- The potential limitations of placebo use for participants with mental health disorders or mental health problems, such as exacerbating feelings of distress and contributing to a sense of betrayal and paranoia.

## 12A Four P model

### Theory review questions

- 1** a Perpetuating risk factor      b Predisposing risk factor  
 c Precipitating risk factor      d Protective factor  
 e The Four P model

### Exam-style questions

#### Remember and understand

- 2** A. increases the likelihood of somebody developing a mental health disorder.  
**3** B. progression of a mental health disorder, whereas a precipitating risk factor is about the development.  
**4** [Protective factors are characteristics in a person's life that prevent them from developing a mental health disorder, either for the first time or after previously having a mental health disorder.]

I have provided an appropriate explanation for what is meant by protective factors.

- 5** [A predisposing risk factor only increases someone's susceptibility to developing a mental health disorder, whereas a precipitating risk factor also directly leads to the occurrence of a mental health disorder.]

I have identified that a predisposing risk factor only increases susceptibility, whereas a precipitating risk factor also directly leads to the occurrence of a mental health disorder.

I have used an appropriate distinguishing word, such as whereas.

#### Apply and analyse

- 6** B. precipitating risk factor.  
**7** C. perpetuating risk factor because it inhibits recovery from their mental health disorder.

- 8 a** [Adequate sleep could act as a protective factor for Zeynep.]

I have identified a protective factor for Zeynep.

I have referred to the character's name in my response (Zeynep), and to the scenario.

Other acceptable response could include:

- Zeynep having an adequate diet
  - Zeynep using cognitive behavioural strategies
  - Support from Zeynep's family, friends and community etc.
- b** [Predisposing risk factors increase an individual's susceptibility to developing a mental health disorder.] [Zeynep's family history of mental health disorders is an example of a predisposing risk factor.]

I have provided an appropriate definition of predisposing risk factors with reference to the phrase 'increase susceptibility'.

I have identified that Zeynep's family history of mental health disorders is a predisposing risk factor.

I have referred to the character's name in my response (Zeynep), and to the scenario.

### Questions from multiple lessons

- 9** [According to the restoration theory, sleep (specifically REM sleep) helps to maintain neural pathways in the brain, therefore enhancing learning and memory.] [This could increase Hakan's ability to learn from and remember situations that he experiences in his day to day life, increasing his capacity to respond to stressors.] [This therefore increases Hakan's resilience and prevents the re-occurrence of a mental health disorder.]

I have identified a restorative effect of sleep according to restoration theory.

I have linked this restorative effect of sleep to Hakan's mental functioning.

I have explained how this restorative effect of sleep would therefore act as a protective factor.

I have referred to the character's name in my response (Hakan), and to the scenario.

- 10 a** [Enes' psychologist is worried that a precipitating risk factor will increase his susceptibility to and contribute to the occurrence of a mental health disorder.] [This is evident as the psychologist is worried that an event, such as Enes losing his job or significant relationships, could act as a key event that directly causes or increases the likelihood of developing a mental health disorder.]

I have identified that Enes' psychologist is concerned about potential precipitating risk factors.

I have provided an appropriate justification with reference to how losing work or relationships could directly cause or increase the chances of a mental health disorder.

I have referred to the character's name in my response (Enes), and to the scenario.

- b** [Enes displays high levels of functioning.] [This is evident through Enes being able to independently look after himself by cooking dinner.] [Enes also displays high levels of social wellbeing.] [This is evident as he is able to manage and maintain relationships with family and friends.]

I have identified one relevant characteristic of a mentally healthy person.

I have explained how Enes displays this characteristic of a mentally healthy person with reference to the scenario.

I have identified a second relevant characteristic of a mentally healthy person.

I have explained how Enes displays this characteristic of a mentally healthy person with reference to the scenario.

I have referred to the character's name in my response (Enes), and to the scenario.

Other acceptable responses could include:

- Enes displays high levels of resilience as he is able to cope with the stress of his work and maintain high levels of functioning

## **Key science skills**

- 11 a [Dr Abara used an independent groups research design.<sup>1</sup>][This is because participants in each group were separate and only exposed to one condition.<sup>2</sup>]

  I have identified that Dr Abara used an independent groups research design.<sup>1</sup>

I have provided an appropriate justification of Dr Abara's use of independent groups.<sup>2</sup>

  I have referred to the character's name in my response (Dr Abara), and to the scenario.

- b [Group two is the control group in Dr Abara's experiment.<sup>1]</sup>] This is because group two did not have the independent variable applied to them by receiving no treatment, therefore providing a baseline of results to compare to group one.<sup>2</sup>

  I have identified that group two is the control group.<sup>1</sup>

  I have provided an appropriate justification with reference to how the independent variable was not applied to group two in order to provide a baseline of results.<sup>2</sup>

  I have referred to the character's name in my response (Dr Abara), and to the scenario.

- c [An extraneous variable is individual participant differences such as the type of mental health disorders between groups.<sup>1</sup>] [Some mental health disorders are more difficult to recover from than others, therefore affecting whether participants are able to avoid re-occurrence regardless of whether a protective factor is present or not.<sup>2</sup>]

  I have identified one relevant extraneous variable.<sup>1</sup>

  I have explained how this extraneous variable could impact results.<sup>2</sup>

  I have referred to the character's name in my response (Dr Abara), and to the scenario.

Other acceptable response could include:

- Age of participants
  - Occupation of participants
  - Sleep quality of participants
  - Sex of participants
  - Standardised testing procedures and conditions
  - Both marks would be rewarded assuming the extraneous variable was relevant to the scenario and students were able to justify how they could impact results

## 12B Biological risk factors

## Theory review questions



## **Exam-style questions**

## **Remember and understand**

- 3** C. poor sleep.

**4** D. genetic vulnerability.

**5** A. perpetuating risk factor, because it inhibits the individual's ability to recover.

**6** D. Four P model - precipitating factor; biological risk factor - exercise

**7** [Both poor sleep and substance use are precipitating risk factors in that they increase susceptibility to and contribute to the occurrence of mental health disorders.<sup>1</sup>]

I have identified a similarity between poor sleep and substance use.<sup>1</sup>

Other acceptable responses include:

- Both poor sleep and substance use are biological risk factors.
  - Both could also be either predisposing or perpetuating risk factors so long as appropriate justification is provided.

[Poor response to medication is a biological risk factor that involves somebody not being able to experience the intended biological effects of a medication due to genetic factors.<sup>1</sup>] [Poor response to medication is a perpetuating risk factor because it inhibits the ability for someone to recover from a mental health disorder with the aid of medication.<sup>2</sup>]

I have defined poor response to medication as a biological risk factor.<sup>1</sup>

I have explained why poor response to medication is a perpetuating risk factor, with reference to the phrase 'inhibits recovery'.<sup>2</sup>

## Apply and analyse

- 9 A. genetic factors influencing the effectiveness of the medication

10 C. substance use

11 B. substance use and poor sleep

12 D. biological precipitating risk factor.

13 [A biological risk factor refers to a factor relating to Finton's physiological characteristics that can lead to the development or progression of a mental health disorder.<sup>1</sup>] [For example, Finton's genetic vulnerability due to a family history of mental health disorders.<sup>2</sup>] [A predisposing risk factor refers to a characteristic that increases Finton's susceptibility to developing a mental health disorder.<sup>3</sup>] [This is also demonstrated through Finton's genetic vulnerability.<sup>4</sup>]

  I have explained biological risk factors.<sup>1</sup>

  I have provided an example from the scenario of a biological risk factor.<sup>2</sup>

- I have explained predisposing risk factor, with reference to the phrase 'increases susceptibility'.<sup>3</sup>
- I have provided an example from the scenario of a predisposing risk factor.<sup>4</sup>
- I have referred to the character's name in my response (Finton), and to the scenario.

### Questions from multiple lessons

- 14 C. partial sleep deprivation; precipitating risk factor.
- 15 [The restoration theory of sleep proposes that sleep restores biological and psychological functions.<sup>1</sup>] Therefore, poor sleep has biological consequences such as not restoring adequate neurotransmitter levels in the brain.<sup>2</sup> [Given that poor sleep has biological consequences, it therefore acts as a biological risk factor and contributes to the development of mental health disorders.<sup>3</sup>]

- I have explained the restoration theory of sleep.<sup>1</sup>
- I have explained how poor sleep has biological consequences.<sup>2</sup>
- I have explained how poor sleep acts as a biological risk factor.<sup>3</sup>

- 16 [Stimulants are a class of drugs that increase activity in the central nervous system.<sup>1</sup>] The excessive use of stimulants can result in addiction and dependency, decreasing peoples' ability to function effectively in everyday life without their biological effects and therefore acting as a biological risk factor for the development of a mental health disorder.<sup>2</sup>]

- I have provided an appropriate definition of stimulants.<sup>1</sup>
- I have explained how the excessive use of stimulants could be a biological risk factor.<sup>2</sup>

### Key science skills

- 17 a [The dependent variable in Dr Craig's scenario is the percentage of participants who were diagnosed with a mental illness by the psychologist.<sup>1</sup>]

- I have identified that the dependent variable is the percentage of mental illness.<sup>1</sup>
- I have referred to the character's name in my response (Dr Craig), and to the experiment scenario.

- b [Dr Craig used convenience sampling.<sup>1</sup>] This is because he simply recruited patients from his hospital and did not use any stratification or randomisation to create a sample that is representative of the population.<sup>2</sup>]

- I have identified that Dr Craig used convenience sampling.<sup>1</sup>
- I have provided an appropriate justification.<sup>2</sup>
- I have referred to the character's name in my response (Dr Craig), and to the experiment scenario.

- c [Dr Craig used the independent groups experimental research design.<sup>1</sup>] This is evident as Dr Craig separated participants into two separate groups, with each group being exposed to a different condition (Group 1 having poor sleep and Group 2 having adequate sleep).<sup>2</sup>]

- I have identified that Dr Craig used independent groups.<sup>1</sup>
- I have provided an appropriate justification with reference to how participants were separated into two distinct groups that experienced different conditions.<sup>2</sup>
- I have referred to the character's name in my response (Dr Craig), and to the experiment scenario.

- d [One extraneous variable is individual participant differences such as the sleep habits of participants prior to the experiment.<sup>1</sup>] [Participants in Group 2 may already be experiencing poor sleep, so by them sleeping for their regular amount of time they are not actually getting adequate sleep and therefore impacting the results.<sup>2</sup>] [Another extraneous variable is non-standardised testing conditions.<sup>3</sup>] [Standardised testing conditions would be difficult to monitor in the hospital environment and participants in the control condition could have poor sleep due to hospital noises, meaning that they wouldn't be a good representation of the 'adequate sleep group' and therefore also impacting the results.<sup>4</sup>]

- I have identified one extraneous variable.<sup>1</sup>
- I have explained how this extraneous variable could impact the results of Dr Craig's experiment.<sup>2</sup>
- I have identified a second extraneous variable.<sup>3</sup>
- I have explained how this second extraneous variable could impact the results of Dr Craig's experiment.<sup>4</sup>
- I have referred to the character's name in my response (Dr Craig), and to the experiment scenario.

Other acceptable responses could include:

- Genetic vulnerability acts as an extraneous variable
- The age of participants acts as an extraneous variable
- The sex of participants acts as an extraneous variable
- Other extraneous variables could be used as long as an appropriate explanation was provided for how the extraneous variables could impact the results of Dr Craig's experiment

## 12C Psychological risk factors

### Theory review questions

- 1 a Stress  
c Poor self-efficacy
- b Rumination  
d Impaired reasoning and memory
- 2 C. X - Predisposing risk factor; Y - Impaired reasoning and memory; Z - Rumination

### Exam-style questions

#### Remember and understand

- 3 A. Impaired reasoning and memory  
4 C. rumination.
- 5 [Poor self-efficacy involves an individual not believing in their capacity to complete particular tasks and meet goals.<sup>1</sup>] This means that an individual has an underlying lack of confidence in their ability to complete tasks required to function effectively in everyday life, such as

complete work for school or a job, thereby increasing their susceptibility to developing a mental health disorder, acting as a predisposing risk factor.<sup>2]</sup>

I have provided an appropriate description of poor self-efficacy.<sup>1</sup>

I have explained how poor self-efficacy acts as a predisposing risk factor, with reference to the phrase 'increases susceptibility'.<sup>2</sup>

6 [Stress can be considered a psychological risk factor because it involves psychological processes such as an individual's subjective appraisal of a stressor.<sup>1</sup>] [It also can be considered a precipitating risk factor because a stressor can act as the cause for an individual to no longer be able to cope with the pressures of their everyday life, therefore leading to the occurrence of a mental health disorder.<sup>2</sup>]

I have explained how stress can be considered as a psychological risk factor.<sup>1</sup>

I have explained how stress can be considered as a precipitating risk factor, with reference to the phrase 'increases susceptibility'.<sup>2</sup>

#### Apply and analyse

7 C. rumination

8 B. Impaired reasoning and memory

9 [Daniel not believing in his capacity to get the lead role in the school play despite knowing he is talented is an example of Daniel's poor self-efficacy.<sup>1</sup>]

I have identified that Daniel not thinking that he will get the main part in the school play is an example of his poor self-efficacy.<sup>1</sup>

I have referred to the character's name in my response (Daniel), and to the scenario.

10 [George's stress resulted in him being unable to complete daily living tasks such as going to school.<sup>1</sup>] [This therefore compromises his ability to function effectively in everyday life, which could directly lead to the development of a mental health disorder.<sup>2</sup>]

I have explained how George is unable to complete daily living tasks like going to school.<sup>1</sup>

I have explained how this demonstrates George's poor functioning and could lead to the development of a mental health disorder.<sup>2</sup>

I have referred to the character's name in my response (George), and to the scenario.

