



Lumen Christi College

Semester Two Examination, 2022

Question/Answer Booklet

AEBLY

Biology

Student Number: In figures

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In words

Time allowed for this paper

Reading time before commencing work: ten minutes

Working time for paper: 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: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted 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 (min)	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 2022*. 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 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.

Suggested working time: 40 minutes.

1. In 2019, between Christmas and New Year, lightning sparked fires. Two fires tore through more than 40,000 hectares of Western Australia's Stirling Range National Park, decimating rare and unique flora and fauna. Across the following three years, species have been observed to re-establish. If there are no fires for more than thirty years, there is a high probability of total species recovery.

Which best describes the above situation?

- (a) Primary succession.
- (b) Secondary succession.**
- (c) Habitat degradation.
- (d) Competitive exclusion.

2. What characterises a biodiversity hotspot?

- (a) An area with a large variety of animal and plant life.
- (b) An area with numerous introduced species where native species are at great risk of extinction.
- (c) An area with more than 1500 endemic plant species that has lost more than 70% of its native habitat.**
- (d) A place where the full range of one ecosystem's living organisms have accumulated in one spot.

3. Which species will be most closely related?

- (a) Those that share the same kingdom.
- (b) Those that share the same domain.
- (c) Those that share the same order.**
- (d) Those that share the same class.

Questions 4 to 8 are based on the following information.

Melophoris wheeleri is a species of small brown ant that is endemic to Australia. The ants, approximately 5 mm in length, are widespread across the continent and are considered an arid to semi-arid species. *Melophoris wheeleri* are specialist seed harvesters and obligate granivores. The ant species is known to include seeds of exotic plants in their diet. In Western Australia *Melophoris wheeleri* have a distribution ranging from the Pilbara, to the Goldfields, and as far south as Perth. There are three known subspecies; one is common in Perth gardens.

4. *Melophoris wheeleri* would best be classified as a
- (a) producer.
 - (b) primary consumer.
 - (c) secondary consumer.
 - (d) apex predator.
5. According to the morphological species definition, the three subspecies would be distinguished by
- (a) their differences in structural characteristics.
 - (b) their inability to breed and produce viable offspring.
 - (c) differences in spatial distribution.
 - (d) the time they spend within each ecological zone.
6. For *Melophorus wheeleri* to be considered a keystone species
- (a) they must play a critical role in maintaining the structure and function of the ecosystem.
 - (b) a reduction in their numbers must have little impact on the ecosystem survivability.
 - (c) given their relatively low biomass their disappearance would have a greater impact than would be expected.
 - (d) they must have very high numbers and biomass and have a large impact on the survivability of the ecosystem.

Questions 7 to 8 are based on the following information.

A Year 11 student on a Biology field trip in her local council reserve laid five pitfall traps. These were spread across the reserve. Each pitfall trap was set in line with the surface of the soil, had an open surface of 2cm² and contained 10 mL of ethanol. After leaving the set traps for a 24-hour period, the student collected the samples and took these back to the laboratory. When in the laboratory, the student counted a total of 73 *Melophorus wheeleri*.

7. To calculate the density of the ant population, the student would need
- (a) to know the area of the reserve.
 - (b) to know the area where the traps were laid.
 - (c) to know the total area where the ants are active.
 - (d) no more information. The student already has sufficient data.
8. The pitfall traps contained alcohol, which led to the death of captured animals. In this situation the pitfall trapping activity
- (a) required ethics approval because it led to the capture and death of animals.
 - (b) required ethics approval because it had the potential to capture vertebrates.
 - (c) did not require ethics approval because the work was for educational purposes.
 - (d) did not require ethics approval because the traps were designed to capture non vertebrate species.

9. Within southwest Western Australia there are at least 12 ant subfamilies, comprised of 61 genera and at least 500 species. This indicates there is high

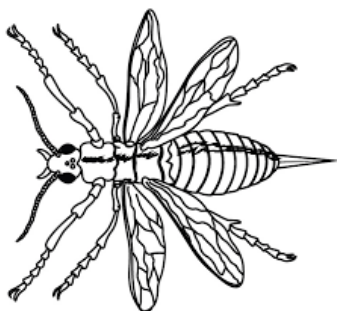
- (a) genetic diversity.
- (b) species diversity.
- (c) ecosystem diversity.
- (d) total biodiversity.

