

2020
Higher School Certificate
Trial Examination

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- NESA approved calculators may be used
- Write your student number and/or name at the top of every page

Total marks – 100

Section I – Pages 2–12

20 marks

- Attempt Questions 1–20
- Allow about 35 minutes for this section

Section II – Pages 13–32

80 marks

- Attempt Questions 21–36
- Allow about 2 hours and 25 minutes for this section

This paper MUST NOT be removed from the examination room

STUDENT NUMBER/NAME:

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Section I

20 marks

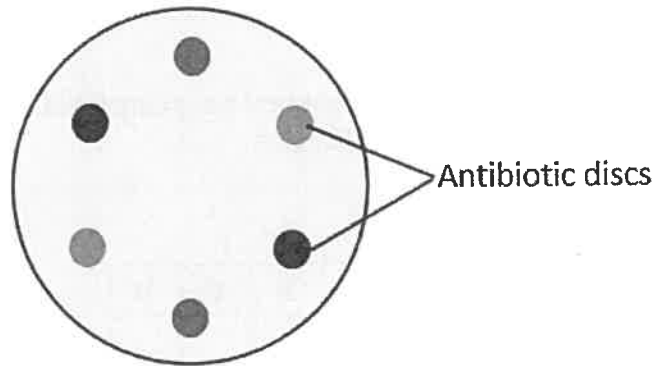
Attempt Questions 1–20

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Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

	A	B	C	D
1				
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- 1 A bacterial culture was spread across an agar plate. Six absorbent paper discs soaked in different antibiotics were placed on the agar.



The agar plate was incubated overnight and the bacterial growth was examined the next day.

Which of the following would make a suitable control for this experiment?

- A. A separate agar plate with no bacteria
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 - C. A separate agar plate with un-soaked antibiotic discs
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- 2 Which is most correct of homologous chromosomes?
- A. Homologous chromosomes cannot cross over.
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 - C. Homologous chromosomes carry the same alleles.
 - D. Homologous chromosomes are from the same parent.
- 3 Mutations in cell replication are a source of genetic variation in living organisms.

These types of mutations only occur in which of the following?

- A. Asexual reproduction only
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- C. Both asexual and sexual reproduction
- D. Meiosis and not mitosis

- 4 A newborn baby's hearing is screened in hospital shortly after birth. Her left ear does not show clear responses and she is referred to a paediatric audiologist. After further testing, the baby is found to have a congenital defect in her left inner ear resulting in moderate hearing loss.



Source: <https://www.pregnancybirthbaby.org.au/newborn-hearing-test>

Which is most likely to be an effective treatment for congenital hearing defects?

- A. Cochlear implant
 - B. Hearing aid
 - C. Bone conduction implant
 - D. Laser surgery
- 5 Excessive sun exposure can cause damage to the DNA in skin cells. In particular, structures called 'cytosine dimers' can form where there are two adjacent cytosine (C) bases. Enzymes involved in DNA replication often erroneously pair Adenine (A) with the Cytosine (C) in the dimer, causing a mutation.

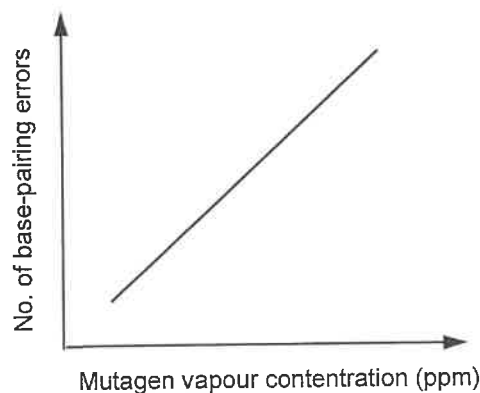
What is the name given to this kind of mutation?

- A. Deletion mutation
- B. Frameshift mutation
- C. Inversion mutation
- D. Substitution mutation

- 6 A team of scientists have developed a new drug, but it requires testing on mice in a lab. They are discussing whether the benefits of this process outweigh the harmful consequences for the mice.

Which of the following does this discussion address?

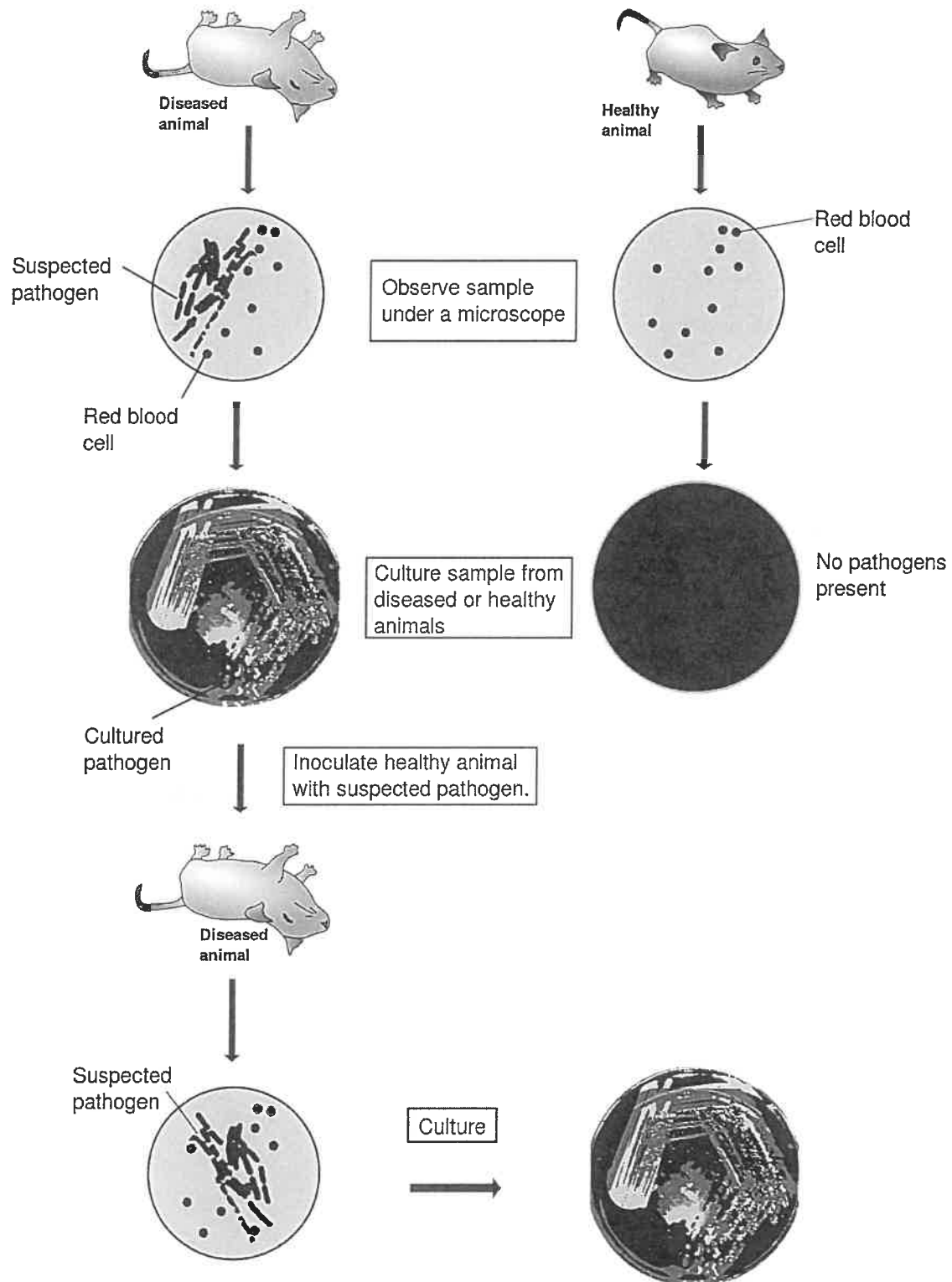
- A. Ethical implications
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- 7 A chemical mutagen is known to cause significant damage to DNA structure through the disruption of the normal base-pairing process. The graph below shows the relationship between exposure to mutagen vapours and the frequency of base-pairing errors.



Which of the following correctly describes the trend observed?

- A. An increased number of base-pairing errors leads increased vapour production.
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 - C. An increased in mutagen vapour concentration leads to decreased base-pairing errors.
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- 8 If a media is inoculated with a single bacterium, how many bacteria will be present after one hour, if reproduction occurs every 20 minutes?
- A. 3
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 - C. 8
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Refer to the following diagram to answer Questions 9 and 10.