#### Questions from multiple lessons

11 C. Sympathetic nervous system

12 a [Adem is experiencing distress.<sup>1</sup>]

I have identified that Adem is experiencing distress.<sup>1</sup>

I have referred to the character's name in my response (Adem), and to the scenario.

b [Adem is experiencing a life event.<sup>1</sup>] [This is because Adem has attended a major work assignment, which causes him to adapt to new circumstances.<sup>2</sup>]

I have identified that Adem is experiencing a life event.<sup>1</sup>

I have provided an appropriate justification with reference to how Adem has to adapt to new circumstances.<sup>2</sup>

I have referred to the character's name in my response (Adem), and to the scenario.

c [For Adem's primary appraisal, he appraised the assignment that his boss gave him as a threat.<sup>1</sup>] [This is because of the potential to be fired in the future.<sup>2</sup>] [For Adem's secondary appraisal, he evaluated that he did not have adequate resources to cope.<sup>3</sup>] [This is because Adem did not think that he had enough time to finish the assignment before the deadline.<sup>4</sup>] [As a result, Adem experienced stress from this assignment which resulted in him not being able to cope with these pressures at work and function effectively, therefore precipitating a mental illness.<sup>5</sup>]

I have identified that Adem appraised the assignment as a threat in terms of primary appraisal.<sup>1</sup>

I have explained that Adem appraised the assignment as a threat because of the potential to be fired in the future.<sup>2</sup>

I have identified that Adem has evaluated that he does not have adequate resources to cope with the assignment in terms of secondary appraisal.<sup>3</sup>

I have explained that Adem appraised the assignment as exceeding resources he has to cope because of his perceived lack of time.<sup>4</sup>

I have linked Adem's appraisal to being a precipitating factor for his mental illness.<sup>5</sup>

I have referred to the character's name in my response (Adem), and to the scenario.

#### Key science skills

13 a [The independent variable in Dr Quina's experiment is the presence of rumination.<sup>1</sup>]

I have identified that the independent variable is the presence of rumination.<sup>1</sup>

I have referred to the character's name in my response (Dr Quina), and to the scenario.

b [The dependent variable in Dr Quina's is the presence of a mental health disorder.<sup>1</sup>]

I have identified that the dependent variable in Dr Quina's experiment is if participants still have a mental health disorder.<sup>1</sup>

I have referred to the character's name in my response (Dr Quina), and to the scenario.

c [Dr Quina used an independent groups research design.<sup>1</sup>] [This is because participants were separated into two distinct groups that had different conditions, one group who only had a mental health disorder but did not ruminate and the other that had a mental health disorder and were also known to ruminate.<sup>2</sup>]

- I have identified that Dr Quina used an independent groups research design.<sup>1</sup>

---

I have provided an appropriate justification with reference to how the two groups are different to each other.<sup>2</sup>

---

I have referred to the character's name in my response (Dr Quina), and to the scenario.

---

d [One extraneous variable evident is individual participant differences such as the type of mental health disorder that participants had.<sup>1</sup>] [If participants had varying types of mental health disorders between groups this could have impacted whether they still had a mental health disorder at the end of the experiment regardless of if they ruminated or not.<sup>2</sup>]

I have identified an extraneous variable.<sup>1</sup>

---

I have explained how this extraneous variable could impact the results of Dr Quina's experiment.<sup>2</sup>

---

I have referred to the character's name in my response (Dr Quina), and to the scenario.

Other acceptable responses could include:

- Age of participants
  - How often participants ruminate and to what degree
  - Presence of other risk factors
  - Both marks would still be awarded as long as you had explained how the extraneous variable could impact the results of Dr Quina's experiment

## 12D Social risk factors

## Theory review questions

- 1** **a** stigma **b** loss of a significant relationship  
**c** disorganised attachment **d** social risk factors

**2** D. X - Disorganised attachment; Y - Precipitating risk factors;  
Z - Stigma as a barrier to accessing treatment

## **Exam-style questions**

## **Remember and understand**

- 3 A. stigma as a barrier to accessing treatment
  - 4 B. the loss of a significant relationship.
  - 5 [Disorganised attachment refers to the inconsistent behaviour displayed by an infant towards their main caregiver when they are not provided with consistent and adequate support.<sup>1</sup>] [This can result in the infant being unable to trust others and form meaningful, supportive relationships later in life, increasing their susceptibility to developing a mental health disorder as an adult.<sup>2</sup>]

- I have described disorganised attachment.<sup>1</sup>

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I have explained how disorganised attachment could act as a predisposing risk factor, with reference to the phrase 'increases susceptibility'.<sup>2</sup>

- 6 [Stigma refers to a mark of shame or disgrace an individual feels due to the negative societal views they perceive others to have concerning a factor which sets them apart. The resulting shame felt by the individual can prevent them from seeking treatment, inhibiting their recovery and therefore perpetuating their mental health disorder.<sup>1</sup>][As this shame stems from perceived views held by society, real or imagined, stigma as a barrier to accessing treatment represents a social risk factor.<sup>2</sup>]

  I have explained how stigma as a barrier to accessing treatment can be considered as a perpetuating risk factor, with reference to the phrase 'inhibits recovery'.<sup>1</sup>

---

  I have explained how stigma as a barrier to accessing treatment can be considered as a social risk factor.<sup>2</sup>

## Apply and analyse

- 7 A. the loss of a significant relationship.

8 B. stigma as a barrier to accessing treatment.

9 a [Disorganised attachment occurs when an infant's primary caregiver does not provide consistent and reliable support.<sup>1</sup>] Phillip's disorganised attachment with his parents means that he is unable to trust others due to not being able to rely on his parents who were mostly absent due to work, therefore meaning that Phillip is unable to experience the support of meaningful relationships that could protect him from a mental health disorder.<sup>2</sup>]

---

  I have described disorganised attachment.<sup>1</sup>

---

  I have explained how disorganised attachment has increased Phillip's susceptibility to developing a mental health disorder.<sup>2</sup>

---

  I have referred to the character's name in my response (Phillip), and to the scenario.

- b** [One possible source of stigma is that society has certain views about males needing to be strong and therefore not needing to seek help for their problems.<sup>1</sup>] [This source of Stigma could have contributed to Phillip worrying that a psychologist would think that he is overreacting and needs to toughen up, therefore making him too embarrassed to seek treatment.<sup>2</sup>]

- I have identified one possible source of stigma.<sup>1</sup>

---

I have explained how this stigma could act as a barrier to Phillip accessing treatment.<sup>2</sup>

---

I have referred to the character's name in my response (Phillip), and to the scenario.

## Questions from multiple lessons

- 10 D. stigma as a barrier to accessing treatment

11 A. a dyssomnia.

12 a [Matthais experienced a significant life event.<sup>1</sup>] [This is because by Matthais' partner of 45 years dying, he had to adapt to new situations such as living alone and not having support to complete tasks such as shopping.<sup>2</sup>]

---

  I have identified that Matthais experienced a life event.<sup>1</sup>

---

  I have provided an appropriate justification with reference to how Matthais had to adapt to new situations.<sup>2</sup>

- I have referred to the character's name in my response (Matthais), and to the scenario.
- b** [When Matthais' partner died it significantly compromised his functioning, as demonstrated by Matthais not being able to go shopping by himself.<sup>1</sup>] [This therefore acted as the specific cause of Matthais' symptoms of mental illness, therefore precipitating his development of a mental health disorder.<sup>2</sup>]
- I have provided an example from the scenario of how the loss of a significant relationship led to the development of Matthais' mental health disorder.<sup>1</sup>
- I have described how the loss of a significant relationship was a precipitating risk factor that was the specific cause for Matthais' development of a mental health disorder.<sup>2</sup>
- I have referred to the character's name in my response (Matthais), and to the scenario.
- 
- Key science skills**
- 13 a** [Dr Begis used independent groups design in his experiment.<sup>1</sup>]
- I have identified that Dr Begis used an independent groups experimental research design.<sup>1</sup>
- I have referred to the character's name in my response (Dr Begis), and to the scenario.
- b** [Dr Begis compromised confidentiality.<sup>1</sup>] [This is because Dr Begis published the results with the names of participants and their mental health status.<sup>2</sup>]
- I have identified that Dr Begis compromised confidentiality.<sup>1</sup>
- I have provided an appropriate justification with reference to how Dr Begis published results with the names of participants included.<sup>2</sup>
- I have referred to the character's name in my response (Dr Begis), and to the scenario.
- c** [Dr Begis' experiment does not demonstrate internal validity.<sup>1</sup>] [This is because there are other factors that could have impacted if a participant developed a mental illness (dependent variable) other than if participants had experienced disorganised attachment (independent variable), such as the presence of other risk factors.<sup>2</sup>]
- I have identified that Dr Begis' experiment does not demonstrate internal validity.<sup>1</sup>
- I have provided an appropriate justification with reference to how there may not have been a cause and effect relationship between the independent and dependent variable (internal validity).<sup>2</sup>
- I have referred to the character's name in my response (Dr Begis), and to the scenario.
- 

## 12E Cumulative risk

### Theory review questions

- 1 increased; multiple; risk factors
- 2 B. W - Predisposing risk factor; X - Increases risk; Y - Decreases risk; Z - Protective factor

### Exam-style questions

#### Remember and understand

- 3 C. interaction between multiple risk factors and/or protective factors on mental health.
- 4 [Cumulative risk refers to the increased susceptibility to developing a mental health disorder due to the interaction of multiple risk factors that an individual experiences at the same time.<sup>1</sup>] [These multiple risk factors combine and interact to significantly increase the risk of developing a mental health disorder.<sup>2</sup>]

I have described cumulative risk.<sup>1</sup>

I have described how cumulative risk contributes to the development of a mental health disorder.<sup>2</sup>

#### Apply and analyse

- 5 D. cumulative risk.
- 6 [Vincent is likely to develop a mental health disorder.<sup>1</sup>] [The presence of multiple risk factors such as his partner separating from him, his tendency to ruminate and his poor response to medication greatly increase his susceptibility to developing a mental health disorder.<sup>2</sup>]

I have commented that Vincent is likely to develop a mental health disorder.<sup>1</sup>

I have referred to the concept of cumulative risk to demonstrate how Vincent is likely to develop a mental health disorder.<sup>2</sup>

I have referred to the character's name in my response (Vincent), and to the scenario.

### Questions from multiple lessons

- 7 A. parasomnia.
- 8 B. a social risk factor.
- 9 C. cumulative risk.
- 10 a** [Shahid is experiencing partial sleep deprivation.<sup>1</sup>]
- I have identified this Shahid is experiencing partial sleep deprivation.<sup>1</sup>
- b** [Shahid experienced multiple risk factors in the lead up to his exams, such as being stressed, having poor sleep and also his genetic predisposition to having a mental health disorder.<sup>1</sup>] [The increased risk of developing a mental health disorder due to the combination and interaction of all of these different risk factors at once, therefore, contributed to Shahid's development of a mental health disorder.<sup>2</sup>]
- I have described how Shahid experienced multiple risk factors during the time period leading up to his exams.<sup>1</sup>

I have described how the combination of these multiple risk factors contributed to Shahid's development of a mental health disorder.<sup>2</sup>

I have referred to the character's name in my response (Shahid), and to the scenario.

## Chapter 12 test

### Multiple choice questions

- 1 A. predisposing risk factors only increase the susceptibility to developing a mental health disorder, whereas precipitating risk factors can also directly contribute to their occurrence.
- 2 D. a psychological risk factor that inhibits the recovery from a mental health disorder.
- 3 C. inhibit the ability to recover from a mental health disorder.
- 4 B. it involves views held by society.
- 5 B. stigma as a barrier to accessing treatment.
- 6 C. genetic vulnerability, which also acts as a predisposing risk factor.
- 7 D. stress and the loss of a significant relationship.
- 8 C. cumulative risk.
- 9 A. when an individual experiences difficulty believing in their capacity to complete a task.
- 10 B. social risk factor that occurs due to the inconsistent care and support for an infant by a caregiver.

### Short answer questions

- 11 a [Rumination involves repeatedly thinking about the negative aspects of a situation.<sup>1</sup>] [This compromises Tia's ability to overcome distressing thoughts and situations in her life, therefore inhibiting her ability to recover from a mental health disorder and acting as a perpetuating risk factor.<sup>2</sup>]

I have described rumination.<sup>1</sup>

I have described how rumination acts as a perpetuating risk factor for Tia's mental health, with reference to the phrase 'inhibits recovery'.<sup>2</sup>

I have referred to the character's name in my response (Tia), and to the scenario.

- b [Poor response to medication due to genetic factors occurs internally within an individual as a function of their body, making it a biological risk factor.<sup>1</sup>] [For Tia, this poor response perpetuated her mental health disorder through reducing the effectiveness of medication and inhibiting recovery.<sup>2</sup>]

I have explained the concept of poor response to medication due to genetic factors.<sup>1</sup>

I have explained how poor response to medication acts as a biological risk factor for Tia's mental health.<sup>2</sup>

I have referred to the character's name in my response (Tia), and to the scenario.

- 12 [Rumination refers to repeatedly thinking about the negative aspects of a situation.<sup>1</sup>] [Beatrice displayed rumination by fixating on negative thoughts about how her boss told her off for being five minutes late.<sup>2</sup>]

I have described rumination.<sup>1</sup>

I have described how Beatrice displayed rumination with reference to her scenario.<sup>2</sup>

I have referred to the character's name in my response (Beatrice), and to the scenario.

- 13 [Poor self-efficacy refers to when an individual does not believe in their capacity to complete a task or meet their goals.<sup>1</sup>] [Poor self-efficacy can act as a psychological risk factor because it involves aspects of cognitive functioning, involving negative thought patterns and low self-esteem.<sup>2</sup>] [Poor self-efficacy can also act as a predisposing risk factor because it results in a consistent lack of confidence, therefore reducing the ability to complete daily tasks and increasing the susceptibility to developing a mental health disorder.<sup>3</sup>]

I have described poor self-efficacy.<sup>1</sup>

I have explained how poor self-efficacy acts as a psychological risk factor.<sup>2</sup>

I have explained how poor self-efficacy acts as a predisposing risk factor, with reference to the phrase 'increases susceptibility'.<sup>3</sup>

- 14 a [One social risk factor that influenced Angus' mental health is disorganised attachment.<sup>1</sup>] [This is evident through Angus' parents not being present or reliable during his childhood, causing issues later in life like not being able to trust others.<sup>2</sup>] [Another social risk factor that influenced Angus' mental health is the loss of a significant relationship.<sup>3</sup>] [An example of this is Angus losing the relationship with his close friend over a conflict, causing him significant distress and concern about developing relationships in the future.<sup>4</sup>]

I have identified that disorganised attachment is one social risk factor that influenced Angus' mental health.<sup>1</sup>

I have provided an example of disorganised attachment, with reference to Angus' parents being absent and unreliable during his infancy.<sup>2</sup>

I have identified that the loss of a significant relationship is another social risk factor that influenced Angus' mental health.<sup>3</sup>

I have provided an example of disorganised attachment, with reference to how Angus lost the relationship with his close friend over a conflict.<sup>4</sup>

I have referred to the character's name in my response (Angus), and to the scenario.