Question 10 refers to the dichotomous key presented below. The key is used to classify insects.

Dichotomous Key for Insects

1a	One pair of wings	go to 3
b	Two pairs of wings	go to 2
2a	Hind wings reduced to tiny knobs	Diptera
b	Hind wings not reduced to tiny knobs	go to 3
3a	Front and hind legs of similar size	go to 4
b	Front and hind legs not of similar size	go to 5
4a	Front and hind wings of similar size	go to 6
b	Front and hind wings not of similar size	Isoptera
5a	Antenna are short and bristly	Odonata
b	Antenna are not short and bristly	Hymenopta
6a	Head visible from above	Mantodea
b	Head covered by hook-like structure	Blattaria

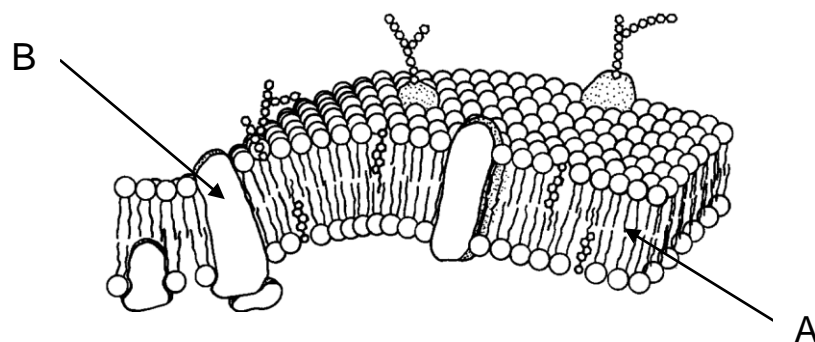
10. Consider the insect illustrated below



The insect illustrated would be classified as

- (a) Odonata.
- (b) Hymenopta.
- (c) Mantodea.
- (d) Blattaria.

Questions 11 and 12 refer to the diagram of the cell membrane presented below.



11. Structure A is best described as a
- (a) double layer of phospho-lipid molecules.
 - (b) layer of globular protein molecules.
 - (c) bi-layer of polar, carbohydrate molecules.
 - (d) fluid arrangement of lipid molecules.
12. Structure B is a
- (a) receptor protein that controls movement of proteins across the membrane.
 - (b) structural protein that stabilises the membrane molecules.
 - (c) gap in the membrane that allows passage for large materials.
 - (d) channel protein that provides for passive transport of materials.
13. Which of the following best describes the term 'metabolism'.
- (a) The sum of physical and chemical processes that occur in an organism and are needed to sustain life.
 - (b) All the chemical reactions that occur in an animal's body.
 - (c) The total of the physical and chemical processes that occur within an animal's body that allow matter to be broken down.
 - (d) The process of cellular respiration that occurs within the cells of plants or animals.
14. Inhibitors slow the rate of enzymatic reactions by
- (a) blocking the active site.
 - (b) distorting the shape of the active site.
 - (c) both (a) and (b).
 - (d) neither (a) or (b).

15. Capillary, adhesion, and cohesion are terms to describe water. Which one of the following has the correct definitions for capillary, adhesion and cohesion?

	Capillarity	Adhesion	Cohesion
(a)	The capacity for particles to stick to a different surface.	The upwards movement of water through fine tubes.	The capacity for particles to stick together.
(b)	The capacity for particles to stick to a different surface.	The capacity for particles to stick together.	The upwards movement of water through fine tubes.
(c)	The capacity for particles to stick together.	The upwards movement of water through fine tubes.	The capacity for particles to stick to a different surface.
(d)	The upwards movement of water through fine tubes.	The capacity for particles to stick to a different surface.	The capacity for particles to stick together.

