**BIOLOGY**

**Insert School Logo**

**UNIT 1 & 2**

**2020**

**Name**:

**Teacher**:

**Time allowed for this paper**

Reading time before commencing work: ten minutes

Working time: three hours

**Materials required/recommended for this paper**

***To be provided by the supervisor***

This Question/Answer booklet

Multiple-choice answer sheet

***To be provided by the candidate***

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in this examination

**Important note to candidates**

No other items may be taken into the examination room. It is **your** responsibility to ensure that

you do not have any unauthorised material. If you have any unauthorised material with you, hand

it to the supervisor **before** reading any further.

**Structure of this paper**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Section | Number of questions available | Number of questions to be answered | Suggested working time (minutes) | Marks available | Percentage of examination |
| Section One  Multiple-choice | 30 | 30 | 40 | 30 | 30 |
| Section Two  Short answer | 5 | 5 | 90 | 100 | 50 |
| Section Three  Extended answer  Part A | 2 | 1 | 50 | 40 | 20 |
| Part B | 2 | 1 |
|  |  |  |  | **Total** | 100 |

**Instructions to candidates**

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2020*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.

3. Answer the questions according to the following instructions.

Section One: Answer all questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Section Two: Write your answers in this Question/Answer booklet. Wherever possible, confine your answers to the line spaces provided.

Section Three: Consists of two parts each with two questions. You must answer one question from each part. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet.

4. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.

5. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

**Section One: Multiple-choice 30% (30 Marks)**

This section has **30** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question, shade a box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 40 minutes.

1. Two different species of parrot belong to the order Psittaformes, but are classified into different families. Based on this information, these parrots are likely to

(a) have very similar morphology.

(b) inhabit the same ecosystem.

(c) have identical DNA.

(d) share a recent common ancestor.

2. Which of the following statements best defines biodiversity?

(a) A method of classification that uses genetic similarity to determine relatedness.

(b) A community of different species that interact with each other and their environment.

(c) The genetic variation within the individuals of a particular species.

(d) The variety of living organisms within different ecosystems.

3. Which of the following **best** reflects the formation of the eukaryotic cell as proposed by the endosymbiotic theory?

(a) Ancient bacterial cells engulfed cyanobacteria to form plant cells.

(b) Aerobic bacteria ingested prokaryotic cells which later developed into specialised cell organelles.

(c) Prokaryotic cells ingested bacterial cells which later developed into mitochondria and chloroplasts.

(d) Photosynthetic cyanobacteria ingested aerobic bacteria to form algal cells.

4. Photosynthesis provides a food web with

(a) solar energy.

(b) chemical energy.

(c) heat energy.

(d) light energy.

5. Which of the following best describes an enzyme's effect on activation energy?

(a) Increasing the energy required to start the reaction.

(b) Decreasing the energy required to start the reaction.

(c) Stimulating the active site to receive molecules.

(d) Increasing the rate of cellular respiration.

6. Which of the following factors is **not** density-independent?

(a) Competition

(b) Floods

(c) Drought

(d) Salinity

The diagram below relates to question 7 and 8.

A picture containing rain, large, bird, group

Description automatically generated

7. The distribution pattern shown in the diagram above is

(a) clumped.

(b) random.

(c) uniform.

(d) even.

8. Which of the following organisms most likely displays this type of distribution?

(a) Wedge-tailed eagle

(b) Penguin

(c) Fox

(d) Tuna

9. The laughing Kookaburra, *Dacelo novaeguineae*, was introduced into the ecosystems of Western Australia's south west in the late 1800's. Kookaburras are carnivores and are known to steal chicks of other bird species from their nests. This is an example of

(a) competition.

(b) parasitism.

(c) predation.

(d) mutualism.

10. Which of the following chemical equations **best** represents the process of cellular respiration?

(a) H2O + CO2 O2 + C6H12O2 + ATP

(b) C6H12O2 + O2 CO2 + H2O + ATP

(c) ADP + Pi + O2 ATP

(d) C6H12O2 + CO2 H2O + O2 + ATP

11. Which of the following taxonomic groups would include the greatest number of species?

(a) Family

(b) Species

(c) Genus

(d) Phylum

12. The ability of any cell to carry out metabolic processes is limited by the availability of factors specific to each reaction. For example, aerobic respiration cannot take place in the absence of

(a) water and glucose.