- b [Cumulative risk refers to the increased risk of developing a mental health disorder that occurs when an individual experiences multiple risk factors at once.<sup>1</sup>] [Cumulative risk could lead to Angus developing a mental health disorder because he is experiencing multiple risk factors at once, such as disorganised attachment, poor self-efficacy and the loss of a significant relationship, therefore greatly increasing his risk of developing a mental health disorder.<sup>2</sup>]

- I have defined cumulative risk.<sup>1</sup>
- I have explained how cumulative risk could lead to Angus developing a mental health disorder.<sup>2</sup>
- I have referred to the character's name in my response (Angus), and to the scenario.
- c [Disorganised attachment refers to when an infant's primary caregiver provides inconsistent care and support.<sup>1</sup>] [Due to Angus' parents not being present during his infancy, a form of disorganised attachment, Angus experiences many negative impacts which persist throughout his adult life, such as finding it difficult to trust others. This demonstrates that disorganised attachment acted as a predisposing risk factor by increasing his susceptibility to developing a mental health disorder.<sup>2</sup>]
- I have explained disorganised attachment.<sup>1</sup>
- I have explained how disorganised attachment acts as a predisposing risk factor for Angus, with reference to the phrase 'increases susceptibility'.<sup>2</sup>
- I have referred to the character's name in my response (Angus), and to the scenario.
- Key science skills questions**
- 15 a [Dr Visser used random sampling.<sup>1</sup>] [This was achieved by ensuring that every member of Dr Visser's population of interest (his psychology practice) had an equal chance of being selected for the experiment by having their names drawn out of a hat.<sup>2</sup>]
- I have identified that Dr Visser used random sampling.<sup>1</sup>
- I have explained that every member of the population has an equal chance of being selected for the experiment.<sup>2</sup>
- I have referred to the character's name in my response (Dr Visser), and to the scenario.
- b [Dr Visser used a placebo treatment by having participants in group two consume a sugar pill containing no active ingredient.<sup>1</sup>] [This means that participants in group two still expected to be consuming a drug that could improve their mental health, meaning that both groups were equally likely to experience the placebo effect.<sup>2</sup>] [This controlled for this kind of participant expectation.<sup>3</sup>]
- I have identified that Dr Visser used a placebo treatment by having group one take a sugar pill containing no active ingredient.<sup>1</sup>
- I have described how both groups were equally likely to experience the placebo effect.<sup>2</sup>
- I have described how participant expectations were controlled as an extraneous variable.<sup>3</sup>
- I have referred to the character's name in my response (Dr Visser), and to the scenario.

### Extended response

- 16 Students need to demonstrate that they have a thorough and holistic understanding of the factors that contribute to the development and progression of mental health disorders. This includes the ability to use the biopsychosocial approach to mental health and the Four P model to analyse different risk factors for mental health.

For reference to the **biopsychosocial approach to mental health**, students could have mentioned the following points, providing details about how each acts as a kind of biological, psychological or social risk factor:

- Petra's family history of mental health disorders demonstrates the biological risk factor of genetic vulnerability.
- The stress that Petra is experiencing due to her final exams and her desire to go to university demonstrates the psychological risk factor of stress.
- The stigma that mental illness is a sign of weakness making Petra worried about seeing a psychologist demonstrates the social risk factor of stigma as a barrier to accessing treatment.
- Petra's poor sleep as a result of her stress about exams as a biological risk factor. This may have been linked to sleep-onset insomnia and the negative effects of insomnia.
- Petra's poor self-efficacy as seen in her lack of belief in her ability to pass exams, as well as her belief that she will develop a mental illness like her family, as a psychological contributing factor.
- That the combination of biological, psychological and social risk factors demonstrates the role of the biopsychosocial model in analysing the interrelated components that contribute to an individual's mental state.

For reference to **predisposing, precipitating and perpetuating risk factors**, students could have mentioned the following points:

- Petra's genetic vulnerability to developing a mental health disorder is a predisposing risk factor. This means that it increases her susceptibility to developing a mental health disorder.
- Petra's stress is an example of a precipitating risk factors. This means that it increases her susceptibility to and contributes to the occurrence of a mental health disorder.
- Stigma as a barrier to accessing treatment is an example of a perpetuating risk factor for Petra's mental health. This means that it inhibits her ability to recover from a mental health disorder.
- Petra's poor sleep could be described as an example of a precipitating risk factor for Petra's mental health. This means that it increases her susceptibility to and contributes to the occurrence of a mental health disorder. It also perpetuates her current stress, which may impact her biological and psychological functioning.

For reference to the **concept of cumulative risk**, students should have mentioned the following points:

- The accumulation of multiple risk factors, as opposed to only one risk factor, greatly increased the risk of Petra developing a mental health disorder and making it more difficult to overcome.
- In order to overcome this accumulated risk, Petra would need to utilise multiple protective factors.

## 13A Stress, phobia and anxiety

### Theory review questions

- 1 a Stress  
b Anxiety  
c Phobia

2

The mental health continuum

Eustress	Distress Anxiety	Specific phobia Anxiety disorder
Mentally healthy	Mental health problem	Mental health disorder

3

Characteristic	Stress	Anxiety	Specific phobia
The sympathetic nervous system becomes dominant	✓	✓	✓
The response is to a known stimulus	✓	✓/✗	✓
Some amount can be adaptive	✓	✓	✗
Distress is always prominent	✗	✓	✓
Within the 'normal' range of functioning on the mental health continuum	✓	✓	✗
A diagnosable mental health disorder	✗	✗	✓
May contribute to the development or progression of mental health disorders	✓	✓	✗

### Exam-style questions

#### Remember and understand

- 4 A. both stress and anxiety can involve distress.  
5 A. Stress can be an adaptive response to a stimulus, whereas phobia is maladaptive.  
6 [Stress occurs when a person perceives they cannot cope with a current stressor, whereas anxiety occurs when a person perceives they cannot cope with a stressor that may occur in the future.<sup>1</sup>]

I have outlined one difference between stress and anxiety.<sup>1</sup>

I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses may include:

- Stress can be both eustress and distress, whereas anxiety is only marked by distress

- 7 [Both stress and anxiety can be adaptive to functioning; that is, mild amounts of stress and anxiety can be helpful to a person's functioning.<sup>1</sup>]

I have outlined one similarity between stress and anxiety.<sup>1</sup>

Other acceptable responses could include:

- Both stress and anxiety involve activation of the sympathetic nervous system

#### Apply and analyse

- 8 D. The sympathetic nervous system

- 9 [The psychologist is likely to say that Renata is experiencing anxiety.<sup>1</sup> [This is because she is feeling uneasy, apprehensive and worried, but not in response to a specific stressor.<sup>2</sup>]

I have identified that Renata is likely experiencing anxiety.<sup>1</sup>

I have given a reason to justify my response.<sup>2</sup>

I have referred to the character's name in my response (Renata), and to the scenario.

- 10 [Anxiety is characterised by feelings of worry, apprehension and unease. Excessive anxiety can lead to feelings of distress,<sup>1</sup> [which can affect daily functioning and be maladaptive.<sup>2</sup> [On the other hand, stress can be both in the form of eustress and distress.<sup>3</sup> [Eustress can be adaptive because it can give people more energy to address the stressor.<sup>4</sup>]

I have identified that anxiety is related to distress.<sup>1</sup>

I have identified that distress is maladaptive.<sup>2</sup>

I have identified that stress can be eustress.<sup>3</sup>

I have identified that eustress can be adaptive.<sup>4</sup>

I have used an appropriate distinguishing phrase, such as 'on the other hand'.

#### Questions from multiple lessons

- 11 D. anxiety, and is demonstrating approach coping.

- 12 a [Stimulus generalisation.<sup>1</sup>]

I have correctly identified the process of classical conditioning as stimulus generalisation.<sup>1</sup>

- b [Rowan demonstrates the characteristics of having a specific phobia of birds. He goes out of his way to avoid the phobic stimulus, such as not going to his niece's birthday to avoid encountering birds.<sup>1</sup> [This is also an example of how his fear affects his daily functioning because he is unable to see his friends and family due to this phobia.<sup>2</sup>]

I have referred to avoidance of phobic stimulus as a characteristic of specific phobia.<sup>1</sup>

I have referred to the effect on daily functioning as a second characteristic of specific phobia.<sup>2</sup>

I have used evidence from the scenario to explain why Rowan is likely to have a specific phobia.

I have referred to the character's name in my response (Rowan), and to the scenario.

Other acceptable responses could include:

- Phobic reaction (excessive and disproportionate fear) to a specific stimulus

#### Key science skills

- 13 a [It is hypothesised that<sup>1</sup> [prolonged exposure to the phobic stimulus (independent variable) will increase the likelihood of a phobic response being displayed (dependent variable) in the population of young children.<sup>2</sup>]

- I have started my hypothesis with "It is hypothesised that".<sup>1</sup>
- I have included the independent and dependent variables and population.<sup>2</sup>
- I have stated a direction of my hypothesis.

b [One ethical consideration that Maia did not take into account in her experiment is voluntary participation.<sup>1</sup>] [Her participants were her younger siblings who did not choose to be a part of her study, and as such she has breached this ethical consideration.<sup>2</sup>]

- I have identified one relevant ethical consideration for this scenario.<sup>1</sup>
- I have described why this ethical consideration was not appropriately considered.<sup>2</sup>
- I have referred to the character's name in my response (Maia), and to the scenario.

Other acceptable responses could include:

- Informed consent
- Debriefing when deception is used
- Withdrawal rights of the participant
- No harm
- Confidentiality

c Characteristics of a specific phobia include:

- [Persistent and irrational fear of a specific stimulus<sup>1</sup>]
- [Avoidance of the phobic stimulus<sup>2</sup>]
- [Fear of phobic stimulus affects daily functioning<sup>3</sup>]

- I have outlined one characteristic of a specific phobia.<sup>1</sup>
- I have outlined a second characteristic of a specific phobia.<sup>2</sup>
- I have outlined a third characteristic of a specific phobia.<sup>3</sup>

## 13B Contributing factors to phobia

### Theory review questions

1	Definition	Key term	Category
	The increase in susceptibility and contribution to phobia caused by a type of passive learning through association	Precipitation by classical conditioning	P
	The inhibiting of recovery from phobia caused by a kind of learning through the consequences of an action	Perpetuation by operant conditioning	P
	The activation of the sympathetic nervous system in the face of a perceived threat	Biological stress response	B
	A kind of cognitive bias caused by inaccurate or exaggerated memory	Memory bias	P
	The feeling of shame associated with receiving professional help	Stigma around seeking treatment	S
	An inadequate neural transmission of GABA	GABA dysfunction	B
	A predisposition to think about and process information in a certain way	Cognitive bias	P
	Events or stimuli in a person's surroundings that induce the stress response	Specific environmental triggers	S
	The strengthening of synaptic connections due to repeated coactivation	Long-term potentiation	B
	A kind of cognitive bias in which a stimulus or event is thought to be far worse than it is	Catastrophic thinking	P

### Exam-style questions

#### Remember and understand

- 2 B. there is a deficiency of this inhibitory neurotransmitter.
- 3 B. classical conditioning precipitates phobia while operant conditioning perpetuates phobia.
- 4 [Operant conditioning has a perpetuating role in specific phobia.<sup>1</sup>] [This is because the consequence stage of operant conditioning can negatively reinforce avoidant behaviours to phobic stimuli that prevent someone from becoming anxious.<sup>2</sup>]

I have correctly identified that operant conditioning has a perpetuating role.<sup>1</sup>

I have explained how operant conditioning perpetuates specific phobia with reference to negative reinforcement.<sup>2</sup>

- 5 [Long-term potentiation involves the strengthening of connections between neurons that are repeatedly coactivated.<sup>1</sup>] [In terms of phobia development, this involves coactivation of the neural signals involving the perception of a phobic stimulus and of the neural signals in the stress response.<sup>2</sup>] [This strengthens their association in memory and learning, contributing to a phobia.<sup>3</sup>]

I have correctly identified the process of long-term potentiation.<sup>1</sup>

- I have explained how long-term potentiation operates to pair perception and stress response neural signals.<sup>2</sup>
- I have explained how long-term potentiation strengthens an association in memory and/or learning and linked this to phobia development.<sup>3</sup>

### Apply and analyse

6 C. stigma around seeking treatment.

7 C. long-term potentiation.

8 a [If Carson has low levels of GABA, his inhibitory activation of neurons during the stress response might not be high enough.<sup>1</sup> [This means there is an over-activation of neural pathways, causing anxiety and a phobic response as the fight-flight-freeze response is more easily triggered.<sup>2</sup>]

I have identified that GABA dysfunction means there is not enough inhibitory neural activation in the stress response.<sup>1</sup>

I have explained that over-activation of neurons triggers the stress response (flight-fight-freeze response) which causes phobic anxiety.<sup>2</sup>

I have referred to the character's name in my response (Carson), and to the scenario.

b [Carson may have had a specific environmental trigger that developed his phobia<sup>1</sup> [such as a traumatic experience in crowds, like being lost in one as a child.<sup>2</sup>]

I have correctly named one type of social contributing factor.<sup>1</sup>

I have explained how this social factor may have led Carson to fear crowds by identifying specific experience.<sup>2</sup>

I have referred to the character's name in my response (Carson), and to the scenario.

9 [Flynn is showing a memory bias<sup>1</sup> [in that he recalls his experience with repeated hexagons as the most horrific experience he ever had.<sup>2</sup> [This strengthens his phobia of the patterns, as he associates them with a traumatic experience.<sup>3</sup> [Flynn also presents catastrophic thinking.<sup>4</sup> [He thinks that if he walks near a metal fence, he will have a public breakdown.<sup>5</sup> [This strengthens his phobic response in that the stimulus becomes associated with very bad consequences.<sup>6</sup>]

I have correctly identified memory bias as a cognitive bias.<sup>1</sup>

I have explained how memory bias presents in Flynn's scenario.<sup>2</sup>

I have explained how memory bias contributes to Flynn's phobia.<sup>3</sup>

I have correctly identified catastrophic thinking as a cognitive bias.<sup>4</sup>

I have explained how catastrophic thinking presents in Flynn's scenario.<sup>5</sup>

I have explained how catastrophic thinking contributes to Flynn's phobia.<sup>6</sup>

I have referred to the character's name in my response (Flynn), and to the scenario.

Other acceptable responses could include:

- You may have linked the relative cognitive biases slightly differently in the way they contribute to the phobia.