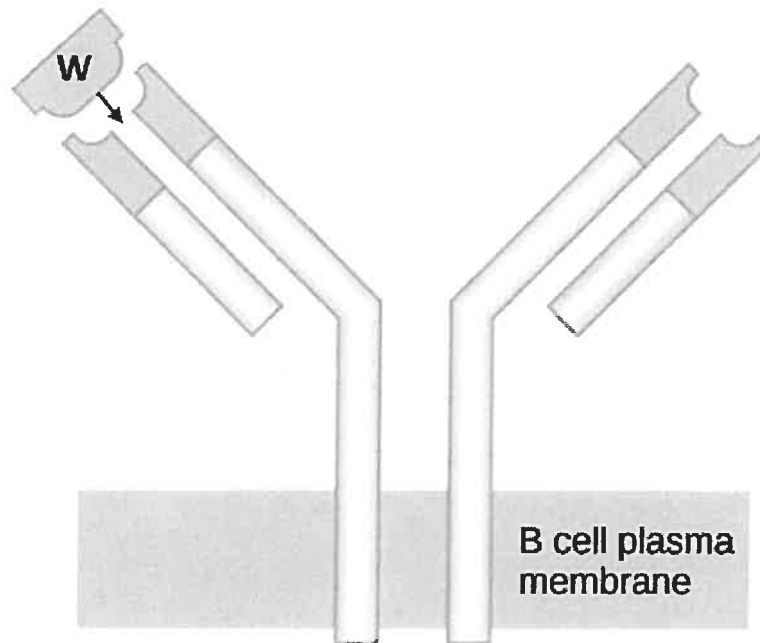


- 9 This diagram represents the work of a scientist that contributed to the current understanding of infectious diseases.

What is the name of that scientist?

- A. Louis Pasteur
 - B. Robert Koch
 - C. Frank Macfarlane Burnet
 - D. Howard Florey
- 10 What conclusion was made from this information?
- A. Disease is caused by macroorganisms.
 - B. Inoculation with microorganisms creates immunity.
 - C. Disease is transmitted by blood.
 - D. The pathogen isolated is the cause of the disease.
- 11 Which of the following is an example of a transgenic biotechnology?
- A. Scientists have introduced a gene from the petunia plant into soybean plants to make them resistant to a common chemical herbicide.
 - B. Crossing a male cow of the Friesian variety, which produces large quantities of milk, with a Jersey cow, which produces creamy milk, has created some offspring who produce large amounts of creamy milk.
 - C. Producing seedless watermelons by crossing diploid plants (two sets of chromosomes) with tetraploid plants (four sets of chromosomes) of the same species.
 - D. The first cloned pet, a cat, named 'carbon copy', was born after scientists successfully fused a somatic cell from the pet cat with an enucleated egg cell from a different surrogate cat.

- 12 The image below could be used to explain how part of the immune system works.



Source: Image adapted from <https://www.labroots.com/trending/immunology/1783/new-protein-found-in-b-lymphocytes>

What is the name given to W?

- A. Antigen
 - B. Antibody
 - C. Pathogen
 - D. Bacteria
- 13 What would be the mRNA sequence from the following DNA strand?

CATTAG

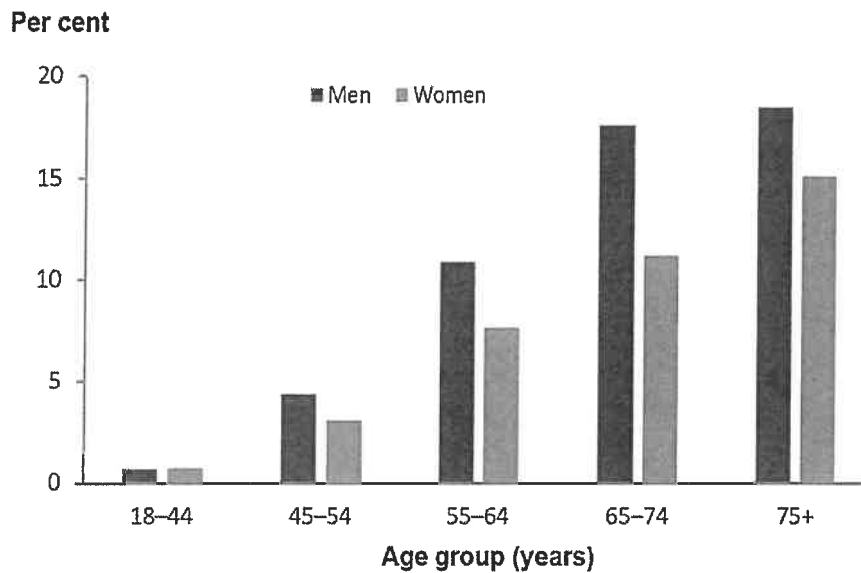
- A. GTUUTC
- B. GUA AUC
- C. UTAATC
- D. GTAATU

- 14 Which is a major feature of the inflammatory response?
- A. The production of antibodies to identify foreign material
 - B. The identification of antigenic agents
 - C. The production of histamines
 - D. The increased production of suppressor cells
- 15 The 'crossing over' of chromosomes is one process that introduces genetic variation into a species.
- Which of the following outlines when 'crossing over' occurs?
- A. The early stages of meiosis
 - B. The late stages of meiosis
 - C. The early stages of mitosis
 - D. The late stages of mitosis
- 16 What is the name given to the structural unit of a protein?
- A. Base
 - B. Peptide
 - C. Nucleotide
 - D. Amino acid

Refer to the following information to answer Questions 17 and 18.

An estimated 1.3 million (out of 24.6 million) Australians had Type 2 Diabetes in 2017–18. It was more common for men (7%) than women (5%) and increased rapidly up to age 75. There were 9500 deaths attributed to Type 2 Diabetes in 2017.

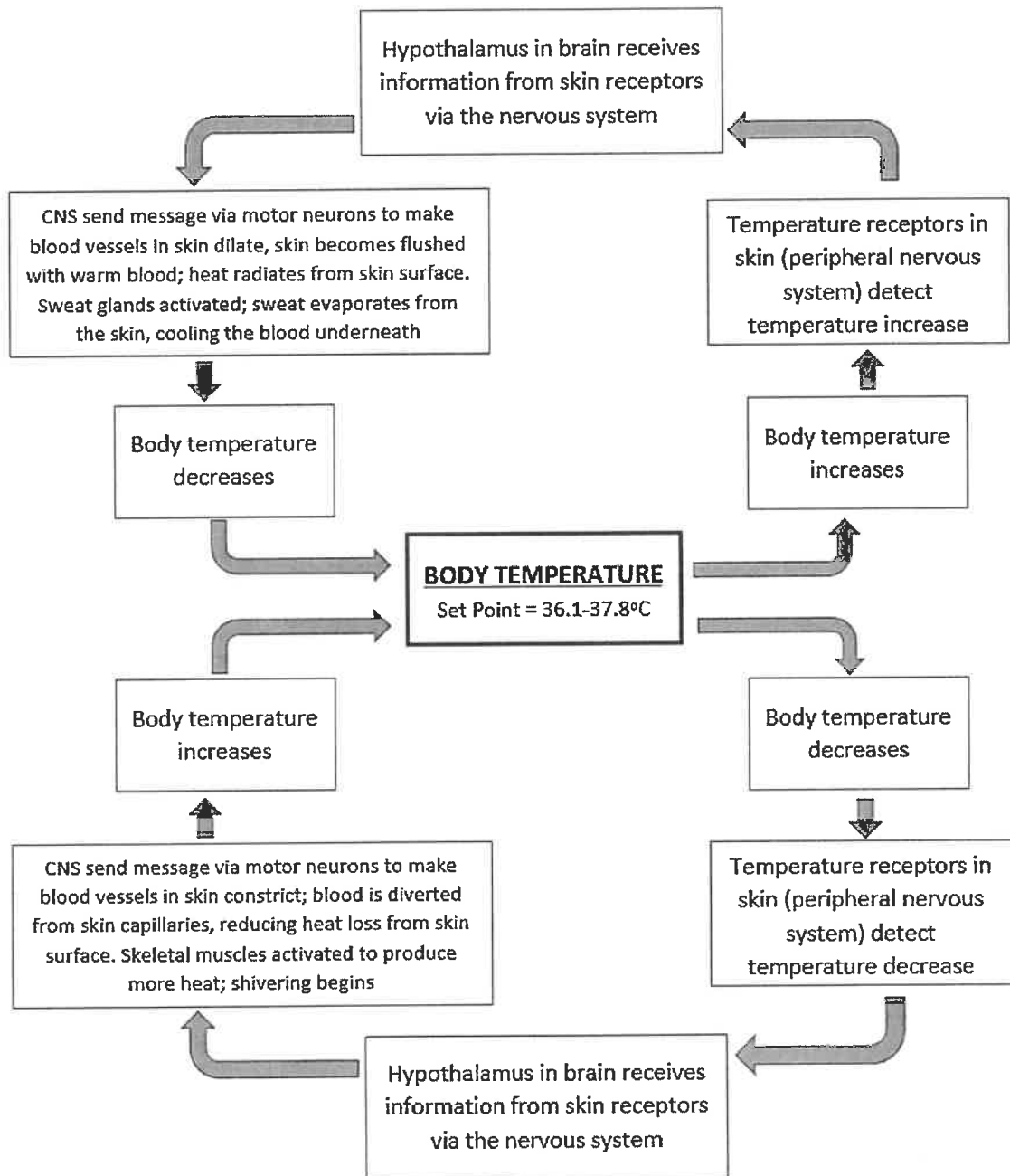
Figure 1: Prevalence of self-reported type 2 diabetes, among persons aged 18 and over, by age and sex, 2017–18



Sources: Australian Institute of Health & Welfare, Australian Bureau of Statistics & Diabetes NSW

- 17 According to the data, which group is most likely to have Type 2 Diabetes?
- Females 18-44 years
 - Males 65-74 years
 - Males over 75 years
 - Females over 75 years
- 18 What was the prevalence of Type 2 Diabetes in Australia in 2017?
- 12 per 100 000 persons
 - 730.8 per 100 000 persons
 - 38.6 per 100 000 persons
 - 5284.6 per 100 000 persons

19 Refer to the following diagram.



What does this diagram represent?