16. Which of the following best identifies an industrial scale application of the photosynthetic process?

- (a) Local councils collect organic materials from residents' verges. The organic material is composted to produce a high-quality soil improver.
- (b) Grapes are gathered at vineyards and placed in large fermentation vats. Following treatment with yeasts, wine and champagne is produced.
- (c) Following industrial scale farming, the crops are harvested. The grain is used to produce biodiesel for machinery.
- (d) Seaweed is grown in the Southern Ocean. The process increases biomass and combats climate change.

17. Which of the following best identifies the hierarchical organisation within multicellular organisms?

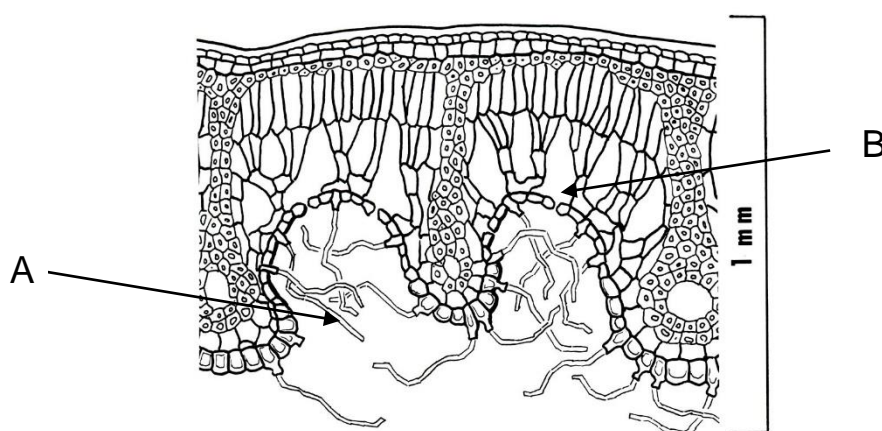
- (a) Organs, tissues, systems and cells.
- (b) Cells, tissues, organs and systems.
- (c) Systems, cells, organs, tissues.
- (d) Tissues, systems, cells and organs.

18. Which of the following below is the correct biomolecule match of the monomer with the correct polymer.

	Carbohydrates	Proteins	Lipids
(a)	Monosaccharide	Amino acid	Fatty acid + glycerol
(b)	Glycerol	Amino acid	Fatty acid
(c)	Amino acid	Monosaccharide	Fatty acid + glycerol
(d)	Monosaccharide	Amino acid	Glycerol

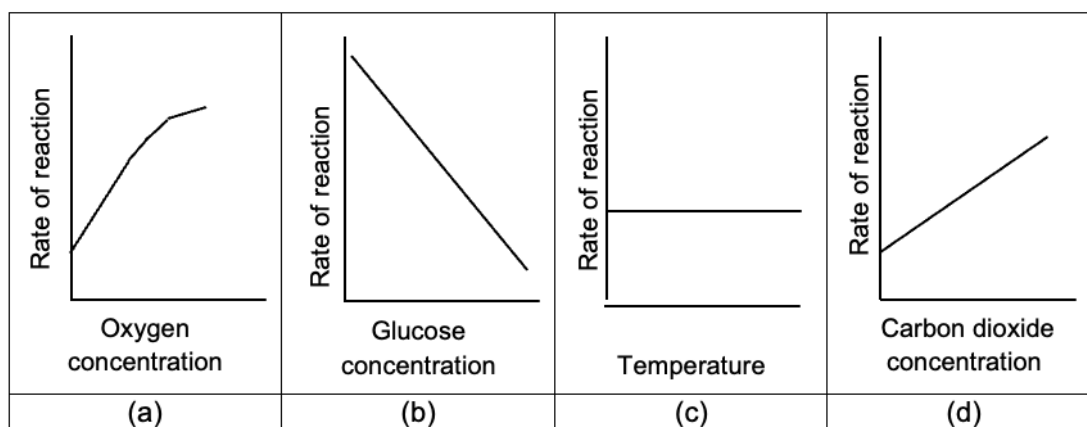
19. Which of the following would suggest a cell is prokaryotic?
- (a) It is single celled.
 - (b) A cell wall is evident.
 - (c) Ribosomes are present.
 - (d) A circular chromosome is visible.
20. Which of the following most correctly identifies root pressure in plants?
- (a) The force exerted by ions within plant roots.
 - (b) The force responsible for water rising through plant's stems.
 - (c) The force exerted by water as it moves sideways into a plants' roots.
 - (d) The pressure that the plants roots apply on the ground as they grow upwards.