### Questions from multiple lessons

10 A. the sympathetic nervous system.

11 a [Ali would likely show a decrease in frequency and beta waves<sup>1</sup> [and show an increase in amplitude and non-beta waves.<sup>2</sup>]

I have correctly identified that Ali would have a decrease in frequency/beta waves.<sup>1</sup>

I have correctly identified that Ali would have an increase in amplitude/non-beta waves.<sup>2</sup>

I have referred to the character's name in my response (Ali), and to the scenario.

b [Ali's specific environmental trigger was witnessing his brother being bitten and going to hospital when he was a child.<sup>1</sup> [This would contribute to his phobia because it shows spiders as dangerous and something to fear.<sup>2</sup>]

I have correctly identified Ali's specific environmental trigger as witnessing his brother being bitten as a child.<sup>1</sup>

I have explained how this environmental trigger may have contributed to Ali's phobia.<sup>2</sup>

I have referred to the character's name in my response (Ali), and to the scenario.

c [As depressants decrease levels of alertness,<sup>1</sup> [Ali may have felt less alert to and aroused by the spider's presence<sup>2</sup> [meaning his phobic reaction was less severe than when he is sober or more alert.<sup>3</sup>]

I have correctly linked a decreased level of alertness to Ali's consumption of a depressant.<sup>1</sup>

I have explained how decreased alertness might be responsible for decreased arousal to the spider.<sup>2</sup>

I have linked this decrease in arousal to Ali's less severe phobic response.<sup>3</sup>

I have referred to the character's name in my response (Ali), and to the scenario.

12 a [Observational learning.<sup>1</sup>]

I have correctly identified the type of learning involved in Grace's phobia as observational learning.<sup>1</sup>

b [Grace's phobia of dogs is reinforced in observational learning<sup>1</sup> [as when she shows fear of dogs, so does her mother. This shows that it is the appropriate or right reaction to have to dogs.<sup>2</sup> [In contrast, Grace's mother's phobic response is negatively reinforced by operant conditioning.<sup>3</sup> [When she avoids dogs, her behaviour is reinforced as she is not directly in contact with her phobic trigger.<sup>4</sup>]

I have identified that Grace's reinforcement is within observational learning.<sup>1</sup>

I have explained how the reinforcement stage of observational learning applies to Grace's scenario.<sup>2</sup>

- I have identified that Grace's mother's phobic response is negatively reinforced in operant conditioning.<sup>3</sup>
- I have explained how reinforcement in operant conditioning applies to Grace's mother's response.<sup>4</sup>
- I have referred to the characters' name in my response (Grace and her mother), and to the scenario.

Other acceptable responses could include:

- You may have explained Grace's reinforcement within observational learning in other ways. For example, she's reinforced because she wants to be like her mother, or feels similar to her mother, and her mother reacts the same way to dogs. So long as it applied to the scenario, reinforcement under observational learning could be explained in a variety of ways.
- c [Grace's mother's breathing is an example of the stress response.<sup>1</sup>][This involves an activation of the sympathetic nervous system when she is presented with a phobic stimulus which puts her body into heightened arousal, including an increase of oxygen in the airways.<sup>2</sup>]
- I have correctly identified that Grace's mother's breathing is an example of the stress response.<sup>1</sup>
- I have explained the role of the stress response in relation to heavy breathing to phobic stimuli.<sup>2</sup>
- I have referred to the character's name in my response (Grace's mother), and to the scenario.
- d [Stimulus discrimination.<sup>1</sup>]
- I have correctly identified the relevant process of operant conditioning as stimulus generalisation.<sup>1</sup>

## 13C Interventions for phobia

### Theory review questions

- 1 a Systematic desensitisation; P      b Psychoeducation; S  
 c Agonist; B      d Benzodiazepine; B  
 e Exercise; B      f Breathing retraining; B

### Exam-style questions

#### Remember and understand

- 2 C. exercise as it works off stress hormones.
- 3 B. a social intervention that teaches the importance of challenging unrealistic thoughts and not encouraging avoidant behaviours.
- 4 D. psychological, biological
- 5 [Exercise can induce relaxation by inducing the release of mood-enhancing hormones like endorphins<sup>1</sup>][and by using up stress hormones that make the body feel anxious like cortisol.<sup>2</sup>]

- I have identified one way exercise induces relaxation.<sup>1</sup>
- I have identified another way exercise induces relaxation.<sup>2</sup>

- 6 [Phobic anxiety involves fast-paced and often shallow breathing, sometimes causing hyperventilation and activation of other sympathetic nervous system responses.<sup>1</sup>][Breathing retraining involves teaching someone to control their breath and work on reducing fast-breathing through deep, slow breaths.<sup>2</sup>][When someone has phobic anxiety, they can apply this technique to induce physiological relaxation to reduce phobic anxiety through parasympathetic responses.<sup>3</sup>]

- I have explained that phobic anxiety often involves fast, uncontrolled breath, linking it sympathetic nervous system arousal.<sup>1</sup>

- I have explained how breathing retraining is taught.<sup>2</sup>

- I have explained how applying breathing techniques can induce physiological relaxation and anxiety through parasympathetic responses.<sup>3</sup>

- 7 [Benzodiazepines work as an agonist for GABA by binding to the GABA receptor sites on neurons<sup>1</sup>][increasing the effectiveness of GABA,<sup>2</sup>][thereby allowing GABA to have its inhibitory effects.<sup>3</sup>][By making the neuron less likely to fire, the over-excitation of neurons that causes anxiety is reduced, providing a temporary relief of the stress response.<sup>4</sup>]

- I have explained that benzodiazepines are GABA agonists that bind to GABA receptors.<sup>1</sup>

- I have explained that they increase the effectiveness of GABA.<sup>2</sup>

- I have explained how GABA is then able to provide its inhibitory effect.<sup>3</sup>

- I have linked the inhibitory effect of GABA to reducing the stress response.<sup>4</sup>

### Apply and analyse

- 8 B. psychoeducation about the need to not encourage avoidant behaviours.
- 9 A. increasing the inhibitory effect of GABA
- 10 a [Eliza should begin by learning relaxation techniques, such as breathing retraining.<sup>1</sup>][She should then develop a fear hierarchy, ranking experiences from least anxiety-inducing interactions with cats, to being in direct contact with a cat.<sup>2</sup>][She should then gradually work her way through this fear hierarchy, pairing fearful stimuli with relaxation techniques.<sup>3</sup>][Eliza should continue this process until she is able to touch or be near a cat without producing the fear response.<sup>4</sup>]

- I have explained the step of learning a relaxation technique.<sup>1</sup>

- I have explained the step of developing a fear hierarchy.<sup>2</sup>

- I have explained the step of gradual exposure along the fear hierarchy with the use of relaxation techniques.<sup>3</sup>

- I have explained the final step of exposure to the direct phobic stimulus without the fear response.<sup>4</sup>

- I have referred to the character's name in my response (Eliza), and to the scenario.

- b** [Eliza could also undergo cognitive behavioural therapy.<sup>1</sup>][This would first involve her identifying any unhelpful thoughts and behaviours she performs surrounding cats, for example, the belief that they are all evil and out to get her.<sup>2</sup>][She would then attempt to substitute the unhealthy thoughts/behaviours with more healthy ones, for example, by challenging the belief that all cats are evil as a hypothesis rather than a fact and/or by implementing behavioural changes such as the use of breathing retraining.<sup>3</sup>]

I have correctly identified that the other psychological intervention Eliza could use would be cognitive behavioural therapy.<sup>1</sup>

I have explained the stage of cognitive behavioural therapy involving identifying unhelpful thoughts and behaviours.<sup>2</sup>

I have explained the stage of cognitive behavioural therapy involving replacing unhelpful thoughts and behaviours with more helpful ones with brief examples.<sup>3</sup>

I have referred to the character's name in my response (Eliza), and to the scenario.

#### Questions from multiple lessons

**11** C. sleep-onset insomnia

**12** B. cognitive behavioural therapy

**13** D. specific environmental triggers.

**14** [Benzodiazepines have the same structure as GABA neurotransmitters, so they can act like a 'key'<sup>1</sup>][to fit into the same 'lock' or receptor site as GABA,<sup>2</sup>][helping GABA to have its inhibitory effect more effectively.<sup>3</sup>]

I have explained how benzodiazepines act as a 'key' that has the same structure as GABA.<sup>1</sup>

I have explained that benzodiazepines fit into the 'lock' or GABA receptor site.<sup>2</sup>

I have explained that benzodiazepines help GABA to have its inhibitory effect.<sup>3</sup>

**15 a** [Fatima's response is an example of a specific phobia.<sup>1</sup>][This is because her behaviour is maladaptive which isn't always the case with anxiety,<sup>2</sup>][and is of extreme fear as opposed to mere apprehension and worry.<sup>3</sup>]

I have correctly identified that Fatima's response is an example of specific phobia.<sup>1</sup>

I have provided one reason why this response is different from anxiety.<sup>2</sup>

I have provided another reason why this response is different from anxiety.<sup>3</sup>

I have referred to the character's name in my response (Fatima), and to the scenario.

Other acceptable responses could include:

- Anxiety is the fear of future stressors, whereas Fatima's fear of running water is present when the stimulus is there

- b** [Context-specific effectiveness involves the selection of an appropriate coping mechanism for the demands of the stressor.<sup>1</sup>][Exercise would not be an example of context-specific effectiveness for Fatima<sup>2</sup>][because it is an avoidant coping strategy.<sup>3</sup>][which is not appropriate for phobias as it only reduces her fear temporarily, without actually dealing with the cause.<sup>4</sup>]

I have briefly explained what context-specific effectiveness involves.<sup>1</sup>

I have identified that exercise would not be an example of context-specific effectiveness.<sup>2</sup>

I have identified that it is an avoidant coping strategy.<sup>3</sup>

I have justified why it would not demonstrate context-specific effectiveness, referring to the context of it being a phobia and not addressed with avoidance.<sup>4</sup>

I have referred to the character's name in my response (Fatima), and to the scenario.

I have used the language of coping, referring to avoidant coping.

#### Key science skills

**16** D. objective quantitative, subjective qualitative

## Chapter 13 test

### Multiple choice questions

- B. specific environmental trigger.
- C. catastrophic thinking which is a psychological contributing factor.
- B. the role of the stress response.
- A. the loud noise, fear of the white rat.
- B. long-term potentiation.
- C. phobia involves only distress, whereas stress does not.
- A. the co-activation of neural signals involved in activating the fear response and the perception of a stimulus strengthens their association.
- D. context-dependent cue.
- B. perpetuation by operant conditioning..
- C. sympathetic, parasympathetic.

### Short answer questions

- 11 a** [Amelia was likely experiencing anxiety<sup>1</sup>][because she was shaking and very worried about crossing the bridge, however, she was eventually able to cross the bridge, showing that her anxiety was not entirely maladaptive.<sup>2</sup>][On the other hand, Grace appeared to have a phobia of heights<sup>3</sup>][given her break down and complete inability to cross the bridge, demonstrating that her fears are maladaptive.<sup>4</sup>]

- I have correctly identified that Amelia is experiencing anxiety.<sup>1</sup>
- I have justified why Amelia is experiencing anxiety, using the scenario and a feature which is comparable to phobia and stress (amount of anxiety, adaptiveness of response).<sup>2</sup>
- I have correctly identified that Grace is experiencing a phobia.<sup>3</sup>
- I have justified why Grace is experiencing a phobia, using the scenario and a feature which is comparable to anxiety and stress (amount of anxiety, maladaptiveness of response).<sup>4</sup>
- I have referred to the characters' names in my response (Grace and Amelia), and to the scenario.
- b [While Amelia employed an approach coping strategy<sup>1</sup>][by directly confronting the stressor and crossing the bridge,<sup>2</sup>] Grace employed an avoidant coping strategy<sup>3</sup>][by breaking down and venting emotionally.<sup>4</sup>]
- I have correctly identified that Amelia employed the use of an approach coping strategy.<sup>1</sup>
- I have provided a relevant example from the scenario to support this answer.<sup>2</sup>
- I have correctly identified that Grace employed the use of an avoidance coping strategy.<sup>3</sup>
- I have provided a relevant example from the scenario to support this answer.<sup>4</sup>
- I have used the language of coping strategies (approach and avoidance coping strategies).
- I have referred to the characters' names in my response (Grace and Amelia), and to the scenario.
- c [Both Grace and Amelia would have appraised the stressor as a stressful; threat<sup>1</sup>][as both girls experienced distress and viewed it as a potential for future harm.<sup>2</sup>]
- I have correctly identified that both Grace and Amelia would have appraised the stressor as stressful; threat.<sup>1</sup>
- I have provided examples from the scenario to justify that they appraised the stressor as stressful; threat.<sup>2</sup>
- I have used the language of Lazarus and Folkman's transactional model, referring to stressful; threat.
- I have referred to the characters' names in my response (Grace and Amelia), and to the scenario.

Other acceptable responses could include:

- You may have said Grace appraised the stressor as harm/loss if you correctly justified it in terms of the scenario (that Grace felt the confrontation with the bridge had already harmed her in some way)

- 12 [Cognitive biases like catastrophic thinking<sup>1</sup>][psychologically contribute to phobia because when a person thinks about the worst case scenario in regards to a certain stimulus, they come to associate it with fear.<sup>2</sup>]

- I have correctly identified one psychological contributing factor.<sup>1</sup>
- I have described how this factor psychologically contributes to phobia.<sup>2</sup>
- Other acceptable responses could include:
- Precipitation by classical conditioning
  - Perpetuation by operant conditioning
- 13 a [Cognitive behavioural therapy would first involve Dylan identifying his unhealthy cognition of catastrophic thinking about fish.<sup>1</sup>][He would then need to try and replace these unhealthy thoughts,<sup>2</sup> perhaps by questioning whether his fears are just hypotheses rather than facts, and thinking about the likelihood of them happening.<sup>3</sup>]
- I have outlined that cognitive behavioural therapy would first require identifying the unhealthy cognition of catastrophic thinking.<sup>1</sup>
- I have identified that these cognitions would need to be replaced.<sup>2</sup>
- I have suggested a way Dylan could replace his unhealthy cognitions.<sup>3</sup>
- I have referred to the character's name in my response (Dylan), and to the scenario.
- b [Dylan could possibly be in an altered state of consciousness induced by his fear<sup>1</sup>][as he is demonstrating psychological features outside normal waking consciousness. For example, he has reduced self-control demonstrated by his inability to control his yelling and body movements<sup>2</sup>][and also, his time orientation is inaccurate suggesting he might have some perceptual distortions.<sup>3</sup>]
- I have stated that Dylan could be in an altered state of consciousness.<sup>1</sup>
- I have provided one justification with an example for my response.<sup>2</sup>
- I have provided a second justification for my response.<sup>3</sup>
- I have used the language of psychological states, referring to self-control and time orientation.
- I have referred to the character's name in my response (Dylan), and to the scenario.
- 14 a [Systematic desensitisation works to de-condition the association that produces the phobic response.<sup>1</sup>][For Coen, this is between the conditioned stimulus of the cat and the conditioned response of fear.<sup>2</sup>][By using relaxation techniques in intervals after gradual exposure to a cat-related stimulus, cats overtime will become associated with relaxation rather than fear.<sup>3</sup>]
- I have briefly described how systematic desensitisation works in relation to classical conditioning.<sup>1</sup>
- I have described what the classically conditioned association is for Coen.<sup>2</sup>
- I have explained how the processes in systematic desensitisation work to undo this association with the use of relaxation techniques and gradual exposure.<sup>3</sup>

I have used the language of classical conditioning, referring to the conditioned stimulus and conditioned response.