- A. How the body relies on environmental conditions to regulate heat
- B. How the body mitigates the effect of a changing external environment
- C. How an ectotherm regulates its internal temperature
- D. How an endotherm adapts behaviour to regulate its internal environment

20 Which statement explains how cloning might eventually assist humans to live longer?

- A. If an ageing human is replaced with a clone, they could essentially live forever.
- B. Cloning human organs could allow them to be used to replace unhealthy ones.
- C. Clones usually live longer than the organisms from which they take their DNA.
- D. Food obtained from cloned plants and animals would be healthier than ordinary food.

Section II**80 marks****Attempt Questions 21–36****Allow about 2 hours and 25 minutes for this section**

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Show all relevant working in questions involving calculations. Extra writing space is provided at the back of this booklet.

If you use this space, clearly indicate which question you are answering.

Question 21 (4 marks)**Marks**

If there are two alleles of a gene, for example, Purple flower (P) and White flower (W), there would be three possible genotypes from these two alleles: PP, PW and WW. Some characteristics have multiple alleles of the one gene which then increases the number of possible genotypes, as shown in the table below.

<i>Number of alleles</i>	<i>Number of genotypes</i>
2	3
3	6
4	
5	15

- (a) Predict the number of possible genotypes with FOUR alleles. 1

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- (b) Explain your prediction in (a), using a worked example. 3

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Question 22 (4 marks)**Marks**

The Tasmanian Devil is a native marsupial found mainly in coastal forests of Tasmania. It is at risk of extinction from the contagious devil facial tumour disease (DFTD) cancer. Devil numbers have been reduced to less than 10 percent of the original population in some parts of Tasmania. With no vaccine or cure for DFTD currently available, a breeding program is the key to the devil's survival.

**Tasmanian Devil (no facial disease)****Tasmanian Devil (facial tumour)**

The facial cancer spreads because nearly all devils have very similar MHCs (genes that allow the immune system to recognise foreign molecules). When the devils fight, cancer cells get transferred from an infected devil to an uninfected devil. Because of their similar MHCs, the immune system doesn't recognise the invader and the cancer easily spreads.

Some scientists propose introducing MHC diversity into the devil population through genetic engineering, via a virus vector. In this way, scientists could create Tasmanian devils with different MHC complexes and introduce them back into the population.

Question 22 continues on the next page

Question 22 (continued)

Marks

- (a) Suggest an explanation for most devils having very similar MHC immunity. **1**

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- (b) Describe a technique that scientists could use to genetically engineer cells from a Tasmanian Devil so that genes responsible for producing MHC immunity could be modified. **3**

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End of Question 22

Question 23 (3 marks)

Marks

Describe ONE cause and the effects of a named genetic disease.

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Question 24 (4 marks)

(a) What is meant by the term *bush medicine*?

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(b) Explain the recent increased interest in bush medicine. Use an example to support your answer.

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Question 25 (5 marks)**Marks**

Plant species have evolved to maintain suitable water conservation strategies. Crassulacean acid metabolism (CAM) plants, such as the pineapple *Ananas comosus* (see picture below), absorb carbon dioxide at night and convert it into malic acid for storage. During the day, the malic acid is converted back into carbon dioxide and used for photosynthesis.



Source: <https://www.britannica.com/plant/pineapple>

- (a) Using your understanding of plant structure and function, explain how the CAM process, outlined above, would help *Ananas comosus* maintain water balance.

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Question 25 continues on the next page

Question 25 (continued)

Marks

- (b) Identify and describe a DIFFERENT feature or mechanism to (a) that helps a named plant to maintain water balance. **2**

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End of Question 25

Question 26 (4 marks)

Marks

During the course, you investigated how electromagnetic radiation, chemicals, and naturally occurring mutagens affect the DNA of organisms.

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In the space below, construct a table to distinguish between the action of chemical mutagens and naturally occurring mutagens, giving an example of each.

Question 27 (3 marks)

Outline THREE modes of disease transmission and provide examples for each.

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Question 28 (6 marks)

Marks

Genetic technologies such as DNA sequencing and DNA profiling can be used to determine inheritance patterns in human populations.

- (a) Compare the results obtained from DNA sequencing and DNA profiling. 2

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- (b) Discuss the impact of DNA profiling on society. 4

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Question 29 (3 marks)

Marks

Distinguish between *active* and *passive* immunity.

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Question 30 (7 marks)**Marks**

DNA has both coding and non-coding sections, which vary in terms of biological function. This difference in function also means that the location of genetic mutations can change the impact upon the function of the cell. Some mutations have no impact upon function.

7

Complete the table below, explaining the relationship between mutations on coding and non-coding sections of DNA.

	<i>Coding section of DNA</i>	<i>Non-coding section of DNA</i>
<i>Biological term for the section</i>		
<i>Biological function</i>		
<i>How function can be impacted by mutation</i>		
<i>How mutation can sometimes have no impact</i>		

Question 31 (12 marks)**Marks**

The link between smoking and lung cancer is well established but remains a significant health problem in Australia. The Australian Government and public health organisations have undertaken many different activities to prevent adolescents from taking up smoking and reduce smoking rates in Australia. These have included increases in tobacco tax (excises), changes to tobacco packaging, smoke-free environments, public education campaigns and restrictions on adolescents' access to tobacco.

Figure 1. Percentage of adolescents who are current smokers (1996–2014)

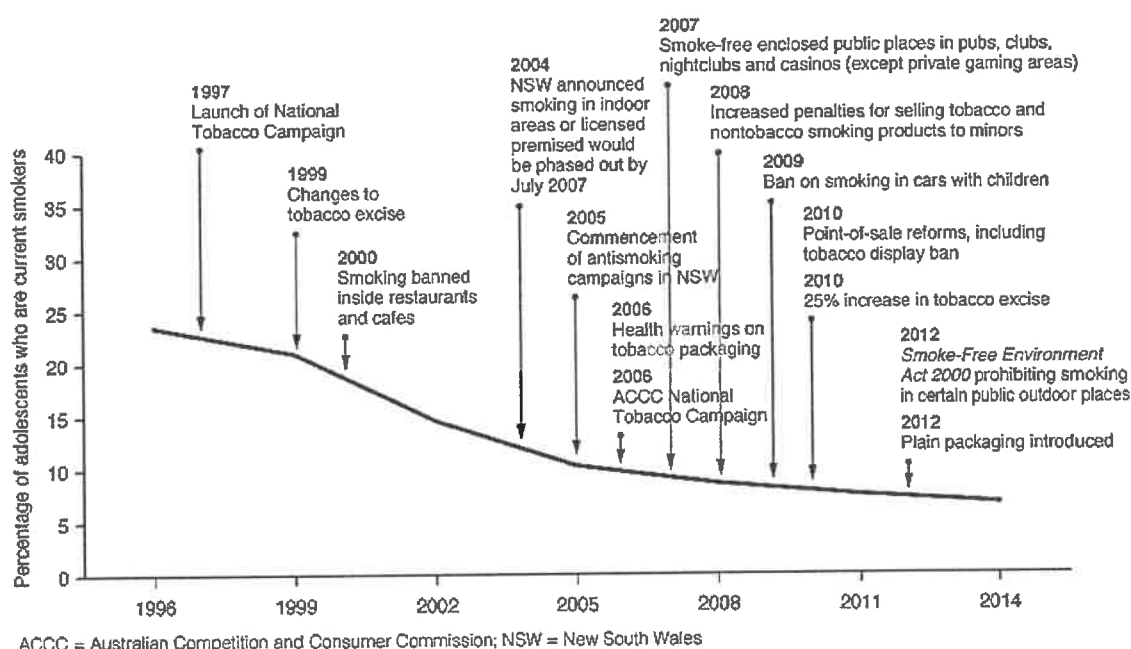
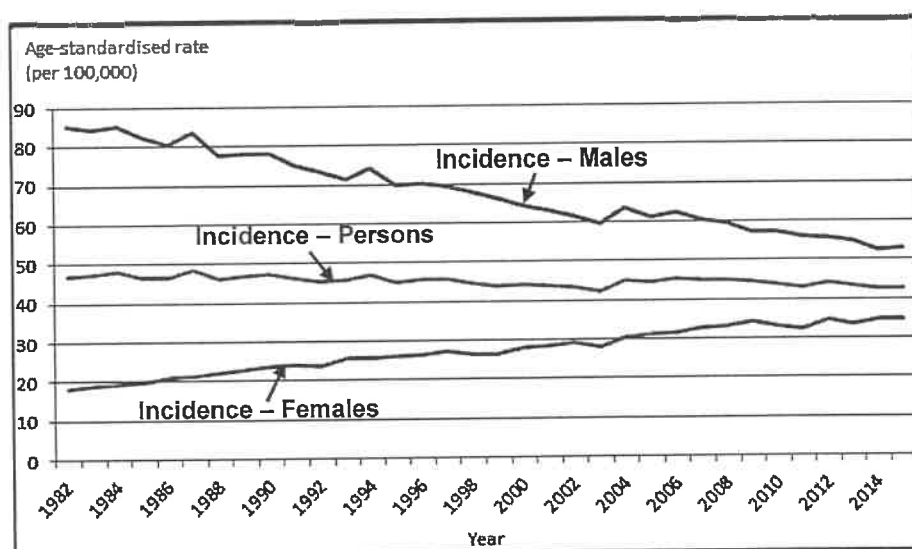