(b) oxygen and glucose.

(c) glucose and carbon dioxide.

(d) water and carbon dioxide.

13. In a terrestrial community, the group of organisms **generally** exhibiting the greatest biomass are the

(a) decomposers.

(b) producers.

(c) first order consumers.

(d) second order consumers.

14. A biology student was designing an experiment with the aim to make plants grow faster. For a period of two weeks, lettuce seedlings were exposed to red and violet light every day for either 6, 10 or 18 hours. In order to determine any effect the light may have on lettuce growth, the student should measure

(a) average leaf diameter.

(b) rate of transpiration.

(c) rate of photosynthesis.

(d) average cellular chlorophyll content.

15. Which of the following variables affect photosynthesis and should have been controlled in the lettuce growth experiment?

(a) water, nutrients and non-experimental light sources.

(b) carbon dioxide, temperature and water.

(c) carbon dioxide, water and time exposed to different coloured light.

(d) oxygen, water and temperature.

16. Arthropods, like insects and spiders, have an open circulatory system, meaning that

(a) blood and nutrients are carried around their bodies in vessels linked to one another through a simplified heart.

(b) haemolymph circulates freely as they do not have a heart.

(c) the haemolymph bathes the cells in nutrients directly before being returning to the head via a tubular heart.

(d) oxygen is readily available to cells from the haemolymph.

17. Which of the following is **not** an example of primary succession?

(a) Post-fire seed germination.

(b) Coastal scrubland growing on a newly formed volcanic island.

(c) Plants establishing an area of glacial retreat.

(d) Spinifex growing on newly formed sand dunes.

18. The leaf epidermis is an example of a tissue because

(a) the cells all have a waxy cuticle.

(b) light can penetrate through to the cells underneath.

(c) cell structure and function are the same.

(d) every cell has the same genetic material.

19. Which of the following statements best reflects the main difference between the 'lock and key' model and 'induced fit' model of enzyme function?

(a) The lock and key model involves catabolic reactions, while the induced fit model involves anabolic reactions.

(b) The lock and key model states that only one enzyme can bind with one specific substrate, while the induced fit model states that one enzyme can bind with many different substrates.

(c) The lock and key model involves the formation of an enzyme-substrate complex, while the induced fit model does not.

(d) The lock and key model describes the active site of an enzyme as fixed, while the induced fit model states that the active site can modify its shape to strengthen binding.

The image below refers to question 20.

A picture containing outdoor, grass, sitting, standing

Description automatically generated

20. How does the broad bean in the image above obtain nitrogen from the atmosphere?

(a) Nitrogen, as nitrites in the soil, is dissolved in water and absorbed into the roots.

(b) Nitrogen-fixing bacteria within the root nodules convert N2 into ammonia.

(c) Nitrogen is converted into ammonia in the soil before uptake by root nodules.

(d) Nitrogen-fixing fungi in the root nodules convert N2 into amino acids during cellular respiration.

The image below relates to question 21.

A tree in a grassy field

Description automatically generated

21. The trees and shrubs that grow in arid regions, such as those pictured above, are much smaller than their counterparts in a rainforest ecosystem. Photosynthetic reactions are reduced due to

(a) stomata closing during the day, reducing the amount of CO2 exchanged and water being carried from the roots to the leaves.

(b) the absence of rainfall affecting transpiration.

(c) overexposure to sunlight.

(d) stomata opening only at night when CO2 levels in the atmosphere are low.

22. A spiracle is

(a) the term used to describe the hairs on plant root cells.

(b) a microscopic pore on the leaves of plants that allows gas exchange.

(c) a specialised cell in fish gills that actively absorbs oxygen from the surrounding water.

(d) an external opening for gas exchange in some arthropods.

23. When conducting an experiment, the variable that is deliberately altered is the

(a) dependent variable.

(b) independent variable.

(c) resultant variable.

(d) control.

The image below relates to question 24.