I have referred to the character's name in my response (Coen), and to the scenario.

- b [Classical conditioning is a precipitating risk factor for Coen<sup>1</sup>] [because it increases his susceptibility to and contributes to the occurrence of his phobia of cats.<sup>2</sup>] [For Coen, the fear (CR) to his cat (CS) through association with biting and scratching (UCS) has been applied to all other cats through a process of stimulus generalisation.<sup>3</sup>]

I have correctly identified that classical conditioning is a precipitating risk factor.<sup>1</sup>

I have correctly described what makes classical conditioning precipitating.<sup>2</sup>

I have correctly outlined the process of classical conditioning involved in Coen's fear of all cats.<sup>3</sup>

I have used the language of classical conditioning, referring to stimulus generalisation and CR, CS and UCS.

I have referred to the character's name in my response (Coen), and to the scenario.

### Key science skills questions

- 15 A. a single-blind procedure.

- 16 a [While rating scales collected quantitative data,<sup>1</sup>] [the interviews would have collected qualitative data.<sup>2</sup>]

I have correctly described that rating scales collected quantitative data.<sup>1</sup>

I have correctly described that the interviews collected qualitative data.<sup>2</sup>

Other acceptable responses could include:

- Rating scales could be described as being subjective data, and interviews as subjective data

- b [One possible extraneous variable in this study is the experimenter bias.<sup>1</sup>] [As the psychiatrist was present for the data collection and knew the participants personally, he may have had a bias in the way he interpreted their results.<sup>2</sup>]

I have identified a relevant extraneous variable in the scenario.<sup>1</sup>

I have described how this extraneous variable may have affected results in line with the scenario.<sup>2</sup>

Other acceptable responses could include:

- Other extraneous variables such as non-standardised testing procedures, participant-related variables, etc., so long as they were justified in line with the scenario.

- c [No,<sup>1</sup>] [the results could not be generalised because a convenience sample with just a few participants was used, meaning the sample was not necessarily reflective of the population.<sup>2</sup>]

I have correctly stated that the results could not be generalised.<sup>1</sup>

I have provided a reason for the results not being generalisable in line with the scenario.<sup>2</sup>

Other acceptable responses could include:

- Other justifications for the results not being generalisable e.g. the presence of potential confounding variables, so long as you specified them in line with the scenario.

### Extended response

- 17 Students need to demonstrate that they have a thorough and holistic understanding of phobia through the biopsychosocial model, as well as an ability to apply learning concepts from across the study design. Given Curtis observed his mother behaving a certain way and being reinforced for it, discussion of the following learning models would be awarded:

- Observational learning: Curtis observed his mother's phobic anxiety surrounding germs and within that, he observed processes of operant conditioning perpetuation (via negative reinforcement) of her avoidant behaviours. This would have provided a source of vicarious conditioning.
- Classical conditioning: a discussion of the precipitating effects of classical conditioning could be relevant
- Operant conditioning: the A-B-C model of operant conditioning could be applied to both Curtis and his mother
- These psychological learning models could be linked to social and biological processes involved in phobia e.g. long-term potentiation and classical conditioning, or the social processes of observational learning

Students also need to discuss other possible contributing factors for Curtis, outside the learning models already discussed, with reference to the biopsychosocial model. Contributing factors that could have been discussed include:

- The role of the stress response (biological)
- Long-term potentiation (biological)
- Cognitive biases, especially catastrophic thinking (psychological)
- Specific environment triggers (social)
- Stigma around seeking treatment (social) and GABA dysfunction (biological), although contributing factors to phobia, were not explicitly indicated in the scenario and so would not be as highly awarded in responses as other contributing factors

Students also needed to comment on a range of potential interventions that could help Curtis to treat his phobia, also referencing the biopsychosocial model. These could have included:

- Use of relaxation techniques such as breathing retraining and exercise (biological)
- Cognitive behavioural therapy (psychological)
- Systematic desensitisation (psychological)
- Psychoeducation for families/supporters (social) - referencing challenging unrealistic and anxious thoughts, and/or not encouraging avoidant behaviours
- Benzodiazepines (biological), although an intervention for phobia, was not as explicitly relevant to the scenario as it was not mentioned that Curtis had GABA dysfunction. While it would be accepted, it would not be awarded as highly as other possible interventions.

## 14A Resilience

### Theory review questions

- 1** **a** Biological protective factors
- b** Adversity
- c** Psychological protective factors
- d** Resilience
- e** Social protective factors
- 2** Biological protective factors: A, E, G  
Psychological protective factors: D  
Social protective factors: B, C, F, H

### Exam-style questions

#### Remember and understand

- 3** A. the ability to 'bounce back' after hardship.
- 4** C. involves changing in the face of problems or hardship in a way that is healthy and allows them to be overcome.
- 5** B. accessing support from family and friends.
- 6** [One psychological protective factor is the use of cognitive and behavioural strategies.<sup>1</sup>] [This could increase a person's resilience if they are better equipped with approaches to overcome and respond to stressors<sup>2</sup>] [thereby decreasing stressor's occurrence or reoccurrence in their life.<sup>3</sup>]

I have correctly identified a relevant psychological protective factor.<sup>1</sup>

I have described how this could influence a person's resilience, showing knowledge that resilience involves the ability to respond to or overcome stressors.<sup>2</sup>

I have described how this would be a protective factor, with reference to decreasing occurrence or reoccurrence.<sup>3</sup>

Other acceptable responses could include:

- Other psychological protective factors such as increasing one's self-efficacy, so long as they were protective and explained in line with resilience.

#### Apply and analyse

- 7** D. he hasn't demonstrated an ability to deal with his brother dying in a healthy way.
- 8** B. Not getting adequate sleep, not getting support from family and friends.
- 9** **a** [Athena could increase her ability to overcome her sickness by getting adequate sleep.<sup>1</sup>] [By sleeping more, Athena's body will be able to get stronger and healthier, helping her to meet daily demands, reducing the main source of her stress.<sup>2</sup>] [This could increase Athena's resilience by reducing the presence and occurrence of sickness.<sup>3</sup>]

I have correctly identified a relevant biological protective factor.<sup>1</sup>

I have described how this factor could influence Athena's resilience, with reference to resilience involving the ability to respond to or overcome the stressor or her sickness.<sup>2</sup>

I have described how this factor would be protective, with reference to it reducing the presence of the stressor and its occurrence.<sup>3</sup>

I have referred to the character's name in my response (Athena), and to the scenario.

Other acceptable responses could include:

- Having an adequate diet.
- Other biological protective factors, so long as they addressed Athena's specific stressor of being sick e.g. the use of medication.
- b** [Athena could increase her ability to adapt to the stressor of her sickness and improve her resilience to it by using both cognitive and behavioural strategies.<sup>1</sup>] [Athena should identify her negative thoughts such as letting everyone in her team down and not being well enough, and replace them with more positive ones such as that she could get better in time for the recital.<sup>2</sup>] [She should combine this with behavioural change such as seeking alternative ways to get better.<sup>3</sup>]

I have correctly identified that employing cognitive and behavioural strategies could increase Athena's resilience.<sup>1</sup>

I have discussed how cognitive strategies would involve identifying unhealthy thoughts and replacing them with more healthy ones with examples from the scenario.<sup>2</sup>

I have discussed how behavioural strategies would involve replacing unhealthy behaviours with more healthy ones with examples from the scenario.<sup>3</sup>

I have referred to the character's name in my response (Athena), and to the scenario.

#### Questions from multiple lessons

- 10** D. cerebellum
- 11** C. rumination.
- 12** C. social protective factor that could increase Jireh's resilience.
- 13** **a** [Jovan was displaying resilience to life stressors<sup>1</sup>] [as seen in him bouncing back after the stressor of his aunt's death,<sup>2</sup>] [and also high levels of functioning,<sup>3</sup>] [as he was able to continue his daily functioning even after a significant stressor.<sup>4</sup>]

I have identified one characteristic of a mentally healthy person.<sup>1</sup>

I have described how Jovan displayed that characteristic in the scenario.<sup>2</sup>

I have identified another characteristic of mentally healthy person.<sup>3</sup>

I have described how Jovan displayed that characteristic in the scenario.<sup>4</sup>

I have referred to the character's name in my response (Jovan), and to the scenario

Other acceptable responses could include:

- Social and emotional wellbeing, so long as it was justified in line with the scenario.
- b** [Jovan's mother could have increased her ability to adapt to her sister's death by seeking support from her friends.<sup>1</sup>] [She could

do this by asking them for help organising the funeral, cooking, or to spend more time with her during the time of her sadness.<sup>2</sup> [This could increase her resilience by reducing the occurrence and reoccurrence of grief.<sup>3</sup>]

I have correctly identified one relevant social protective factor.<sup>1</sup>

I have described how this could influence her resilience, showing knowledge that resilience involves the ability to respond to or overcome stressors.<sup>2</sup>

I have described how this would act as a protective factor, with reference to decreasing the occurrence or reoccurrence of the stressor.<sup>3</sup>

I have referred to the character's name in my response (Jovan's mother), and to the scenario.

- c [After Jovan's aunt's death (antecedent), he performed the behaviour of bouncing back and showing a high level of resilience (behaviour).]<sup>1</sup> [This behaviour was punished by his mother, who spoke harshly against his choice of coping mechanism (consequence).<sup>2</sup>] [This made Jovan less likely to perform the same grieving behaviour again, as seen in his choice to grieve and stay home after his grandmother's death<sup>3</sup>] [and show less resilience.<sup>4</sup>]

I have outlined Jovan's initial behaviour of bouncing back that received a consequence.<sup>1</sup>

I have outlined that this behaviour received the consequence of punishment in the scenario.<sup>2</sup>

I have outlined that made Jovan less likely to perform the same behaviour again, meaning that his approach to his grandmother's death was altered.<sup>3</sup>

I have linked this behaviour to levels of resilience displayed.<sup>4</sup>

I have used the language of operant conditioning, referring to behaviour and consequence (positive punishment).

I have referred to the character's name in my response (Jovan), and to the scenario.

that the time periods outlined in the model, such as changing behaviour in six months (contemplation) are vague and not always consistent with the length of each stage in real life.<sup>1</sup>

I have outlined one limitation of the transtheoretical model of behaviour change.<sup>1</sup>

Other acceptable responses could include:

- Limited research on how individuals transition between stages
- Limited research on the motivation and psychological processes involved in transitions between stages
- Order of stages may be inaccurate
- Stages may not encompass all behaviours/stages which need to occur to cause a successful behaviour change

### Apply and analyse

5 D. preparation

6 A. action and preparation.

7 D. contemplation stage.

8 C. pre-contemplation

- 9 [As Stacy is in the maintenance stage, one characteristic she may display is not having gambled for at least six months.<sup>1</sup>] [Stacy will also display the characteristic of working to prevent relapse.<sup>2</sup>]

I have outlined one characteristic of the maintenance stage.<sup>1</sup>

I have outlined a second characteristic of the maintenance stage.<sup>2</sup>

I have referred to the character's name in my response (Stacy), and to the scenario.

10 a [Action stage.<sup>1</sup>]

I have identified that Alannah experienced the action stage.<sup>1</sup>

- b [The occurrence Alannah experienced was relapse.<sup>1</sup>] [This was seen through Alannah starting to use her phone while studying and returning to her ineffective study habits after three months, which involved her returning to the problem behaviour, therefore experiencing a relapse.<sup>2</sup>]

I have outlined that Alannah experienced relapse.<sup>1</sup>

I have justified my response by referring to examples from the scenario.<sup>2</sup>

I have referred to the character's name in my response (Alannah), and to the scenario.

- c [One strength of the transtheoretical model of behaviour change is that it accounts for fluctuations between stages as behaviour change is not a linear process.<sup>1</sup>] [This can be seen through Alannah's relapse during the action stage, as she returns to her original ineffective study habits.<sup>2</sup>]

I have explained one strength of the transtheoretical model of behaviour change.<sup>1</sup>

I have justified how this strength is evident in the scenario through the use of an example.<sup>2</sup>

## 14B Behaviour change

### Theory review questions

- |  |                       |
|--|-----------------------|
| 1 a Pre-contemplation stage                  | b Action stage        |
| c Transtheoretical model of behaviour change | d Contemplation stage |
| e Preparation stage                          | f Relapse             |
| g Maintenance stage                          |                       |

### Exam-style questions

#### Remember and understand

- 2 A. there is limited research on the psychological processes involved in transitioning between stages.
- 3 C. assesses an individual's readiness to change their behaviour.
- 4 [One limitation of the transtheoretical model of behaviour change is

- I have referred to the character's name in my response (Alannah), and to the scenario.

Other acceptable responses could include:

- Helps to explain that change is gradual
- Accounts for differences between individuals

#### Questions from multiple lessons

11 B. poor self-efficacy.

12 D. action stage of the transtheoretical model of behaviour change.

13 a [Azra is currently in the preparation stage of the transtheoretical model of behaviour change.<sup>1</sup>] A behaviour Azra might display in this stage is telling her friends that she is about to start meditating.<sup>2</sup>

- I have identified that Azra is currently in the preparation stage of the transtheoretical model of behaviour change.<sup>1</sup>

- I have outlined a behaviour Azra is likely to demonstrate as part of this stage.<sup>2</sup>

- I have referred to the character's name in my response (Azra), and to the scenario.