Figure 2. Age-standardised incidence rates for lung cancer, 1982 to 2015
Australian Institute of Health & Welfare



Question 31 continues on the next page

Question 31 (continued)

Marks

- (a) Why is tobacco related lung cancer classified as a non-infectious disease? 2

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- (b) Identify TWO trends shown in the data. 2

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- (c) Using the data provided and your own knowledge, evaluate the effectiveness of the strategies implemented to prevent lung cancer due to smoking in Australia. 5

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Question 31 continues on the next page

Question 31 (continued)

Marks

- (d) National Health Surveys (NHS) are conducted every 3–4 years to gather data on the health of individuals from selected households across the country. This data is used to identify rates of disease and gather information on health-related factors, including smoking. Approximately 25 000 households are requested to complete a detailed questionnaire with trained interviewers.

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Assess the validity of the data obtained using this method.

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End of Question 31

STUDENT NUMBER/NAME:

Question 32 (4 marks)

Marks

Compare sexual and asexual reproduction in plants, using examples.

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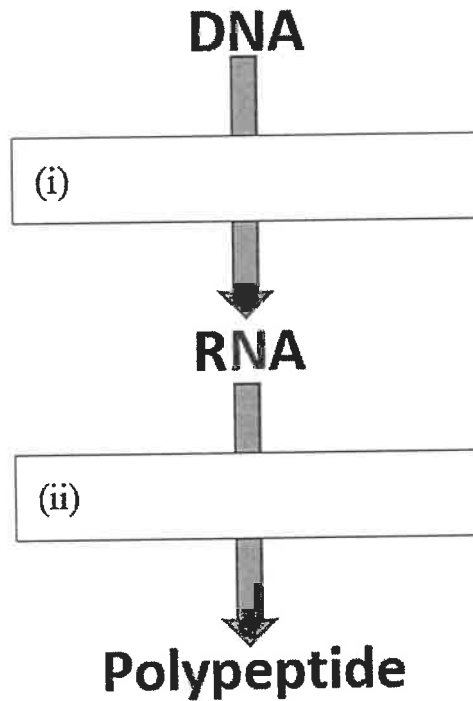
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Question 33 (6 marks)**Marks**

- (a) In order for DNA to be used to create a polypeptide, it must go through TWO processes. **2**

Name these processes in the diagram below.



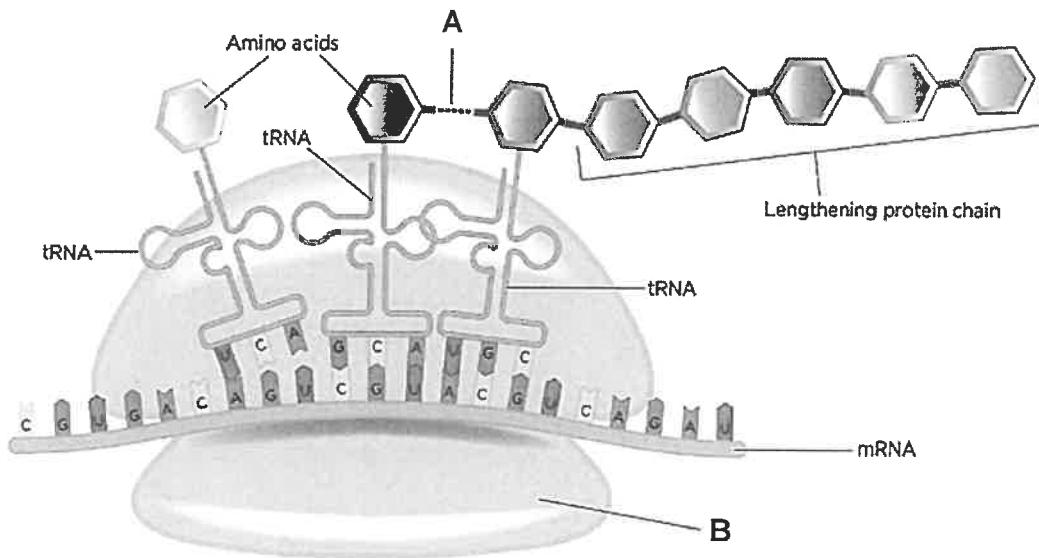
Question 33 continues on the next page

Question 33 (continued)

Marks

(b) Observe the following diagram.

2



Source: Image adapted from <https://www.nursingtimes.net/clinical-archive/genetics/genes-and-chromosomes-3-genes-proteins-and-mutations-28-08-2018/>

Complete the table, identifying **A** and **B** from the diagram above.

Label	Name
A	
B	

(c) *It is important for genetic material to be replicated exactly.*

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Briefly explain this statement.

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End of Question 33

STUDENT NUMBER/NAME:

Question 34 (5 marks)

Marks

Compare the adaptations of TWO different pathogens that facilitate their entry into and transmission between hosts.

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Question 35 (5 marks)

Read the article below to answer the questions that follow.

Dieback – An Epidemic in Native Australian Plant Species

Phytophthora 'dieback' is a plant pathogen that can spread easily, causing disease, death and potential extinction in susceptible plants, and loss of habitat for animals. In Australia, the disease causes damage of epidemic proportions to native vegetation in many regions, particularly in the south-eastern and south-western regions of the country. The disease was first associated with the death of a large number of native plants in the jarrah forests in Western Australia in 1921 and in 1952 in Gippsland (in the south-east of Victoria).

By the 1990s, the disease had destroyed large areas of native vegetation in Western Australia, Tasmania, Queensland and Victoria, causing local susceptible species to disappear. Today, the area of land infected in Western Australia by Phytophthora dieback is equivalent to 500 times the size of Rottnest Island or over one million hectares. Twenty per cent of the state's jarrah forest and up to 80% of the Stirling Range National Park is infected.

The disease is caused mainly by *Phytophthora cinnamomi*, which causes root and crown rots, resulting in shoot dieback, chlorotic foliage and defoliation. When rot has girdled the collar region, plants invariably wilt and die. Young eucalypt seedlings tend to show greater sensitivity to phytophthora dieback than older plants. The spread and severity of disease depends very much on the prevailing weather conditions. Being a water mould, *P. cinnamomi* thrives in warm and wet conditions, when the pathogen sporulates and releases motile zoospores which are attracted to and infect the roots. Infected plants may die during hot, dry spells following wet weather, as plants with rotted roots are unable to take up sufficient water to compensate for increased water loss. This pattern is common in the Mediterranean-type environments of the south-western and south-eastern parts of Australia where a warm and wet spring is followed by a hot and dry summer.

Phytophthora cinnamomi affects a large number of species in Australia's diverse and unique flora, from large trees to prostrate shrubs found that 36 of 47 species native to Tasmania tested were susceptible. An assessment of the susceptibility of 749 native plant species from 253 genera in Western Australia estimated 40% of the 5710 described plant species in the South-West Botanical Province to be susceptible to this pathogen. Of these, about 800 species were ranked as highly susceptible. A field evaluation of susceptibility showed that up to 75% of the native flora in an infested native vegetation site in Brisbane Ranges National Park, Victoria, was susceptible. The disease caused not only local extinction of susceptible species and endangered the continued survival of rare species but also changed the species composition of the plant communities.