A close up of a piece of paper

Description automatically generated

24. A biology student was asked to classify the structure shown in the image above. He suggested that the structure represented xylem tissue because it

(a) stained pink due to the presence of cellulose.

(b) has adjacent companion cells.

(c) contains many sieve plates.

(d) contains lignified rings.

25. The diversity of terrestrial organisms on Antarctica is considerably lower than land masses closer to the equator. The most likely reasons for this include

(a) sub-zero temperatures and high rainfall.

(b) less exposure to light and high salt levels.

(c) low rainfall and reduced exposure to light.

(d) low oxygen levels and sub-zero temperatures.

26. Which of the following statements is **true** of vertebrate circulation?

(a) All vertebrates have double-circulation and a four-chambered heart.

(b) Only mammals and birds have double circulation and a four-chambered heart.

(c) Reptiles, mammals and birds have double circulation but only mammals and birds have four-chambered hearts.

(d) All vertebrates except fish and amphibians have double circulation.

27. Lysosomes are said to be the digestive system of the cell because they

(a) contain enzymes, digest cellular waste and break down molecules.

(b) convert glucose and amino acids into simpler forms that can be metabolised in the cell.

(c) engulf cellular waste products and excrete them via vesicle formation.

(d) produce enzymes that are crucial to chemical digestion.

The image below relates to questions 28 and 29.

A picture containing flower, sitting, old, green

Description automatically generated

28. The image above shows guard cells surrounding stomata in a leaf epidermis. In order for the stomata to open, the guard cells must

(a) become more turgid through the loss of water via osmosis.

(b) become more turgid through the uptake of water via osmosis.

(c) become less turgid through the loss of water via osmosis.

(d) become less turgid through the uptake of water via osmosis.

29. Many Australian plant from arid ecosystems possess adaptations to reduce water loss. Which of the following is **not** **true** of adaptations involving stomata in arid plants?

Stomata

(a) are located on the underside of leaves.

(b) can be sunken in epidermal pits.

(c) are always opened during the day.

(d) are few in number.

30. A structure involved in digestion contains a number of different cells that carry out different functions. This structure is considered to be a/an

(a) tissue.

(b) organ.

(c) system.

(d) cellular mass.

**End of Section One**

**Section Two: Short answer 50% (100 Marks)**

This section has **five** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

**Question 31 (20 marks)**



Below is a simplified energy flow diagram of the food web from a backyard ecosystem.

**A screenshot of a cell phone

Description automatically generated**

(a) Calculate the percentage heat loss to the nearest whole number for; (3 marks)

(i) Producers

(ii) Herbivores

(iii) Carnivores

(b) Explain the difference in heat loss between producers and carnivores. (2 marks)

(c) Inputs and outputs for the decomposers and detritivores are equal. Explain.

(2 marks)

In some ecosystems, particular species can play a pivotal role in maintaining the structure of the community in which it lives.

(d) State the term used to describe these particular species. (1 mark)

(e) Describe **two** ways in which these species influence an ecosystem. (4 marks)

(f) Many conservation scientists believe that effective ecosystem management begins with ensuring the survival of these species. Explain. (2 marks)

(g) Complete the table below by identifying **three** environmental issues caused by humans. Explain how each environmental issue has affected the biodiversity of Australian ecosystems. (6 marks)

|  |  |
| --- | --- |
| **Impact** | **Effect on biodiversity** |
|  |  |
|  |  |
|  |  |

**Question 32 (20 marks)**

(a) Identify **three** biological molecules essential to the structure and function of all living organisms. For each molecule, provide **one** example. (3 marks)

(b) For each of the molecules identified in part (a), explain how they are vital to cellular structure and/or function. (3 marks)

**Molecule** **one**

**Molecule** **two**

**Molecule three**

All cells, and many of their cellular components, are enclosed by a membrane.

(c) Identify **two** examples for the functions of a cell membrane. (2 marks)

Use the images below to answer part (d) and (e).