Other acceptable responses could include:

- Taking small steps towards behaviour change with an appropriate example
- b [While meditating, Azra's brain waves are likely to decrease in frequency and increase in amplitude.<sup>1</sup>]

- I have described that Azra's brain waves will decrease in frequency and increase in amplitude.<sup>1</sup>

- I have referred to the character's name in my response (Azra), and to the scenario.

## Chapter 14 test

### Multiple choice questions

- 1 C. high self-esteem
- 2 D. Actively considering making a change to behaviour within the next six months.
- 3 B. preparation
- 4 A. experience and display appropriate emotional responses.
- 5 D. Lucien - Preparation; Ava - Pre-contemplation
- 6 B. Declan - Support from friends and the community; Marco - Cognitive behavioural strategies
- 7 B. telling his friends about the changes he has made to his sleep habits.
- 8 A. cortisol
- 9 C. exhaustion
- 10 D. It will reduce his future likelihood of being exposed to stressors

### Short answer questions

- 11 [One limitation of the transtheoretical model of behaviour change is that there is limited research on the psychological processes, such as motivation, which are involved in transitioning between stages.<sup>1</sup>]

- I have outlined one limitation of the transtheoretical model of behaviour change.<sup>1</sup>

Other acceptable responses could include:

- The time periods of each stage of the model are not always consistent in real life
- It has been questioned as to whether the stages are in the right order
- It has been questioned as to whether the stages encompass all necessary actions involved in behaviour change

12 [One strength of the transtheoretical model of behaviour change is that it helps to explain that the process of behaviour change is gradual, which is seen through the multiple stages and lengthy time frames of these stages.<sup>1</sup>]

- I have outlined one strength of the transtheoretical model of behaviour change.<sup>1</sup>

Other acceptable responses could include:

- Helps to account for fluctuations in behaviour change and relapses
- Helps to explain that relapses still lead to behaviour change in the long term
- The model provides a broad account of the processes involved in behaviour change

13 [The action stage involves making changes to behaviour for less than six months whereas the maintenance stage involves making changes to behaviour for more than six months.<sup>1</sup>]

- I have identified a difference between the action and maintenance stages.<sup>1</sup>

- I have used an appropriate distinguishing word, such as 'whereas'.

Other acceptable responses could include:

- Action stage might not involve consistent behaviour change, whereas the maintenance stage does

14 a [Caleb is currently demonstrating the action stage.<sup>1</sup>] [This can be seen through Caleb going to training for only the past two months.<sup>2</sup>]

- I have identified that Caleb is currently demonstrating the action stage.<sup>1</sup>

- I have justified my response by referring to Caleb attending training for less than six months.<sup>2</sup>

- I have referred to the character's name in my response (Caleb), and to the scenario.

b [Poor sleep.<sup>1</sup>]

- I have identified a risk factor that Caleb is experiencing.<sup>1</sup>

Other acceptable responses could include:

- Stress

c [A protective factor that Caleb is experiencing is support from his teammates.<sup>1</sup>] [This helps to prevent the occurrence or re-occurrence of a mental health disorder as Caleb is being encouraged by his team mates to continue his behaviour change towards healthier behaviour.<sup>2</sup>]

- I have identified that a protective factor is support from his teammates.<sup>1</sup>
- I have explained how this protective factor helps Caleb.<sup>2</sup>
- I have referred to the character's name in my response (Caleb), and to the scenario.
- 15 a** [Willow is demonstrating the preparation stage of the transtheoretical model of behaviour change.<sup>1</sup>] This is seen through Willow starting to take steps towards healthier behaviour of anger management as she has seen her doctor and is now about to see a counsellor, demonstrating that she is ready to change her behaviour in the next 30 days.<sup>2</sup>]
- I have identified that Willow is demonstrating the preparation stage of the transtheoretical model of behaviour change.<sup>1</sup>
- I have justified my response by referring to examples from the scenario.<sup>2</sup>
- I have referred to the character's name in my response (Willow), and to the scenario.
- b** [When willow is angry, her sympathetic nervous system is activated resulting in fast, shallow breathing.<sup>1</sup>] [Willow's psychologist could teach her to use breathing retraining by first teaching her how to control her breathing with slow, deep breaths.<sup>2</sup>] [Willow could then apply this technique whenever she experiences anger, as this usually leads to increased breathing rate.<sup>3</sup>]
- I have outlined that being angry involves the activation of the sympathetic nervous system.<sup>1</sup>
- I have outlined what breathing retraining involves.<sup>2</sup>
- I have explained how this could be used to manage Willow's anger.<sup>3</sup>
- I have referred to the character's name in my response (Willow), and to the scenario.
- c** [Breathing retraining is an approach coping strategy.<sup>1</sup>] [This is due to the coping strategy directly confronting the stressor of having a 'short-temper' by reducing levels of stress and agitation.<sup>2</sup>]
- I have identified that breathing retraining is an approach coping strategy.<sup>1</sup>
- I have justified my response by referring to the strategy as directly dealing with the stressor.<sup>2</sup>

Other acceptable responses could include:

- Avoidance coping strategy due to not directly confronting the stressor of having a 'short temper'
- Approach coping strategy, as it is addressing the physiological component of anger

- 16** [During the pre-contemplation stage, Maxine is likely to have not believed that she needed to speak Italian on her trip and was unlikely to try to learn Italian in the next six months.<sup>1</sup>] [Maxine is then likely to believe that it would be helpful to learn Italian for her trip, intending to start learning the language within the next six months.<sup>2</sup>] [During preparation, Maxine will make an active commitment to start learning

Italian in the next 30 days, this may involve downloading an app.<sup>3</sup>] [In the action stage, Maxine will have made distinct behaviour change for less than six months, such as using the app every day for 20 minutes in order to learn Italian.<sup>4</sup>] [Finally, in the maintenance stage, Maxine will have made distinct behaviour change towards learning Italian, such as using the app everyday, for more than six months and be working to avoid relapse.<sup>5</sup>]

- I have outlined what Maxine will experience during the pre-contemplation stage, referring to a relevant example.<sup>1</sup>
- I have outlined what Maxine will experience during the contemplation stage, referring to a relevant example.<sup>2</sup>
- I have outlined what Maxine will experience during the preparation stage, referring to a relevant example.<sup>3</sup>
- I have outlined what Maxine will experience during the action stage, referring to a relevant example.<sup>4</sup>
- I have outlined what Maxine will experience during the maintenance stage, referring to a relevant example.<sup>5</sup>
- I have used the language of the transtheoretical model of behaviour change, referring to the stages of: pre-contemplation, contemplation, preparation, action, maintenance and relapse.
- I have referred to the character's name in my response (Maxine), and to the scenario.

## BONUS – CARTOON QUESTION ANSWERS

### Multiple choice questions

- 1 B. stress
- 2 A. a cognitive behavioural strategy.

### Short answer questions

3 [Protective factors prevent the occurrence or re-occurrence of mental health disorders.<sup>1</sup>][By exercising, the brain protects itself from mental health disorders as it is provided with a distraction from stress and with mood-enhancing hormones such as beta-endorphins.<sup>2</sup>]

- I have defined protective factors.<sup>1</sup>
- I have explained how exercise might act as a protective factor for the cartoon brain, discussing a benefit of exercise.<sup>2</sup>
- I have referred to the character's name in my response (the brain), and to the scenario.

4 [The brain is demonstrating resilience to life stressors<sup>1</sup>][by showing the ability to cope through exercise in response to feeling stressed by studying.<sup>2</sup>][The brain is also demonstrating emotional wellbeing,<sup>3</sup>][as it was able to return to a positive mood and not breakdown in the face of stress.<sup>4</sup>]

- I have identified one characteristic of mentally healthy person the brain is demonstrating.<sup>1</sup>
- I have explained how the brain demonstrates this characteristic.<sup>2</sup>
- I have identified another characteristic of mentally healthy person the brain is demonstrating.<sup>3</sup>
- I have explained how the brain demonstrates this characteristic.<sup>4</sup>
- I have referred to the character's name in my response (the brain), and to the scenario.

# GLOSSARY

**Acculturative stress** stress that results from the challenges presented by adapting to a new and foreign culture p. 103

**Accuracy** the precision with which a person completes a task p. 269

**Acquisition** when a response or behaviour is first learned p. 157

**Action potential** the neural message, in the form of an electrical impulse, sent down the axon of a neuron when certain conditions are met p. 86

**Action stage** during this stage the individual has made distinct behaviour change for less than six months p. 462

**Adequate diet** a diet in which a person is provided with the nutrients and energy required to function healthily and effectively p. 455

**Adequate sleep** having enough and the right type of uninterrupted REM and NREM sleep in order to function healthily and effectively p. 455

**Adrenaline (also known as epinephrine)** a neurohormone that increases physiological arousal and contributes to the consolidation of emotionally arousing memories p. 143

**Adversity** the experience of a difficult or distressing situation p. 454

**Affect** the expression of emotions p. 319

**Agonist** a type of drug that imitates neurotransmitters and works to initiate a neural response (excitatory or inhibitory) when it binds to the receptor sites of a neuron p. 439

**Aim** a statement outlining the purpose of the study p. 3

**Alarm reaction** the first stage of the General Adaptation Syndrome which involves the body's initial decline and then rise in arousal to a stressor p. 109

**Allocation** the process of assigning participants to conditions in the experiment for the research p. 19

**Alpha waves** medium sized brain waves with medium-high frequency and low-medium amplitude, indicating an alert but relaxed state p. 276

**Altered states of consciousness (ASC)** a state of consciousness that is characterised by different levels of awareness as compared to normal waking consciousness p. 254

**Alzheimer's disease** a neurodegenerative disease that involves the progressive loss of neurons in the brain and is characterised by memory decline p. 219

**Amplified emotional response** disproportionate emotional reactions in response to an event or stimuli p. 319

**Amplitude** a measurement indicating the intensity of an electric current in the brain, visually represented as the height of the wave peaks p. 275

**Amygdala** a brain structure involved in encoding and consolidating emotionally charged memories p. 205

**Amyloid plaques** fragments of the protein beta-amyloid that accumulate into insoluble plaques that inhibit communication between neurons p. 220

**Antagonist** a type of drug that works to prevent a neural response (excitatory or inhibitory) by blocking the receptor sites of a neuron p. 439

**Antecedent** a stimulus that causes a voluntary behaviour to occur p. 171

**Anterograde amnesia** a condition where new explicit memories cannot be effectively consolidated after trauma to the hippocampus p. 219

**Anxiety** a psychological and physiological response that involves feelings of worry and apprehension p. 424

**Appraisal** an assessment or evaluation p. 115

**Approach strategies** coping strategies which confront the source of the stressor p. 123

**Atkinson-Shiffrin multi-store model of memory** a model of memory which outlines the flow of information in memory formation and retrieval through three separate stores of memory; sensory, short-term and long-term, each of which have a different function, capacity and duration p. 195

**Attention** the first stage of observational learning. Learners must actively focus on the model in order to learn p. 180

**Automatic processes (also known as automatic tasks)** tasks that require low levels of mental processing p. 259

**Autonomic nervous system** the branch of the PNS responsible for connecting the CNS and the body's visceral (non-skeletal) organs, muscles and glands like the heart and liver p. 67

**Avoidance strategies** coping strategies that evade the stressor, seeking to reduce stress by indirectly dealing with it p. 123

**Axon** the long strand-like part of a neuron that transmits a message from one end of the neuron to the other p. 82

**Axon terminals** the ends of a neuron that release a message into the synapse p. 82

**Bar chart** a graph that depicts the relationship between two variables using rectangular bars p. 41

**Behaviour** a voluntary action in response to an antecedent p. 171

**Benign-positive** an initial appraisal of a stimulus as neutral or good, and not causing stress for the individual p. 115

**Benzodiazepines** a type of short-acting anti-anxiety medication that works to reduce anxiety p. 438

**Beta waves** fast, small brain waves with high frequency and low amplitude, indicating high levels of alertness p. 276

**Biological protective factors** factors that increase resilience by supporting healthy physiological functioning p. 455

**Biological risk factors** factors relating to the body that increase the risk of developing a mental health disorder p. 391

**Biological stress response** the activation of autonomic nervous system responses in the face of a stressor p. 431

**Blood alcohol concentration (BAC)** a measure of how much alcohol is in a person's blood p. 325

**Brain** the body's information centre, responsible for initiating and processing actions, thoughts and behaviour p. 66

**Brain surgery** the treatment of brain injury or disease with the use of medical instruments p. 218

**Brain trauma** damage to the brain that is caused by an external force p. 218

**Brain wave** a pattern of electrical current in the brain caused by neurons communicating, visually represented as a wave p. 274

**Breathing retraining** a method used to teach someone breathing control techniques that they can apply when facing their phobic stimulus p. 439

**Bright light therapy** a method used to adjust a person's circadian rhythm through exposure to a high-intensity light source p. 345

**Case study** an in-depth study of an individual or a group of individuals p. 10

**Catastrophes that disrupt whole communities** large-scale events or upheavals that affect an interconnected population p. 104

**Catastrophic thinking** a kind of cognitive bias in which a stimulus or event is predicted to be far worse than it is likely to be in reality p. 433

**Central nervous system** the brain and the spinal cord, responsible for transmitting neural messages to and receiving neural messages from the peripheral nervous system p. 66

**Cerebellum** a brain structure which encodes and stores implicit procedural memories p. 205

**Cerebral cortex** a brain structure where long-term memories are stored p. 204

**Challenge** a further appraisal of a stressor as potentially providing a good opportunity for growth or change for the individual p. 115

**Choosing an experimental research design** the process of choosing an appropriate experimental research design in order to reduce possible extraneous and confounding variables p. 24

**Circadian phase disorder** a sleep disorder which interferes with the normal regulation of the circadian rhythm of sleep, leading to a change in the sleep-wake cycle p. 331

**Circadian rhythm** changes to physiological function or activity that occur as part of a cycle that lasts around 24 hours p. 292

**Classical conditioning** a model of learning in which organisms learn through the involuntary association of two or more stimuli p. 154, 432

**Classically conditioned memory** a type of implicit memory which involves an involuntary response, such as fear, to a stimulus which has repeatedly been associated with an emotionally arousing stimulus p. 204

**Cognition** the mental processes an individual performs in order to understand and process information p. 320, 326

**Cognitive and behavioural strategies** the techniques of cognitive behavioural therapy used to promote an individual's psychological resilience p. 456

**Cognitive behavioural therapy (CBT)** a form of psychotherapy which encourages individuals to substitute unhealthy cognitions and behaviours with more healthy ones. p. 344, 441