Sources:

- <https://bsppjournals.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-3059.2012.02593.x>
- <https://www.environment.gov.au/biodiversity/invasive-species/diseases-fungi-and-parasites/phytophthora-cinnamomi-disease>
- <https://www.dpaw.wa.gov.au/management/pests-diseases/phytophthora-dieback>

Question 35 continues on the next page

Question 35 (continued)

Marks

- (a) Describe how this fungal infection leads to plant death. **2**

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- (b) Explain why the spread of dieback could be considered an epidemic. **3**

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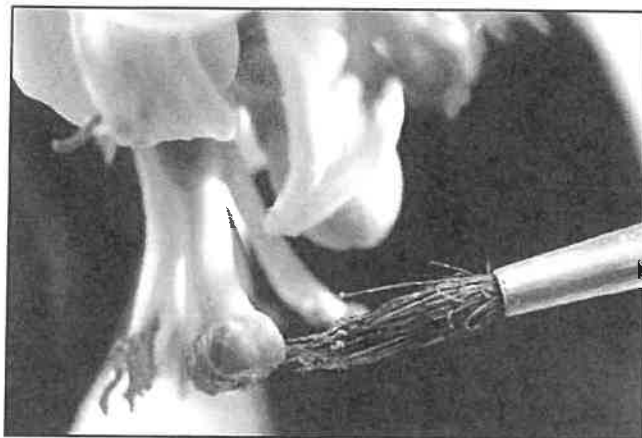
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End of Question 35

Question 36 (5 marks)**Marks**

A scientist wanted to use artificial pollination to cross two plants that had never previously been bred together. To do this, she used a paint brush to transfer pollen from the male parts of Plant X to the female parts of Plant Y.



Source: <https://www.gardeningknowhow.com/edible/fruits/lemons/hand-pollinating-lemons.htm>

- (a) What type of reproduction is this an example of? 1

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- (b) Outline how scientists could ensure that only Plant X pollinates Plant Y. 1

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- (c) Explain the effect that the resultant offspring would have on genetic diversity. 3

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End of paper

STUDENT NUMBER/NAME:

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

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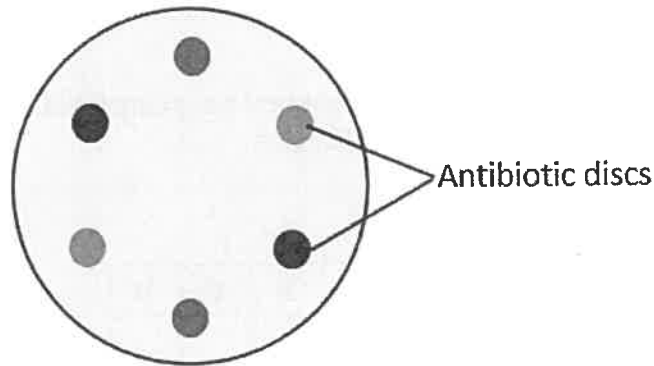
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- 1 A bacterial culture was spread across an agar plate. Six absorbent paper discs soaked in different antibiotics were placed on the agar.



The agar plate was incubated overnight and the bacterial growth was examined the next day.

Which of the following would make a suitable control for this experiment?

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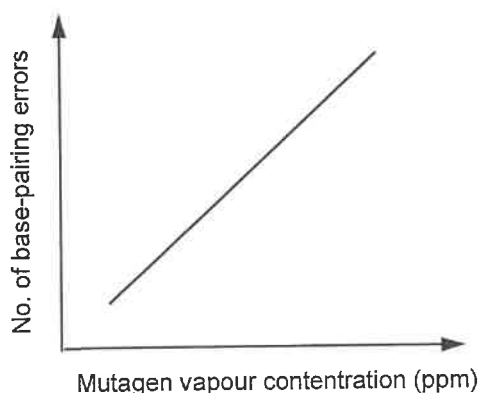
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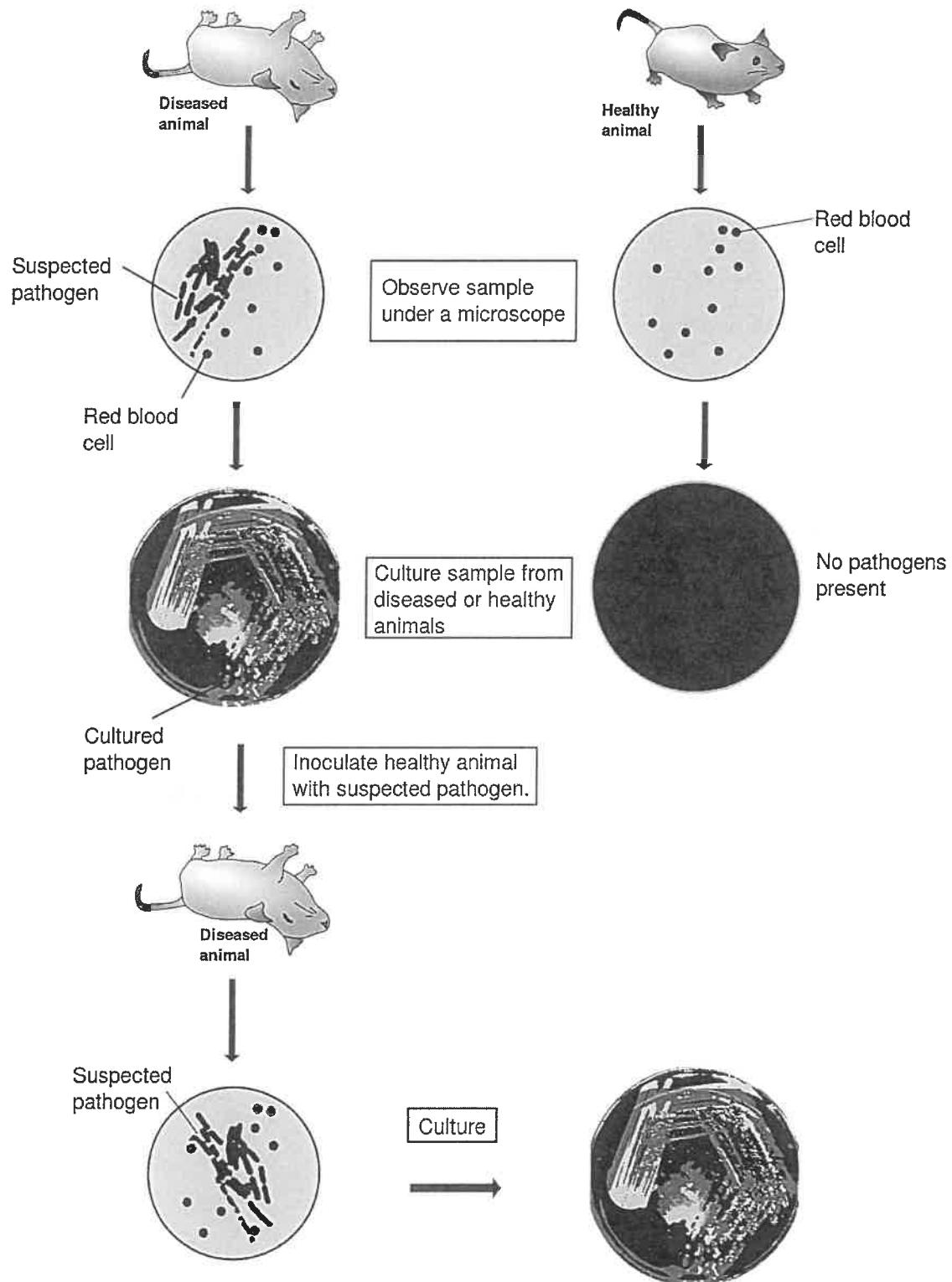
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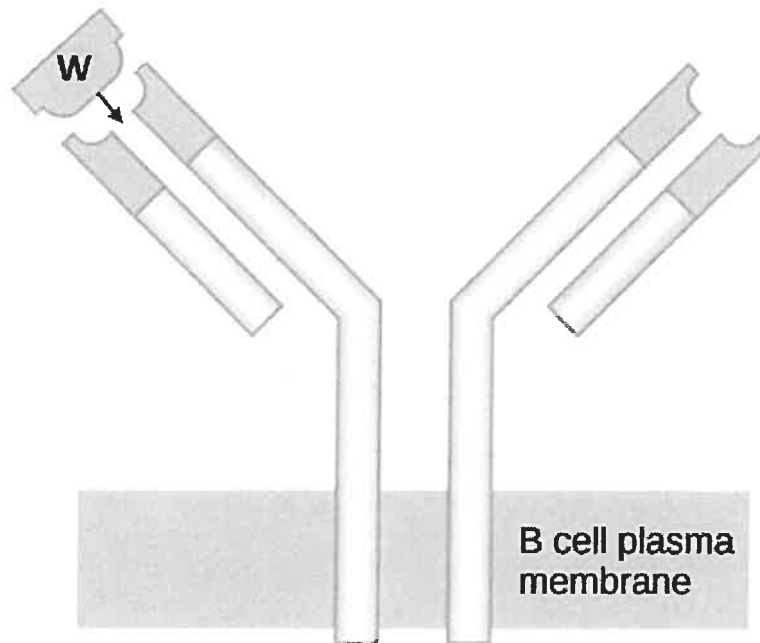


- 9 This diagram represents the work of a scientist that contributed to the current understanding of infectious diseases.

What is the name of that scientist?