A close up of a logo

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A close up of text on a white background

Description automatically generated

A picture containing object, antenna

Description automatically generated

**Eukaryotic cells** **Prokaryotic cell**

(d) Identify **three** major differences between prokaryotic and eukaryotic cells. (6 marks)

(e) Use the diagram of the eukaryotic cells above to identify and name the structures responsible for; (4 marks)

(i) Protein synthesis

(ii) Respiration

(iii) Photosynthesis

(iv) Secretion and transport

(f) Two important organelles within eukaryotic cells, associated with metabolism, have double membranes. Explain how these membranes improve the biochemical function of these structures. (2 marks)

**Question 33 (20 marks)**

A survey of the 'little red kaluta', a small, carnivorous marsupial (*Dasykaluta rosamondae*) was carried out in Western Australia's Pilbara region over a period of six months. Sampling took place on the first two days of every month, with one hundred traps randomly placed in a 2 km2 quadrat in terrain dominated by spinifex and sand. Captured animals were marked with nail polish on the claws of their front, right-hand paw. The gender, health and weight were recorded for each animal captured. The relative population size of the kaluta was calculated after each survey period using the following formula;

N = M x n

m

where M = marked animals,

n = total number of animals captured,

m = number of recaptured animals (marked).

The data from the six-month population survey are shown in the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **June** | **July** | **Aug** | **Sept** | **Oct** | **Nov** |
| **MALE** |  |  |  |  |  |  |
| New individuals | 26 | 18 | 8 | 3 | 1 | 2 |
| Marked (M) | 26 | 44 | 52 | 55 | 56 | 58 |
| Recaptured (m) |  | 19 | 36 | 42 | 0 | 0 |
| Total caught (n) | 26 | 37 | 44 | 45 | 1 | 2 |
| Mean weight (g) | 31 | 35 | 32 | 37 | 21 | 23 |
| **FEMALE** |  |  |  |  |  |  |
| New individuals | 22 | 14 | 11 | 9 | 4 | 5 |
| Marked (M) | 22 | 36 | 47 | 56 | 60 | 65 |
| Recaptured (m) | - | 16 | 21 | 40 | 48 | 55 |
| Total caught (n) | 22 | 30 | 32 | 49 | 52 | 60 |
| Mean weight (g) | 24 | 26 | 28 | 28 | 29 | 30 |
| Pouched young | 0 | 0 | 0 | 0 | 3 | 19 |
| **N males** |  | **86** | **64** | **59** |  | **0** |
| **N females** |  | **68** | **72** | **69** |  | **71** |
| **N total** |  | **154** | **136** | **128** |  | **71** |

(a) Calculate the following population sizes (N) for the October survey period. Show your working and round your answers to the nearest whole number. (3 marks)

Males

Females

Total

(b) On the grid provided, construct an appropriate graph showing the population size of male, female and total kalutas over the six-month survey period. (6 marks)

**A screen shot of a tiled wall

Description automatically generated**

(c) Describe any trends in the graphed data. (3 marks)

(d) Explain **one** problem with the marking technique used by the researchers. (2 marks)

(e) Provide reasons to explain the declining male kaluta numbers as shown in the data collected in the October and November surveys. (2 marks)

(f) The little red kaluta is nocturnal and rests in burrows during the day. Identify **one** advantage of this behaviour. (1 mark)

While relatively little is known about the kaluta, it is not considered a threatened species.

(g) Explain the importance of collecting ongoing data on the kaluta, despite its current status. (3 marks)

**Question 34 (20 marks)**

(a) With the aid of a labelled diagram, describe the structure of the fluid mosaic model of cellular membranes. (6 marks)

(b) Explain the importance of membrane fluidity to cellular function. (4 marks)

Consider the **three** images below of different gas exchange surfaces from a mammal (**W**), a fish (**X**) and an amphibian (**Y**).

(c) Identify **two** features common to all three structures. (2 marks)

**One**

**Two**

(d) Explain the importance of these **two** features to an organism's metabolic activity.

(4 marks)

A close up of an animal

Description automatically generated

**One**

**Two**

(e) Explain why structures '**W**' and '**X**' differ in shape despite having a similar function. (4 marks)

**Question 35 (20 marks)**

A picture containing clock

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(a) Identify the chemical inputs, **A** and **C**, and outputs, **B** and **D** of photosynthesis as shown in the diagram above. (2 marks)

**A**

**C**

**B**

**D**

(b) Name the substance present in the thylakoid membranes. (1 mark)

(c) Describe the reactions/process occurring in the area labelled '**E**'. (3 marks)

(d) Describe the reactions/process occurring in the area labelled '**F**'. (3 marks)

Many enzymes are involved in biochemical reactions that occur within all organisms, including photosynthesis.