Questions 21 and 22 refer to the diagram of a xerophyte leaf cross-section presented below.



21. Structure A is considered a xerophytic adaptation because it will help
- (a) reflect the sun's radiation.
 - (b) create a region of moist air.
 - (c) shield the leaf surface from hot air.
 - (d) close stomates in hottest part of day.
22. The position of structure B is considered a xerophytic adaptation because it
- (a) provides for a physical barrier to evaporation.
 - (b) allows for the closure of stomates during the hottest hours of the day.
 - (c) removes the gas exchange surface from exposure to moving air.
 - (d) enhances the flow of water into the leaf.
23. Biomagnification
- (a) occurs when biodegradable substances are passed between trophic levels.
 - (b) is present in every consumer but is greatest in high order predators.
 - (c) occurs because biomass increases at every trophic level.
 - (d) begins with producers converting light energy to chemical energy.

24. Which graph is true for cellular respiration? **A**



25. Which of the following statements correctly identify phloem tissue?

- (i) Living tissue.
- (ii) Found just below the bark of dicotyledons.
- (iii) Made solely of tracheids.
- (iv) Contains sieve tube cells.
- (v) Transports water and ions around the plant body.

- (a) (i), (ii) and (iii).
- (b) (i), (ii) and (iv).**
- (c) (ii), (iii) and (iv).
- (d) (iii), (iv) and (v).

Questions 26 to 30 are based on the following information.

A group of students investigated the activity of an enzyme, pectinase. They used the method below.

1. Use a permanent pen to mark fifteen 100mL beakers with numbers 1 to 15.
2. Place 50 grams of apple puree into each beaker.
3. Place 2 mL of buffer solution into each beaker.
 - (i) Beakers 1-3 receive 2 mL of buffer pH 3.5,
 - (ii) Beakers 4-6 receive 2 mL of buffer pH 5.5,
 - (iii) Beakers 7-9 receive 2 mL of buffer pH 7.0,
 - (iv) Beakers 10-12 receive 2 mL of buffer pH 8.5 and,
 - (v) Beakers 13-15 receive 2 mL of buffer pH 10.0.
4. Add 1mL of pectinase concentrate to each beaker.
5. Place all beakers into a warm water bath maintained at 30°C for 20 minutes.
6. Remove the beakers from the warm water bath and filter the solutions.
7. Measure the volume of filtrate collected from each beaker.
8. Record all data.

The data was recorded in the table below.

A	Trial 1	Trial 2	Trial 3	Mean	Range
3.5	11	13	12		
5.5	19	20	23	B	
7.0	27	35	29		
8.5	16	4	11		C
10.0	13	14	8		

26. Identify the correct label for the box indicated as **A**.

- (a) Temperature of environment (°C)
- (b) Volume of apple puree (mL)
- (c) pH of solution
- (d) Beaker number

27. Identify the correct value for **B**.

- (a) 21
- (b) 20.6
- (c) 20.66
- (d) 20.67

28. Identify the correct value for **C**.

- (a) 4
- (b) 11
- (c) 12
- (d) 16

29. What type of graph would be most appropriate for this data?

- (a) Line.
- (b) Scatter.
- (c) Column.
- (d) Pie.

30. Identify the best explanation for the experimental results.

- (a) The temperature of the solution impacts the enzyme's active site and alters the rate of the chemical reaction.
- (b) The temperature impacts the speed at which the particles move, thereby impacting the collisions between enzyme and substrate particles.
- (c) The pH is impacting the shape of the enzyme's active site. Changes to the active site affect formation of the enzyme substrate complex.
- (d) The pectinase concentration was changed. More pectinase increases the formation of the enzyme substrate complex and speeds up the reaction rate.