- A. Louis Pasteur
 - B. Robert Koch
 - C. Frank Macfarlane Burnet
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- 11 Which of the following is an example of a transgenic biotechnology?
- A. Scientists have introduced a gene from the petunia plant into soybean plants to make them resistant to a common chemical herbicide.
 - B. Crossing a male cow of the Friesian variety, which produces large quantities of milk, with a Jersey cow, which produces creamy milk, has created some offspring who produce large amounts of creamy milk.
 - C. Producing seedless watermelons by crossing diploid plants (two sets of chromosomes) with tetraploid plants (four sets of chromosomes) of the same species.
 - D. The first cloned pet, a cat, named 'carbon copy', was born after scientists successfully fused a somatic cell from the pet cat with an enucleated egg cell from a different surrogate cat.

- 12 The image below could be used to explain how part of the immune system works.



Source: Image adapted from <https://www.labroots.com/trending/immunology/1783/new-protein-found-in-b-lymphocytes>

What is the name given to W?

- A. Antigen
 - B. Antibody
 - C. Pathogen
 - D. Bacteria
- 13 What would be the mRNA sequence from the following DNA strand?

CATTAG

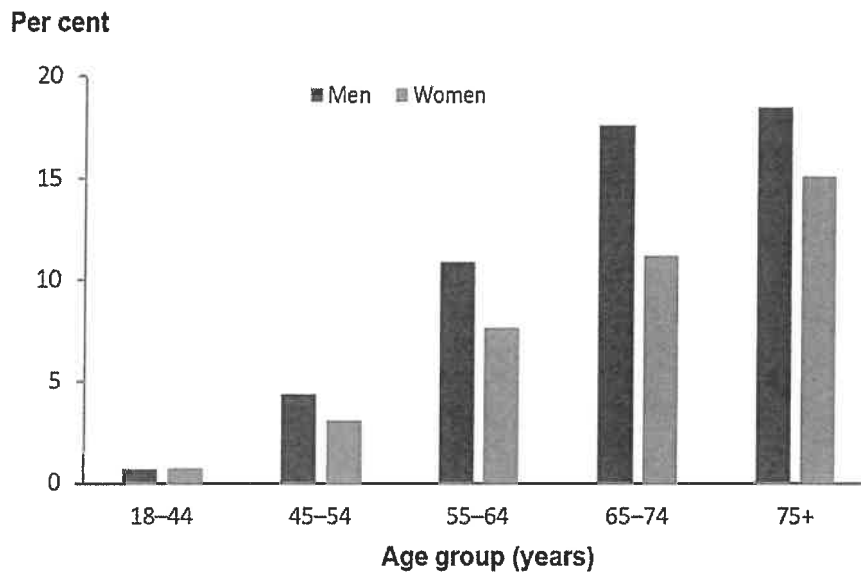
- A. GTUUTC
- B. GUA AUC
- C. UTAATC
- D. GTAATU

- 14 Which is a major feature of the inflammatory response?
- A. The production of antibodies to identify foreign material
 - B. The identification of antigenic agents
 - C. The production of histamines
 - D. The increased production of suppressor cells
- 15 The 'crossing over' of chromosomes is one process that introduces genetic variation into a species.
- Which of the following outlines when 'crossing over' occurs?
- A. The early stages of meiosis
 - B. The late stages of meiosis
 - C. The early stages of mitosis
 - D. The late stages of mitosis
- 16 What is the name given to the structural unit of a protein?
- A. Base
 - B. Peptide
 - C. Nucleotide
 - D. Amino acid

Refer to the following information to answer Questions 17 and 18.

An estimated 1.3 million (out of 24.6 million) Australians had Type 2 Diabetes in 2017–18. It was more common for men (7%) than women (5%) and increased rapidly up to age 75. There were 9500 deaths attributed to Type 2 Diabetes in 2017.

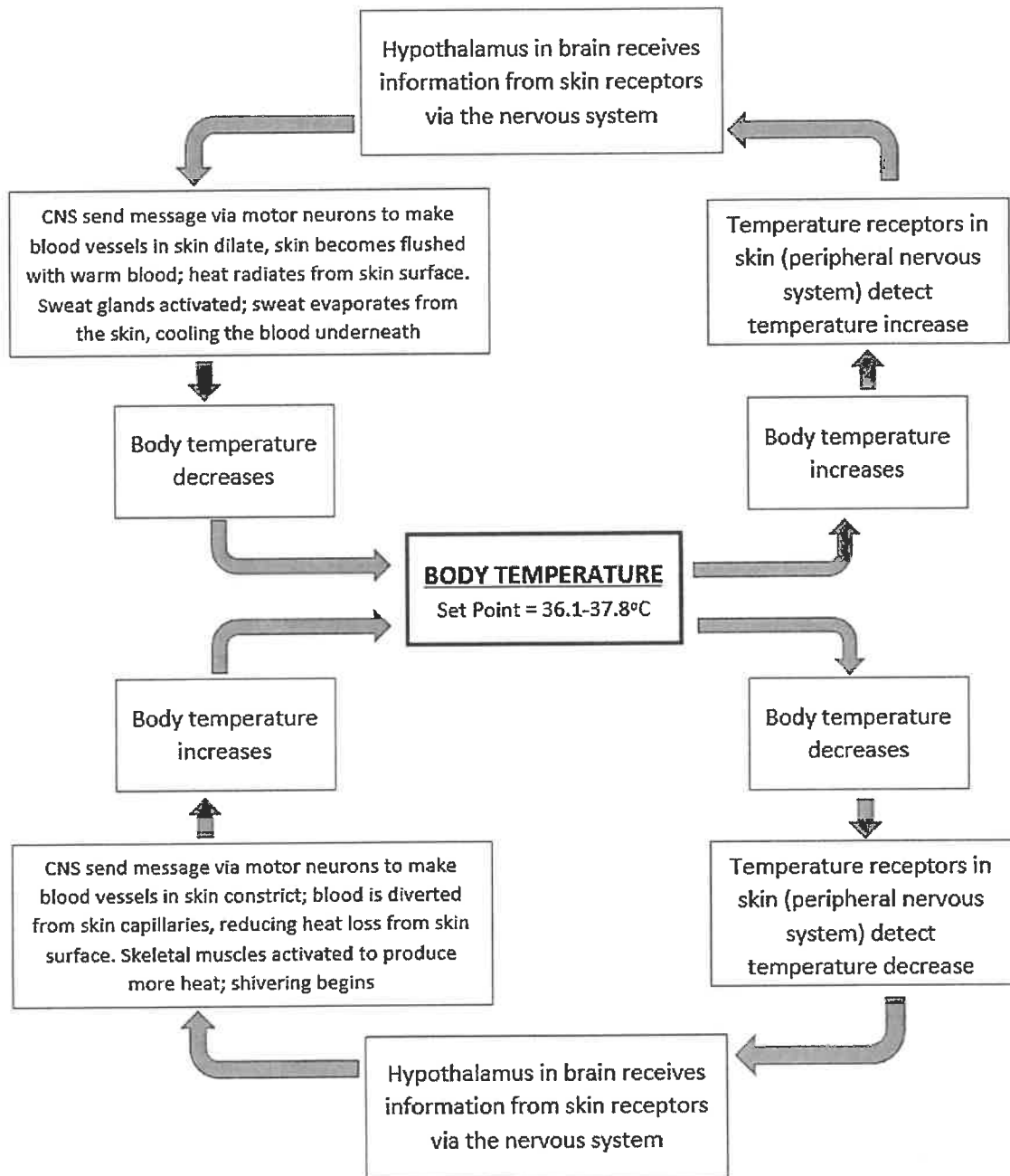
Figure 1: Prevalence of self-reported type 2 diabetes, among persons aged 18 and over, by age and sex, 2017–18



Sources: Australian Institute of Health & Welfare, Australian Bureau of Statistics & Diabetes NSW

- 17 According to the data, which group is most likely to have Type 2 Diabetes?
- Females 18-44 years
 - Males 65-74 years
 - Males over 75 years
 - Females over 75 years
- 18 What was the prevalence of Type 2 Diabetes in Australia in 2017?
- 12 per 100 000 persons
 - 730.8 per 100 000 persons
 - 38.6 per 100 000 persons
 - 5284.6 per 100 000 persons

19 Refer to the following diagram.



What does this diagram represent?

- A. How the body relies on environmental conditions to regulate heat
- B. How the body mitigates the effect of a changing external environment
- C. How an ectotherm regulates its internal temperature
- D. How an endotherm adapts behaviour to regulate its internal environment

20 Which statement explains how cloning might eventually assist humans to live longer?

- A. If an ageing human is replaced with a clone, they could essentially live forever.
- B. Cloning human organs could allow them to be used to replace unhealthy ones.
- C. Clones usually live longer than the organisms from which they take their DNA.
- D. Food obtained from cloned plants and animals would be healthier than ordinary food.

Section II**80 marks****Attempt Questions 21–36****Allow about 2 hours and 25 minutes for this section**

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Show all relevant working in questions involving calculations. Extra writing space is provided at the back of this booklet.