**Cognitive bias** a predisposition to think about and process information in a certain way p. 433

**Cognitive tasks** a form of assessment that measures some aspect/s of a person's thought processes p. 269

**Concentration** the ability to focus on certain stimuli or tasks p. 326

**Conclusion** a statement regarding the results of an investigation as to whether the hypothesis was supported or not p. 47

**Conditioned emotional responses** an emotional response to a stimulus that doesn't naturally produce that response, learned through the process of classical conditioning p. 165

**Conditioned response (CR)** a response caused by the conditioned stimulus p. 155

**Conditioned stimulus (CS)** a stimulus that elicits a response due to its being paired with an unconditioned stimulus p. 155

**Confidentiality** the right of the participant for their personal details to remain private p. 31

**Confounding variables** variables other than the independent variable that have directly and systematically had an effect on the dependent variable p. 23

**Consciousness** the awareness of internal and external stimuli p. 253

**Consciousness continuum** a progression of states of consciousness ranging from least aware to most aware p. 253

**Consequence** an event following an action that makes it either more or less likely to occur again p. 171

**Contemplation stage** during this stage the individual is aware that their behaviour is problematic or unhealthy and is considering taking action within the next six months, but has no active commitment to do so p. 462

**Content limitations** a restraint placed on the thoughts that are occurring in a person's mind p. 259

**Context dependent cues** stimuli in the physical environment where a memory is recalled that act as a prompt to retrieve memories formed in that environment p. 224

**Context-specific effectiveness** when the coping strategy or mechanism used is appropriate for the demands of the stressor p. 121

**Control group** a group that is used as a basis for comparison; participants are not exposed to the experimental condition/s (the IV) p. 12

**Controlled processes (also known as controlled tasks)** tasks that require high levels of mental processing p. 259

**Convenience sampling** when a sample is selected using the quickest and easiest means possible, selecting people who are readily available from the population p. 18

**Coping** the process of dealing with stress p. 115, 121

**Coping flexibility** an individual's ability to adjust or change their coping strategies depending on the unique and changing demands of a stressor p. 122

**Coritsol** a hormone released into the body in times of stress p. 109

**Counterbalancing** a method used in repeated-measures experimental designs to reduce order effects p. 24

**Cross-sectional study** when data is collected from participants from different segments of the population (pre-existing cohorts) to represent a 'snapshot' in time p. 10

**Cued recall** retrieving information from memory with the use of a prompt p. 231

**Cumulative risk** the significantly increased risk of developing a mental health disorder that occurs when an individual has multiple risk factors present in their lives at the same time p. 412

**Daily pressures** small inconveniences and problems that are experienced as a part of day-to-day life p. 103

**Debriefing** occurs at the conclusion of an experiment and involves the researcher outlining the nature of the experiment to participants and includes ensuring that participants do not leave the experiment with lasting harm p. 31

**Deception** when the participant is unaware of the true nature of the experiment p. 31

**Delta waves** slow and large brain waves with low frequency and high amplitude, indicating very low levels of alertness p. 276

**Dendrites** the bushy spines of a neuron that receive a message p. 82

**Dependent variable (DV)** the variable that is being measured in an experiment for changes it experiences due to the independent variable p. 4

**Depressants** a class of drugs that reduce central nervous system and body activity, reducing levels of alertness compared to NWC p. 277

**Descriptive statistics** statistics that are used to organise and summarise data p. 40

**Disorganised attachment** the inconsistent behaviour displayed by an infant towards their main caregiver when they are not provided with consistent and adequate support p. 407

**Distress** a form of stress characterised by a negative psychological state p. 102

**Dopamine** a neurotransmitter primarily responsible for the coordination of voluntary movement and experiences of pleasure and pain p. 92

**Double-blind procedure** a procedure in which both the participants and the person conducting the experiment are unaware of which condition participants have been allocated to, in order to reduce experimenter bias p. 25

**Dyssomnias** sleep disorders characterised by consistent problems with falling asleep, staying asleep, or timing sleep p. 337

**Echoic memory** a type of sensory memory which temporarily stores auditory information p. 195

**Elaborative rehearsal** encoding new information by meaningfully linking it to information already stored in long-term memory to enhance its storage and later retrieval p. 225

**Electro-oculograph (EOG)** a device that detects, amplifies and records the electrical activity of the muscles surrounding the eyes p. 268

**Electroencephalograph (EEG)** a device that detects, amplifies and records the electrical activity of the brain p. 267

**Electromyograph (EMG)** a device that detects, amplifies and records the electrical activity of the body's muscles p. 268

**Emotion-focussed coping** the use of coping strategies that target the emotional components of a stressor, dealing with it indirectly rather than confronting its source p. 115

**Emotional awareness** the understanding and control people have over their feelings, as well as the ability to accurately perceive the emotions of others p. 261

**Emotional wellbeing** the ability for an individual to appropriately control and express their own emotions in an adaptive way, as well as understand the emotions of others p. 367

**Encoding** the process of converting raw information from stimuli into a useable form which can be stored in the brain p. 195

**Episodic memory** a type of explicit memory which involves a personal experience or event p. 203

**Ethics committee** a group of people who review research proposals, consider the potential risks, benefits and implications in order to either approve or disapprove them for research p. 30

**Eustress** a form of stress characterised by a positive psychological state p. 103

**Evolutionary theory of sleep (also known as Circadian theory of sleep)** a theory that proposes that sleep is adaptive and has evolved to meet specific survival needs p. 298

**Excitatory effect** when a neurotransmitter causes the postsynaptic neuron to become more likely to fire an action potential p. 86

**Exercise** the performance of physical activity to improve a person's health and wellbeing p. 122, 440

**Exhaustion** the final stage of the General Adaptation Syndrome which involves the body's defences and energy levels depleting, leading to a greatly reduced ability to cope with current and future stressors p. 109

**Experiment** a study conducted in a carefully controlled environment to measure the cause and effect relationship between variables p. 9

**Experimental group** the group within an experiment that are exposed to experimental conditions (the IV) p. 12

**Experimenter effects** occur when an experimenter's expectations about the study influence the results p. 25

**Explicit memory (also known as declarative memory)** a type of long-term memory that can be consciously retrieved p. 203

**External factors** factors which arise from the environment of an individual and contribute to their mental health p. 360

**External validity** the extent to which the results of an investigation can be applied to other settings, people and time p. 49

**Extinction** when a learned response or behaviour no longer occurs for an extended period of time p. 157, 173

**Extraneous variables** variables other than the independent variable that may produce unwanted results in an experiment p. 23

**Eye-witness testimony** an account given by an individual of an event they have directly observed p. 237

**Fight-flight-freeze response** an account given by an individual of an event they have directly observed p. 108

**Free recall** retrieving information from memory in any order without the use of a prompt p. 231

**Frequency** a measurement indicating how many brain waves there are per second, visually represented as how close the waves appear together p. 275

**Functioning** the way in which an individual approaches everyday demands and operates within their environment p. 366

**GABA** the primary inhibitory neurotransmitter p. 86

**GABA dysfunction** an insufficient neural transmission or reception of GABA in the body p. 431

**General Adaptation Syndrome** a model that examines the biological stages of stress involved in responding to a persistent stressor p. 109

**Generalisability** the extent to which the results of an investigation can be applied to the wider research population p. 48

**Genetic vulnerability** a person's genetic predisposition that increases their susceptibility to developing a mental health disorder p. 392

**Glutamate** the primary excitatory neurotransmitter p. 87, 143

**Harm/loss** a further appraisal of a stressor as having caused some damage for the individual p. 115

**High levels of functioning** the ability for an individual to approach day-to-day tasks independently and effectively meet everyday demands p. 366

**Hippocampus** a brain structure which encodes explicit memories p. 205

**Hypothesis** a testable prediction about the outcome of an experiment; it is written in the form of a statement and includes the variables that will be tested p. 3

**Iconic memory** a type of sensory memory which temporarily stores visual information p. 195

**Impaired reasoning and memory** cognitive biases that limit a person's ability to think about an event in a rational, constructive way and to remember it accurately p. 400

**Implicit memory (also known as non-declarative memory)** a type of long-term memory that is retrieved unconsciously p. 203

**Independent groups design (also known as between groups design)** an experimental design in which participants are split into two or more groups; typically a control group and an experimental group/s p. 12

**Independent variable (IV)** the variable that the experimenter manipulates in order to observe the effect it causes on the dependent variable p. 4

**Induced altered states of consciousness** a type of altered state of consciousness that occurs due to a purposeful action or aid p. 254

**Inferential statistics** statistics that provide information on the statistical significance of the results and suggest how they might apply to a wider population p. 40

**Informed consent** ensuring participants have a thorough understanding of the procedures involved in the research they are partaking in, including potential harm or risks, and still willingly agree to participate p. 31, 373

**Inhibitory effect** when a neurotransmitter causes the postsynaptic neuron to become less likely to fire an action potential p. 86

**Internal factors** factors which arise from within the individual and contribute to their mental health p. 360

**Internal validity** the extent to which the changes in the dependent variable are caused by the independent variable, and not other variables p. 49

**Interneurons** neurons that transfer impulses between sensory and motor neurons as part of the reflex arc p. 77

**Interview** a type of questionnaire that is usually conducted verbally, involving the researcher asking participants questions and recording their responses p. 9

**Irrelevant** an initial appraisal of a stimulus as a non-issue for the individual p. 115

**Jet lag** the mismatch between an individual's internal circadian rhythm and the time of their environment, which occurs after rapidly travelling across time zones p. 333

**Leading questions** questions that contain information that imply or prompt a certain response p. 237

**Levels of awareness (also known as awareness)** the degree to which an individual is conscious of stimuli p. 258

**Life events** stressors that change a person's circumstances and force them to change something about their lifestyle p. 103

**Line graph** a graph that depicts the relationship between two variables using a line that connects each data point p. 41

**Lock-and-key process** an analogy used to describe the role and functions of neurotransmitters and receptor sites in the process of neural transmission p. 86

**Long-term depression** the long-lasting and experience-dependent weakening of postsynaptic responses p. 137

**Long-term memory** store of memory in which a potentially unlimited amount of information is stored for a relatively permanent amount of time p. 197

**Long-term potentiation** the long-lasting and experience-dependent strengthening of synaptic connections p. 137, 431

**Longitudinal study** a type of investigation in which data is gathered from participants over an extended period of time, and the participants are followed up after specific time intervals p. 10

**Loss of a significant relationship** losing a relationship that involved considerable emotional attachment p. 407

**Maintenance rehearsal** repeating new information over and over again to functionally enhance the duration of short-term memory and transfer information to long-term memory p. 225

**Maintenance stage** during this stage the individual has made distinct behaviour change for more than six months and is working to prevent relapse p. 462

**Major stress** stressors that present significant and negative threats to a person's psychological and/or physiological wellbeing p. 104

**Matched participants design** an experimental design in which participants are paired based upon relevant characteristics, whereupon one member of the pair is tested in one condition, and the other member is tested in the other p. 12

**Mean** a measure of central tendency that represents the average of a data set p. 40

**Memory** the process of encoding, storing and retrieving learned information p. 195

**Memory bias** a form of cognitive bias caused by inaccuracy or exaggeration in the recall of an event p. 433

**Mental health** the current state of a person's psychological wellbeing and functioning p. 358

**Mental health continuum** a tool used to track progression of mental health which constantly fluctuates over time, progressing from mentally healthy, to mental health problems, to mental health disorders p. 358

**Mental health disorder** a psychological state characterised by the presence of a severe disturbance and sense of distress which significantly impacts an individual's ability to function independently p. 359

**Mental health problem** a psychological state that is temporarily hindered by the presence of a disturbance to normal functioning, which has negative, but not severe impacts on everyday functioning p. 359

**Mentally healthy** a psychological state that allows an individual to function independently and effectively within their environment, display resilience and have high social and emotional wellbeing p. 359

**Model** the individual who is performing the behaviour that is being watched/observed p. 179

**Mood** the emotional state a person is in at a given time p. 326

**Motivation** the fourth stage of observational learning. The learner must want to reproduce the behaviour in order for learning to occur p. 181

**Motor neurons** neurons that transmit information (motor neural messages) about voluntary movement from the CNS to the PNS p. 67

**Myelin** the fatty protein substance that surrounds and insulates the axon of a neuron p. 82

**Naturally occurring altered states of consciousness** a type of altered state of consciousness that occurs without intervention p. 254

**Negative reinforcement** when a stimulus is removed in order to encourage a behaviour to occur again p. 172

**Neural plasticity** the ability of the brain to physically change in response to experience p. 136

**Neural reception** the process in which a neuron accepts, or receives, a message p. 81

**Neural transmission** the process in which a neuron sends a message p. 81

**Neurodegenerative disease** a disease characterised by the progressive loss of neurons in the brain p. 219

**Neurofibrillary tangles** an accumulation of the protein tau that forms insoluble tangles within neurons, which then inhibit the transport of essential substances throughout the neuron, eventually killing the neuron entirely p. 220

**Neurohormone** a chemical substance sent from neurons into the bloodstream p. 142

**Neuron** a nerve cell responsible for transmitting, receiving and processing information p. 81

**Neurotransmitter** a chemical substance that carries information between neurons p. 85, 142

**Neutral stimulus (NS)** a stimulus that does not initially elicit a response p. 155

**No-harm principle** the role of the researcher to ensure that all participants within an investigation do not experience mental or physical harm p. 30

**Non-standardised testing procedures** when instructions and procedures in an experiment are not consistent for all participants, therefore affecting the results obtained p. 26

**Normal waking consciousness (NWC)** the state of being awake and aware of internal and external stimuli p. 253

**NREM (Non rapid eye movement) sleep** a type of sleep that is subdivided into four different stages, where the sleeper does not experience any rapid eye movement p. 294

**Objective data** data that can be observed or measured by multiple people and obtain the same results p. 36

**Observational learning (also known as social learning, vicarious conditioning, or modelling)** a type of learning that occurs through watching the actions of a model and the consequences that their actions receive p. 179

**Observational study** a type of study in which data is collected through careful monitoring of participants p. 10

**Operant conditioning** learning through the association of a behaviour and the consequence it receives p. 170, 433

**Operationalisation** the process of defining variables in terms of how they will be either manipulated or measured in the experiment p. 5

**Order effects (also known as practice effects)** a source of error in repeated-measures designs due to the order the participants participate in the experimental and control conditions p. 24