End of Section One

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

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

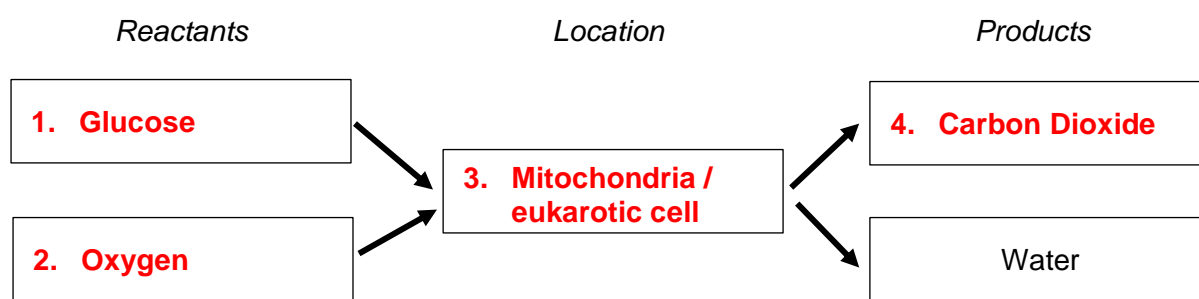
Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

Question 31**[21 marks]**

Cells obtain the energy required for their activities from the chemical process of respiration.

- (a) The model below represents the process of aerobic respiration. Complete the model by placing the correct labels in each box. (4 marks)

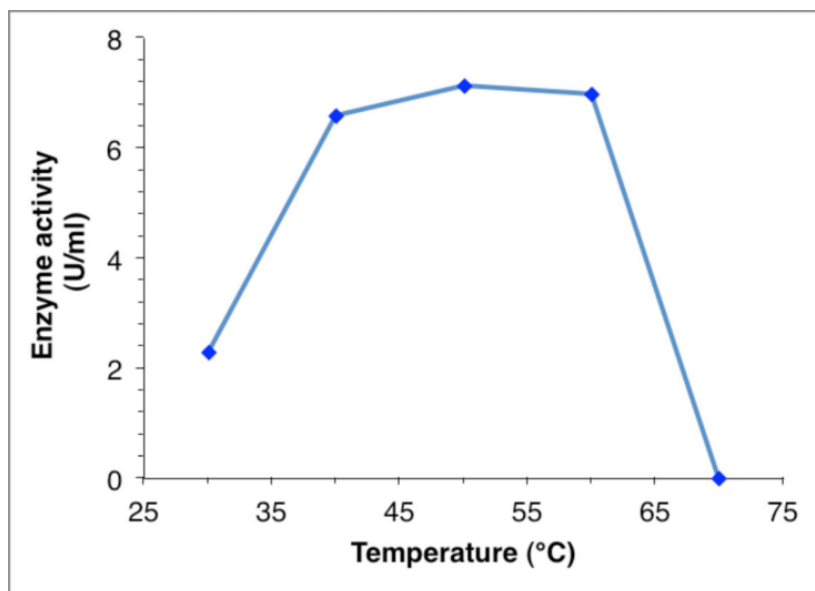


- (b) Describe how anerobic respiration is different when compared to aerobic respiration. (4 marks)

		Marks
Anaerobic	Aerobic	
No oxygen	oxygen	1
Cytoplasm	mitochondria	1
In plants: produces CO ₂ and Alcohol	Produces CO ₂ and water	1
In animals: produces Lactic Acid	produces CO ₂ and water.	1
Total		4

Both aerobic and anaerobic respiration require enzymes. Enzymes are influenced by a variety of conditions.

Examine the graph to the right that shows the effect of one condition on the activity of an enzyme required for respiration.



- (c) Using the “Lock and Key” model of enzyme action, describe and explain what happens to enzyme action above 60°C. (4 marks)

	Marks
Enzyme action decreases rapidly	1
High temperature will denature the enzyme	1
Active site of enzyme is altered	1
Active site of enzyme and substrate no longer match	1
Total	4

Consider the table below that shows the concentration of various ions in the cytoplasm of a marine algal cell and the surrounding seawater.