If you use this space, clearly indicate which question you are answering.

Question 21 (4 marks)**Marks**

If there are two alleles of a gene, for example, Purple flower (P) and White flower (W), there would be three possible genotypes from these two alleles: PP, PW and WW. Some characteristics have multiple alleles of the one gene which then increases the number of possible genotypes, as shown in the table below.

<i>Number of alleles</i>	<i>Number of genotypes</i>
2	3
3	6
4	
5	15

- (a) Predict the number of possible genotypes with FOUR alleles. 1

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- (b) Explain your prediction in (a), using a worked example. 3

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Question 22 (4 marks)**Marks**

The Tasmanian Devil is a native marsupial found mainly in coastal forests of Tasmania. It is at risk of extinction from the contagious devil facial tumour disease (DFTD) cancer. Devil numbers have been reduced to less than 10 percent of the original population in some parts of Tasmania. With no vaccine or cure for DFTD currently available, a breeding program is the key to the devil's survival.

**Tasmanian Devil (no facial disease)****Tasmanian Devil (facial tumour)**

The facial cancer spreads because nearly all devils have very similar MHCs (genes that allow the immune system to recognise foreign molecules). When the devils fight, cancer cells get transferred from an infected devil to an uninfected devil. Because of their similar MHCs, the immune system doesn't recognise the invader and the cancer easily spreads.

Some scientists propose introducing MHC diversity into the devil population through genetic engineering, via a virus vector. In this way, scientists could create Tasmanian devils with different MHC complexes and introduce them back into the population.

Question 22 continues on the next page

Question 22 (continued)

Marks

- (a) Suggest an explanation for most devils having very similar MHC immunity. **1**

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- (b) Describe a technique that scientists could use to genetically engineer cells from a Tasmanian Devil so that genes responsible for producing MHC immunity could be modified. **3**

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End of Question 22

Question 23 (3 marks)

Marks

Describe ONE cause and the effects of a named genetic disease.

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Question 24 (4 marks)

(a) What is meant by the term *bush medicine*?

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(b) Explain the recent increased interest in bush medicine. Use an example to support your answer.

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Question 25 (5 marks)**Marks**

Plant species have evolved to maintain suitable water conservation strategies. Crassulacean acid metabolism (CAM) plants, such as the pineapple *Ananas comosus* (see picture below), absorb carbon dioxide at night and convert it into malic acid for storage. During the day, the malic acid is converted back into carbon dioxide and used for photosynthesis.



Source: <https://www.britannica.com/plant/pineapple>

- (a) Using your understanding of plant structure and function, explain how the CAM process, outlined above, would help *Ananas comosus* maintain water balance.

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Question 25 continues on the next page

Question 25 (continued)

Marks

- (b) Identify and describe a DIFFERENT feature or mechanism to (a) that helps a named plant to maintain water balance. **2**

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End of Question 25

Question 26 (4 marks)

Marks

During the course, you investigated how electromagnetic radiation, chemicals, and naturally occurring mutagens affect the DNA of organisms.

4

In the space below, construct a table to distinguish between the action of chemical mutagens and naturally occurring mutagens, giving an example of each.

Question 27 (3 marks)

Outline THREE modes of disease transmission and provide examples for each.

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Question 28 (6 marks)

Marks

Genetic technologies such as DNA sequencing and DNA profiling can be used to determine inheritance patterns in human populations.

- (a) Compare the results obtained from DNA sequencing and DNA profiling. 2

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- (b) Discuss the impact of DNA profiling on society. 4

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Question 29 (3 marks)

Marks

Distinguish between *active* and *passive* immunity.

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Question 30 (7 marks)**Marks**

DNA has both coding and non-coding sections, which vary in terms of biological function. This difference in function also means that the location of genetic mutations can change the impact upon the function of the cell. Some mutations have no impact upon function.

7

Complete the table below, explaining the relationship between mutations on coding and non-coding sections of DNA.

	<i>Coding section of DNA</i>	<i>Non-coding section of DNA</i>
<i>Biological term for the section</i>		
<i>Biological function</i>		
<i>How function can be impacted by mutation</i>		
<i>How mutation can sometimes have no impact</i>		

Question 31 (12 marks)**Marks**

The link between smoking and lung cancer is well established but remains a significant health problem in Australia. The Australian Government and public health organisations have undertaken many different activities to prevent adolescents from taking up smoking and reduce smoking rates in Australia. These have included increases in tobacco tax (excises), changes to tobacco packaging, smoke-free environments, public education campaigns and restrictions on adolescents' access to tobacco.

Figure 1. Percentage of adolescents who are current smokers (1996–2014)

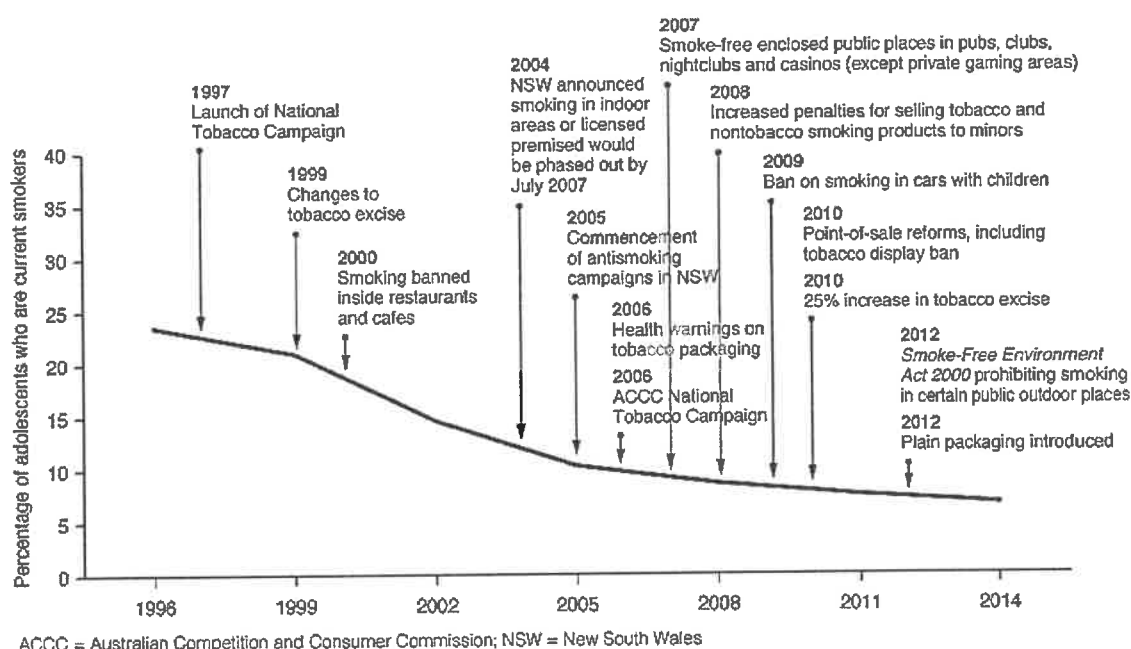
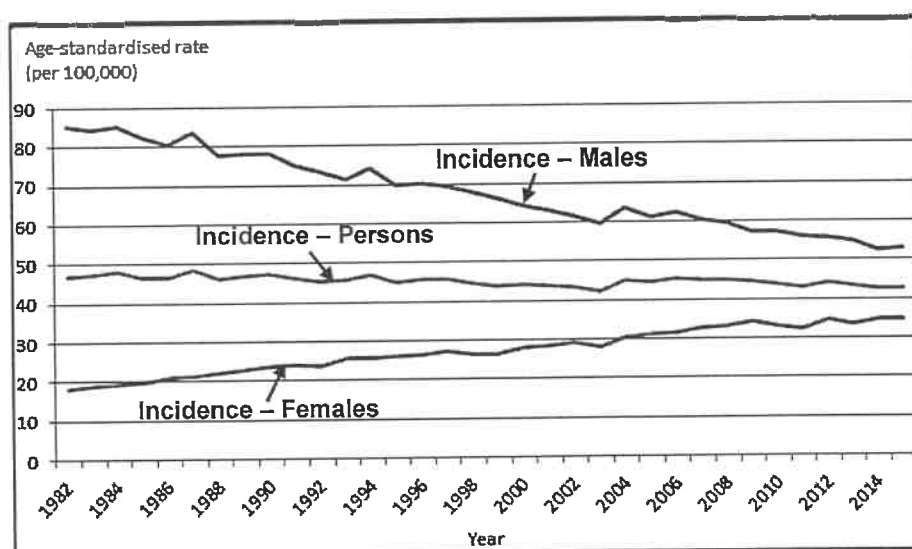


Figure 2. Age-standardised incidence rates for lung cancer, 1982 to 2015
Australian Institute of Health & Welfare



Question 31 continues on the next page

Question 31 (continued)

Marks

- (a) Why is tobacco related lung cancer classified as a non-infectious disease? 2

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- (b) Identify TWO trends shown in the data. 2

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- (c) Using the data provided and your own knowledge, evaluate the effectiveness of the strategies implemented to prevent lung cancer due to smoking in Australia. 5

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Question 31 continues on the next page

Question 31 (continued)

Marks

- (d) National Health Surveys (NHS) are conducted every 3–4 years to gather data on the health of individuals from selected households across the country. This data is used to identify rates of disease and gather information on health-related factors, including smoking. Approximately 25 000 households are requested to complete a detailed questionnaire with trained interviewers.