(e) Define 'enzyme'. (2 marks)

The stroma is a fluid-filled space within a chloroplast that contains DNA, ribosomes and many different enzymes. The fluid is maintained at a pH of 8.

A gardener added a strong, nitrate-based fertiliser to his indoor plants without realising it would decrease the pH of the soil.

(f) Explain the effect of a reduced soil pH on the enzymes and chemical reactions within the stroma. (3 marks)

Many types of medicines, pesticides and toxins are enzyme inhibitors.

(g) Explain how an enzyme inhibitor affects enzyme function. (2 marks)

(h) Describe **two** other factors that can affect the rate at which enzymes function. (4 marks)

**One**

**Two**

**End of Section Two**

**Section Three: Extended answer 20% (40 marks)**

Section Three consists of **four** questions.

Questions 36 and 37 are from Unit 1. Questions 38 and 39 are from Unit 2.Answer **one** question from Unit 1 and **one** question from Unit 2.

Use black or blue pen for this section. Do not use erasable or gel pens. Only graphs and diagrams may be drawn in pencil. Responses can include; labelled diagrams with explanatory notes; lists of points with linking sentences; labelled tables and/or graphs; and/or annotated flow diagrams with introductory notes.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 50 minutes

**Unit 1**

Choose **either** Question 36 **or** Question 37.

Indicate the question you will answer by ticking the box next to the question. Write your answer on pages 25 - 28. When you have answered your first question, turn to page 29 and indicate on that page the second question you will answer.

**Question 36 (20 marks)**

(a) Explain the dynamics of the predator-prey relationship and outline the various strategies used by prey species to avoid predation. (10 marks)

(b) Outline the concept of carrying capacity. Explain how the effects of climate change could influence the carrying capacity of any given species population.

(10 marks)

**Question 37 (20 marks)**

(a) Discuss the biological species concept and its limitations in defining 'species'. Explain how an understanding of the concept of 'species' is important to ecosystem conservation and management.

(10 marks)

(b) Discuss the adaptations Australian plants possess in order to regenerate and reproduce following wildfire.

(10 marks)

Question number:

Question number:

Question number:

Question number:

**Unit 2**

Choose **either** Question 38 **or** Question 39.

Indicate the question you will answer by ticking the box next to the question. Write your answer on the pages provided.

**Question 38 (20 marks)**

(a) Discuss the process of cellular respiration in the presence and absence of oxygen.

(10 marks)

(b) Explain how materials are transported throughout a plant by contrasting the structure and function of the xylem and phloem.

(10 marks)

**Question 39 (20 marks)**

(a) Explain how molecules are transported across cellular membranes through passive and active transport.

(10 marks)

(b) Discuss the function of the digestive system and differentiate between the alimentary structures of a herbivore and a carnivore. (10 marks)

**End of questions**

Question number:

Question number:

Question number:

Question number:

Supplementary page

Question number:

Supplementary page

Question number:

Spare grid

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**ACKNOWLEDGEMENTS**

**Question 20**

Photograph of broad bean roots - Elle Fox, PhD candidate (2020).

**Question 21**

Photograph of spinifex plain near Paraburdoo, Western Australia. S, Dowling.

Attribution 2.0 Generic (CC BY 2.0)

**Question 24**

Photograph of xylem cross-section.

Wikimedia Commons.

**Question 28**

Photograph of lower leaf epidermis of a *Tradescantia pallida* leaf, showing stomata and guard cells. Blue Ridge Kitties, Flickr.

Attribution 2.0 Generic (CC BY 2.0)

**Question 31**

Author constructed diagram.

**Question 32 (d) and (e)**

Images of prokaryotic and eukaryotic cells.

Wikimedia commons.

**Question 34 (c),(d) and (e)**

Author constructed images of gas exchange surfaces.

**Question 35**

Author constructed diagram.