Ion	Ion Concentration (g/L)	
	Algal Concentration	Seawater
Sodium	18	35
Calcium	28	15
Magnesium	12	9

- (d) (i) Identify and describe the process by which the cell would lose calcium ions from its cytoplasm, into the surrounding seawater. (2 marks)

	Marks
(i) Diffusion	1
Movement of substance from high to low conc. requiring no energy / passive	1
Total	2

- (ii) Identify and describe the process by which the cell would gain magnesium ions from the surrounding seawater, into the cytoplasm. (2 marks)

	Marks
(i) Active Transport	1
Movement of substance from low to high conc. requiring energy expenditure	1
Total	2

Many organelles work together to achieve a combined function.

- (e) Explain how mitochondria, the nucleus, ribosomes, golgi body and endoplasmic reticulum work together to produce extra cellular proteins. (5 marks)

Description	Marks
<ul style="list-style-type: none"> Mitochondria produce energy (in form of ATP) that is needed for the process. Nucleus provides the instructions for protein production. Ribosomes are the site where proteins are made. Proteins are transported through the endoplasmic reticulum. Golgi body modifies and packages the proteins for export from the cell. 	1-5
Total	5

Question 32**[20 marks]**

Worldwide, freshwater lakes are increasingly being affected by algal blooms. This is particularly common in water bodies that receive urban and farm water runoff.

- (a) Identify the cause of the algal blooms. (1 marks)

Description	Marks
Eutrophication / nutrient enrichment / nitrates and phosphates	1
Total	1

- (b) Explain how algal blooms impact the:

- (i) biomass of the freshwater ecosystems. (3 marks)

Description	Marks
<ul style="list-style-type: none"> Biomass of water body will increase. High levels of photosynthesis will lead to an accumulation of autotrophic matter within the water body. Biomass tends to remain trapped/contained within the waterbody – even with death it stays in the lake 	1-3
Total	3

- (ii) biodiversity of the freshwater ecosystems. (3 marks)

Description	Marks
<ul style="list-style-type: none"> Biodiversity of water body will decrease. Anoxic conditions/Little oxygen is available OR there is a limited diversity of autotrophs that act as food for herbivores. In response, very few species can survive. 	1-3
Total	3

- (c) Identify two (2) conservation strategies that could be put in place to reduce the occurrence of algal blooms in freshwater lakes. (2 marks)

Description	Marks
For example: Any four of:	
<ul style="list-style-type: none"> Establishment of nutrient traps around the water bodies (e.g. perennial fringing vegetation) Establishment of large areas of perennial native vegetation in the catchment areas. Targeted application of fertilisers – only apply what is needed, not in excess. Use of slow-release fertilisers. Using machinery to deposit fertiliser in ways to reduce run off into water bodies (E.g. Planting and fertilising on the contour) Ensure soil has wetting agents added to increase water and nutrient absorption and minimise runoff at times of rainfall. Keep stock, pets away from the water's edge (control defecation and urination). Do not let sewage, oil, organic rubbish (such as lawn clippings) etc enter waterways 	1-4
Total	4

Increasingly, we hear that climate change is impacting the Earth's temperature and the concentration of carbon dioxide (CO₂) gases within the atmosphere.

- (d) (i) Identify two natural processes that increase CO₂ levels in the atmosphere. (2 marks)

	Marks
Respiration / Combustion / Decomposition	1 – 2
Total	2

- (ii) Identify two natural processes that decrease CO₂ levels in the atmosphere. (2 marks)

	Marks
Photosynthesis / Dissolve in oceans / Coral creation	1 - 2
Total	2

- (e) Outline the human activities that can lead to elevated carbon levels in the earth's atmosphere. (4 marks)

	Marks
Deforestation	1
Elevated levels of burning fossil fuels to produce CO ₂	1
Industrialised agriculture that generates excess CH ₄	1
Industrial processes that produce other "greenhouse" gasses	1
Total	4

- (f) Explain how the expected overall changes in the Earth's temperature will impact the dissolved carbon dioxide in the freshwater bodies. (3 marks)

Description	Marks
Either	
<ul style="list-style-type: none"> More CO₂ in the air will lead to an increasing level of CO₂ dissolving in the water body. More CO₂ in the water will lead to an increase in biomass of autotrophs. This conversion of CO₂ to cellular matter will assist to stabilise CO₂ levels in the waterbody OR <ul style="list-style-type: none"> Higher temperatures will reduce the water bodies capacity to hold CO₂. Less CO₂ in the water will decrease autotroph biomass. Less conversion of CO₂ to cellular matter will assist to stabilise CO₂ levels in the waterbody 	1-3
Total	3

Question 33**[20 marks]**

All organisms carry out gas exchange.