**Outlier** a value that differs from the other values in a data set p. 41

**Parasomnias** a type of sleep disorder which involves engaging in abnormal activities or tasks while sleeping p. 338

**Parasympathetic nervous system** a branch of the ANS responsible for returning and maintaining the body's visceral organs, muscles and glands at optimal and balanced functioning p. 69

**Parkinson's disease** a progressive disease of the nervous system characterised by both motor and non-motor symptoms p. 92

**Partial sleep deprivation** when an individual sleeps for some duration within a 24 hour period, but the sleep duration is too short, or the quality of sleep is poor p. 319

**Participant-related variables (also known as individual participant differences)** individual participant differences that can affect the results p. 24

**Perceptual and cognitive distortions** atypical (abnormal) variation in the way an individual interprets and processes stimuli p. 260

**Peripheral nervous system** all nerves outside the CNS, responsible for transmitting information to and from the CNS p. 67

**Perpetuating risk factor** a risk factor that inhibits a person's ability to recover from a mental health disorder p. 387, 433

**Placebo** a procedure or substance with no active treatment p. 25, 374

**Placebo effect** changes to an individual's mental or physical state as a result of a false belief in the effects of a placebo substance or procedure p. 35, 374

**Poor response to medication** when medication is not effective due to genetic factors p. 392

**Poor sleep** inadequate sleep quality or quantity p. 393

**Population (also known as research population)** the group of people of interest to an experiment p. 3, 17

**Positive punishment** when a stimulus is added in order to discourage a behaviour from occurring again p. 172

**Positive reinforcement** when a stimulus is added in order to encourage a behaviour to occur again p. 172

**Postsynaptic neuron** the neuron that receives a message from the synapse p. 82, 85

**Pre-contemplation stage** during this stage the individual is unaware that their behaviour is problematic or unhealthy and has no intention to change their behaviour in the next six months p. 462

**Precipitating risk factor** a risk factor that increases the susceptibility to and contributes to the occurrence of developing a mental health disorder p. 387, 432

**Predisposing risk factor** a risk factor that increases an individual's susceptibility to developing a mental health disorder p. 387

**Preparation stage** during this stage the individual has begun to take an active commitment towards changing their behaviour within the next 30 days p. 462

**Presynaptic neuron** the neuron that releases a message into the synapse p. 82, 85

**Primacy effect** enhanced recall of information presented at the beginning of a list due to this information being rehearsed and transferred into long term memory p. 226

**Primary appraisal** the initial process of evaluating the nature of an incoming stressor, specifically the kind of stress it will cause p. 115

**Primary data collection** a method of data collection involving data being collected directly by the experimenter p. 35

**Problem-focussed coping** the use of coping strategies that directly target the source of the stressor, aiming to reduce it in a practical way p. 115

**Procedural memory** a type of implicit memory which involves knowing how to carry out tasks, facilitated by motor skills p. 203

**Protective factor** a factor that prevents the occurrence or re-occurrence of mental health disorders p. 388, 455

**Psychoeducation** teaching individuals to better understand mental disorders and how to deal with and treat them p. 443

**Psychological construct** an agreed upon description and understanding of psychological phenomena which cannot be overtly measured or observed p. 252

**Psychological protective factors** factors that promote resilience by supporting a person's mental and cognitive functioning p. 456

**Psychological risk factors** factors relating to cognitive and affective functioning that increase the risk of developing a mental health disorder p. 399

**Punishment (also known as positive punishment)** a type of consequence that makes the behaviour less likely to occur again p. 172

**Qualitative data** data that describes the characteristics of something; data of concepts that can be measured non-numerically p. 36

**Quantitative data** data concerning numerical amounts; expressed numerically p. 36

**Questionnaire (also known as surveys)** a list of questions that participants can respond to in a variety of formats p. 9

**Random allocation** when every member of the sample has an equal chance of being assigned to each condition in an experiment p. 19

**Random sampling** when every member of the population has an equal chance of being selected for the sample p. 18

**Rating scale** a form of questionnaire collecting numerical data from participants' responses p. 10

**Recall** a method of retrieving information from memory p. 231

**Recency effect** enhanced recall of information presented at the end of a list due to this information remaining in short-term memory p. 226

**Receptor sites** protein molecules located on the dendrites of a postsynaptic neuron, responsible for receiving neurotransmitters p. 85

**Recognition** identifying information from memory amongst a list of alternatives p. 232

**Reconstruction** the process of reproducing and piecing together information from memory in an attempt to form a coherent representation of a past event or stimuli p. 233

**Reinforcement** a type of consequence that makes the behaviour more likely to occur again p. 172, 181

**Relapse** a setback involving the return to a problem behaviour p. 462

**Relearning** learning information another time after having already learned this information in the past p. 232

**Reliability** how likely it is that the same results would be obtained by another researcher p. 49

**REM (Rapid eye movement) sleep** a type of sleep where the sleeper experiences rapid eye movement beneath closed eyelids p. 293

**Repeated measures design (also known as within groups design)** an experimental design in which the same participants are in every condition of the experiment p. 12

**Reproduction** the third stage of observational learning. The learner must have the physical and mental capabilities to reproduce the observed behaviour p. 180

**Resilience** the ability to adapt to the environment and cope when stressors arise in order to return to a functioning state p. 368, 454

**Resistance** the second stage of the General Adaptation Syndrome which involves the body sustaining high levels of arousal to a persistent stressor p. 109

**Response cost** Negative punishment & when a stimulus is removed in order to discourage a behaviour occurring again p. 172

**Restoration theory of sleep** a theory that proposes that sleep replenishes psychological and physiological function p. 299

**Retention** the second stage of observational learning. The learner must create a mental representation and remember (retain) the behaviour the model has demonstrated p. 180

**Retrieval** accessing information which has previously been stored in the brain p. 195

**Retrieval cue** stimuli that act as a prompt to access information from long-term memory p. 224

**Rumination** repeatedly focusing on negative psychological thoughts and experiences p. 400

**Sample** a subset of the population, commonly referred to as the research participants p. 17

**Sampling** the process through which the participants for a study are selected from the population of interest p. 17

**Sampling procedures** the method of choosing an appropriate sampling procedure to reduce possible extraneous and confounding variables p. 24

**Secondary appraisal** the process of evaluating the resources available and required in order to cope with a stressor p. 115

**Self-control** A person's ability to restrain or hold composure over their thoughts, feelings and actions p. 261

**Self-efficacy** a person's confidence in their ability to complete tasks and meet goals p. 401

**Self-report** a participant's subjective account of an experience; this type of investigation can be conducted through the use of a questionnaire, interview or rating scale p. 9

**Semantic memory** a type of explicit memory which consists of general knowledge or facts p. 203

**Sensory memory** store of memory which very briefly stores raw information detected by the senses such as sight, hearing and touch p. 195

**Sensory neurons** neurons that transmit information (sensory neural messages) about the body's sensations from the PNS to the CNS p. 67

**Sensory receptor** a nerve ending that detects sensations in the environment and body p. 70

**Sensory stimuli** anything in the environment or body that is detected by the body's senses p. 70

**Serial position effect** a tendency for free recall to be superior for items at the end and beginning of a list compared to items in the middle p. 226

**Serial recall** retrieving information from memory in the order in which it was first encoded p. 231

**Shift work** an occupation which involves working at unusual hours, such as working overnight p. 332

**Short-term memory (also known as working memory)** store of memory which holds information that is consciously being attended to and actively manipulated p. 196

**Single-blind procedure** a procedure in which participants are unaware of which condition they have been allocated to, in order to reduce participant expectations p. 25

**Skeletal muscles** muscles connected to the skeleton that are involved in conscious, voluntary movement p. 68

**Sleep** a regular and naturally-occurring altered state of consciousness that involves disengagement with internal and external stimuli p. 292

**Sleep cycle** a proportion of a sleep episode in which the sleeper progresses through stages of REM and NREM sleep, lasting on average 90 minutes for humans p. 293

**Sleep deprivation** inadequate duration or poor quality of sleep p. 318

**Sleep diaries** a record from an individual containing qualitative descriptions of the amount and nature of their sleep over a certain period of time p. 269

**Sleep disorder** a consistent presence of a particular sleep disturbance which has profound impacts on an individual's sleep, leading to persistent effects on day to day functioning p. 337

**Sleep episode** the full duration of time spent asleep p. 293

**Sleep-onset insomnia (also known as insomnia)** a type of dyssomnia characterised by consistent difficulty initiating sleep p. 338

**Sleep-wake cycle** a daily cycle that is made up of time spent sleeping and time being awake and alert p. 292

**Sleep-wake cycle shift in adolescence** a type of circadian phase disorder where adolescents experience delayed sleep-onset and hence delayed wake p. 332

**Sleep-walking (also known as somnambulism)** a type of parasomnia which involves standing up and undertaking actions or tasks while asleep p. 338

**Social protective factors** factors that increase resilience by providing social support p. 456

**Social risk factors** factors relating to an individual's interaction with their external environment and other people that increase the risk of developing a mental health disorder p. 406

**Social support** the provision of assistance and care from family, friends, or the community p. 456

**Social wellbeing** the ability for an individual to form bonds with others and maintain positive relationships p. 367

**Somatic nervous system** the branch of the PNS responsible for sending motor information from the CNS to the body's skeletal muscle, and bringing sensory information from the body to the CNS in order to formulate voluntary responses p. 67

**Specific environmental triggers** stimuli or experiences in a person's environment that prompt an extreme stress response p. 433

**Specific phobia** a type of anxiety disorder that is categorised by excessive and disproportionate fear when encountering a particular stimulus p. 425

**Speed** the rate at which a person responds to a stimulus in a task p. 269

**Spinal cord** a long cable of nerve tissue (neurons) connecting the brain to the peripheral nervous system, responsible for sending motor information from the brain, and sensory information from the body p. 66

**Spinal reflex** an unconscious response to sensory stimuli that is initiated at the spinal cord, not involving the brain p. 76

**Spinal sensory-motor circuit (reflex arc)** the path that neural messages take as part of the spinal reflex response, involving sensory messages to the spinal cord which are immediately relayed from the spinal cord as motor messages p. 77

**Spontaneous recovery** the return of a previously extinguished learned response or behaviour p. 157, 173

**Standard deviation** a measure of central tendency that represents the spread of data around the mean p. 40

**Standardised instructions and procedures** the consistent use of instructions and procedures for all participants p. 26

**State dependent cues** aspects of an individual's psychological and physiological experience at the time a memory was formed that later act as a prompt to retrieve that memory p. 224

**Stigma** a mark of shame or disgrace experienced by an individual for a characteristic that distinguishes them from others p. 408

**Stigma around seeking treatment** the sense of shame a person might feel about getting professional help p. 434

**Stimulants** a class of drugs that increase central nervous system and body activity, increasing levels of alertness compared to NWC p. 276

**Stimulus discrimination** the process in which an organism only demonstrates a certain response or behaviour to the stimulus it was first acquired in response to p. 158, 173

**Stimulus generalisation** a process in which the learner demonstrates a response or behaviour to stimuli that are similar to the conditioned stimulus or antecedent p. 158, 173

**Storage** retaining converted information so it can be accessed and used in the future p. 195

**Stratified sampling** when the population is divided into groups based upon relevant characteristics, and participants are selected from each group in proportion to how they appear in the population p. 18

**Stress** a psychological and biological experience that occurs when an individual encounters something of significance that demands their attention and/or efforts to cope p. 102, 401, 424

**Stressful** an initial appraisal of a stimulus as a source of worry or emotional significance for the individual p. 115

**Stressor** a stimulus (internal or external) that prompts the stress response p. 102

**Subjective data** data that relies on personal opinion or self-report p. 36

**Substance use** use of either legal or illegal drugs p. 393

**Sympathetic nervous system** a branch of the ANS responsible for activating the body's visceral organs, muscles, and glands for increased activity or when under threat p. 69

**Synapse** the area in which neuronal transmission occurs between two neurons, including the sending end of the presynaptic neuron, the gap between two neurons, and receiving end of the postsynaptic neuron p. 82, 85

**Synaptic gap** the space in between two neurons into which a message is sent p. 82, 85

**Synaptic buttons (also known as synaptic knobs, terminal buttons)** the end of the presynaptic neuron's axon terminals that release neurotransmitters p. 85

**Synaptic plasticity** a type of neural plasticity that refers to the ability of synaptic connections to form, weaken or strengthen in response to activity and experience p. 137

**Systematic desensitisation** a therapy technique used to overcome phobia involving a patient being exposed incrementally to increasingly anxiety-inducing stimuli, combined with the use of relaxation techniques. p. 441

**Table** a method of presenting data using columns and rows p. 41

**The biopsychosocial model** a framework for approaching mental health that suggests that biological, psychological and social factors all interact and contribute to the development of mental illness p. 391

**The Four P model** a framework to understand the impact of different factors on the development and progression of a mental health disorder p. 386

**Theta waves** medium sized brain waves with low-medium frequency and medium-high amplitude, indicating low levels of alertness p. 276

**Threat** a further appraisal of a stressor as potentially causing damage for the individual in future p. 115

**Time orientation** the perception of how much or how little time has elapsed, and the ability to situate things in the past, present or future p. 261

**Total sleep deprivation (also known as full sleep deprivation)** when an individual has no sleep within a 24 hour period p. 318

**Transtheoretical model of behaviour change** a model which assesses an individual's readiness to change by looking at the different stages an individual may progress through as they move towards healthier behaviour p. 461

**Ultradian rhythm** changes to physiological function or activity that arise as part of a cycle which occurs within 24 hours p. 293

**Unconditioned response (UCR)** a natural (unlearned) behavior to a given stimulus p. 155

**Unconditioned stimulus (UCS)** a stimulus that elicits a reflexive response p. 155

**Validity** the extent to which the investigation measures what it intends to measure p. 49

**Variable** a factor or element of an experiment that may be manipulated or measured p. 3

**Video monitoring** a type of data collection involving video and sound recordings of an individual in their sleeping period p. 270

**Visceral muscles/organs/glands** the body's non-skeletal muscles, organs and glands that are largely self-regulating and don't require conscious control. These are controlled by the ANS p. 68

**Voluntary participation** the right of the participant to freely choose to willingly participate p. 31

**Voluntary response** an action coordinated by the body that is performed with conscious control and intention p. 70

**Wellbeing** a state in which an individual is mentally, physically, and socially healthy and secure p. 367

**Withdrawal rights** the right of the participant to leave the study at any point, without fear of consequence p. 31

# Acknowledgements

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