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Assess the validity of the data obtained using this method.

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End of Question 31

STUDENT NUMBER/NAME:

Question 32 (4 marks)

Marks

Compare sexual and asexual reproduction in plants, using examples.

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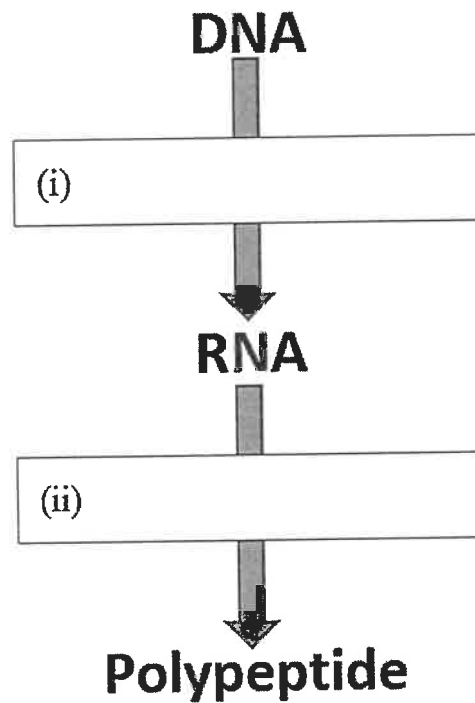
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Question 33 (6 marks)**Marks**

- (a) In order for DNA to be used to create a polypeptide, it must go through TWO processes. **2**

Name these processes in the diagram below.



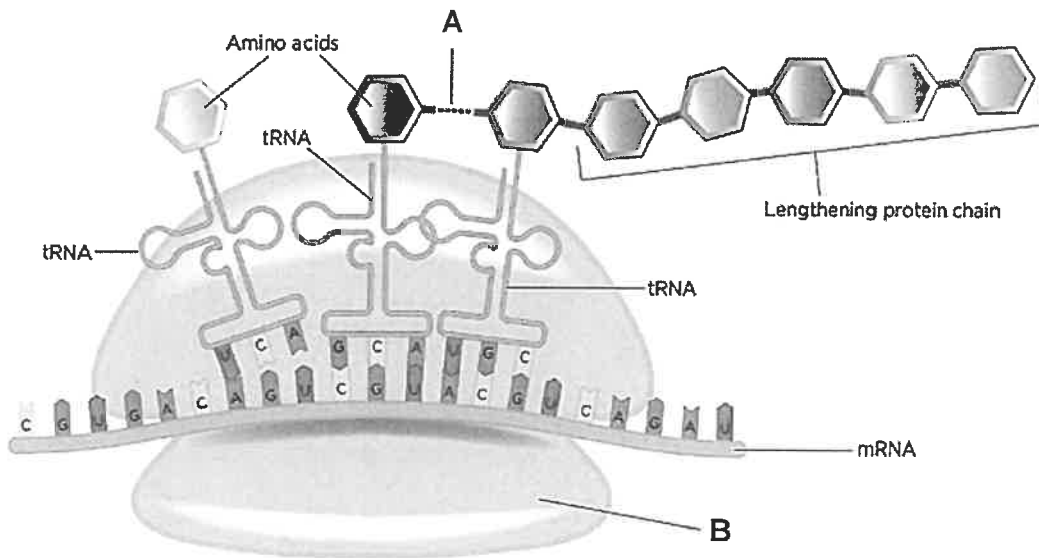
Question 33 continues on the next page

Question 33 (continued)

Marks

(b) Observe the following diagram.

2



Source: Image adapted from <https://www.nursingtimes.net/clinical-archive/genetics/genes-and-chromosomes-3-genes-proteins-and-mutations-28-08-2018/>

Complete the table, identifying **A** and **B** from the diagram above.

Label	Name
A	
B	

(c) *It is important for genetic material to be replicated exactly.*

2

Briefly explain this statement.

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End of Question 33

STUDENT NUMBER/NAME:

Question 34 (5 marks)

Marks

Compare the adaptations of TWO different pathogens that facilitate their entry into and transmission between hosts.

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Question 35 (5 marks)

Read the article below to answer the questions that follow.

Dieback – An Epidemic in Native Australian Plant Species

Phytophthora 'dieback' is a plant pathogen that can spread easily, causing disease, death and potential extinction in susceptible plants, and loss of habitat for animals. In Australia, the disease causes damage of epidemic proportions to native vegetation in many regions, particularly in the south-eastern and south-western regions of the country. The disease was first associated with the death of a large number of native plants in the jarrah forests in Western Australia in 1921 and in 1952 in Gippsland (in the south-east of Victoria).

By the 1990s, the disease had destroyed large areas of native vegetation in Western Australia, Tasmania, Queensland and Victoria, causing local susceptible species to disappear. Today, the area of land infected in Western Australia by Phytophthora dieback is equivalent to 500 times the size of Rottnest Island or over one million hectares. Twenty per cent of the state's jarrah forest and up to 80% of the Stirling Range National Park is infected.

The disease is caused mainly by *Phytophthora cinnamomi*, which causes root and crown rots, resulting in shoot dieback, chlorotic foliage and defoliation. When rot has girdled the collar region, plants invariably wilt and die. Young eucalypt seedlings tend to show greater sensitivity to phytophthora dieback than older plants. The spread and severity of disease depends very much on the prevailing weather conditions. Being a water mould, *P. cinnamomi* thrives in warm and wet conditions, when the pathogen sporulates and releases motile zoospores which are attracted to and infect the roots. Infected plants may die during hot, dry spells following wet weather, as plants with rotted roots are unable to take up sufficient water to compensate for increased water loss. This pattern is common in the Mediterranean-type environments of the south-western and south-eastern parts of Australia where a warm and wet spring is followed by a hot and dry summer.

Phytophthora cinnamomi affects a large number of species in Australia's diverse and unique flora, from large trees to prostrate shrubs found that 36 of 47 species native to Tasmania tested were susceptible. An assessment of the susceptibility of 749 native plant species from 253 genera in Western Australia estimated 40% of the 5710 described plant species in the South-West Botanical Province to be susceptible to this pathogen. Of these, about 800 species were ranked as highly susceptible. A field evaluation of susceptibility showed that up to 75% of the native flora in an infested native vegetation site in Brisbane Ranges National Park, Victoria, was susceptible. The disease caused not only local extinction of susceptible species and endangered the continued survival of rare species but also changed the species composition of the plant communities.

Sources:

- <https://bsppjournals.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-3059.2012.02593.x>
- <https://www.environment.gov.au/biodiversity/invasive-species/diseases-fungi-and-parasites/phytophthora-cinnamomi-disease>
- <https://www.dpaw.wa.gov.au/management/pests-diseases/phytophthora-dieback>

Question 35 continues on the next page

Question 35 (continued)

Marks

- (a) Describe how this fungal infection leads to plant death.

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- (b) Explain why the spread of dieback could be considered an epidemic.

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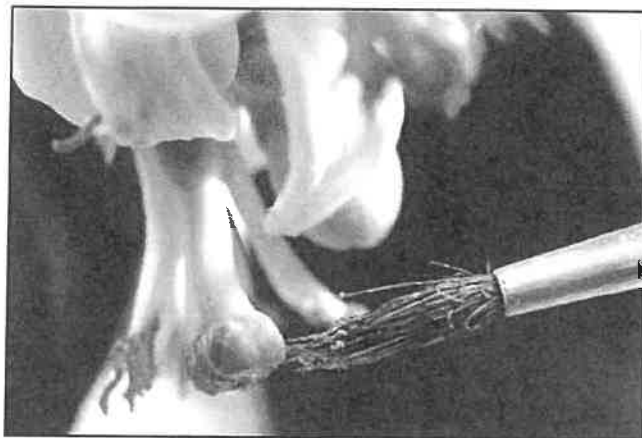
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End of Question 35

Question 36 (5 marks)**Marks**

A scientist wanted to use artificial pollination to cross two plants that had never previously been bred together. To do this, she used a paint brush to transfer pollen from the male parts of Plant X to the female parts of Plant Y.



Source: <https://www.gardeningknowhow.com/edible/fruits/lemons/hand-pollinating-lemons.htm>

- (a) What type of reproduction is this an example of? 1

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- (b) Outline how scientists could ensure that only Plant X pollinates Plant Y. 1

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- (c) Explain the effect that the resultant offspring would have on genetic diversity. 3

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End of paper

STUDENT NUMBER/NAME:

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

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STUDENT NUMBER/NAME:

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If you use this space, clearly indicate which question you are answering.

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