- (a) In the table below, identify the gas or gases taken in and released by heterotrophs and autotrophs. (4 marks)

	Heterotrophs	Autotrophs
Gas or gases taken in.	oxygen	Carbon dioxide Oxygen
Gas or gases released.	Carbon dioxide Water vapour	Carbon dioxide Oxygen Water vapour

Multicellular animals carry out gas exchange through a variety of structures including spiracles, gills, alveoli and skin.

- (b) Identify two (2) structural characteristics of an efficient gas exchange system. (2 marks)

Description	Marks
Any five of:	
<ul style="list-style-type: none"> Large surface area Constant flow of gases over the surface High levels of vascularisation Difference in concentration between the sides of the membrane Moist Thin and permeable Diffusion takes place over very short distances 	1-2
Total	2

- (c) Arthropods use spiracles, trachea and tracheoles to enable gas exchange. Explain how oxygen and carbon dioxide are exchanged between the air and tissues of the arthropod. (3 marks)

Description	Marks
<ul style="list-style-type: none"> Spiracles are small holes found alongside the thorax and abdomen of the body. Each spiracle is linked to one or more trachea. Trachea branch into many fine walled tracheoles. Tracheoles extend deep between the cells of the body Tracheoles are the site of gas exchange 	1-3
Total	3

Angiosperms have adaptations that enable gas exchange at the roots, stems and leaves.

- (d) Explain the process that allows angiosperms to perform gas exchange at their leaf surfaces. (4 marks)

Description	Marks
<ul style="list-style-type: none"> This is achieved via the opening of the stomata. Plants pump K^+ into the guard cells of the stomata. This allows water to move into guard cells by osmosis. As the guard cells become turgid, the stomatal pore is opened 	1-4
Total	4

Many animals and plants employ an internal transport system of some nature to provide cells with their requirements. In most instances, these internal transport systems will be made up of a pump, transport vessels and a transport medium.

- (e) Outline the similarities and differences between an amphibian's heart, with that of a mammal. (4 marks)

	Marks
Similarities:	
Both frogs and cats have two atria	1
Both separate oxygen-rich and oxygen-poor blood in atria	1
Differences:	
Frog does not have a ventricular septum but cats do	1 - 2
Frog mixes oxygen-rich and oxygen-poor blood in the ventricle but cats maintain separation	
Frog has a single ventricle but cats have two ventricles	
Total	4

- (f) In organisms that need an internal transport system, cell requirements are transported via a transport medium. Identify the transport medium used in: (3 marks)

Arthropods: **Haemolymph**

Fish: **Blood**

Trees: **Sap**

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Question 34**[20 marks]**

An oyster farmer wanted to explore the possibility of farming his oysters in large tanks, located in a shed on his property. Currently, he farmed his oysters in a natural tidal estuary. A biologist suggested that he would need to conduct a number of investigations to determine the optimum strength of current needed to replicate the tidal estuary required to grow oysters.

The farmer followed the biologist's advice and obtained four, large tanks, filled each tank with water from the estuary and stocked each tank with 250 oysters. At the start of the investigation, the average biomass of the oysters in each tank was 1.30 grams.

The farmer began to record data, after one month. All oyster survived the investigation.

The results from one of these investigations is presented in the table below. Use this data to answer parts (a) – (e) below.

Tank	Strength of Current (m/min)	Average Oyster Biomass (g)		
		One Month	Two Months	Four Months
1	2.0	3.10	4.20	6.30
2	8.0	2.50	3.80	4.20
3	20.0	2.20	2.40	3.40
4	25.0	1.50	1.70	2.50

- (a) (i) State the: (2 marks)

Independent Variable: **Current**

Dependent Variable: **oyster biomass**

- (ii) State the hypothesis under investigation. (2 marks)

	Marks
variables	1
Linking relationship	1
Eg. low currents will increase oyster biomass	
Total	4

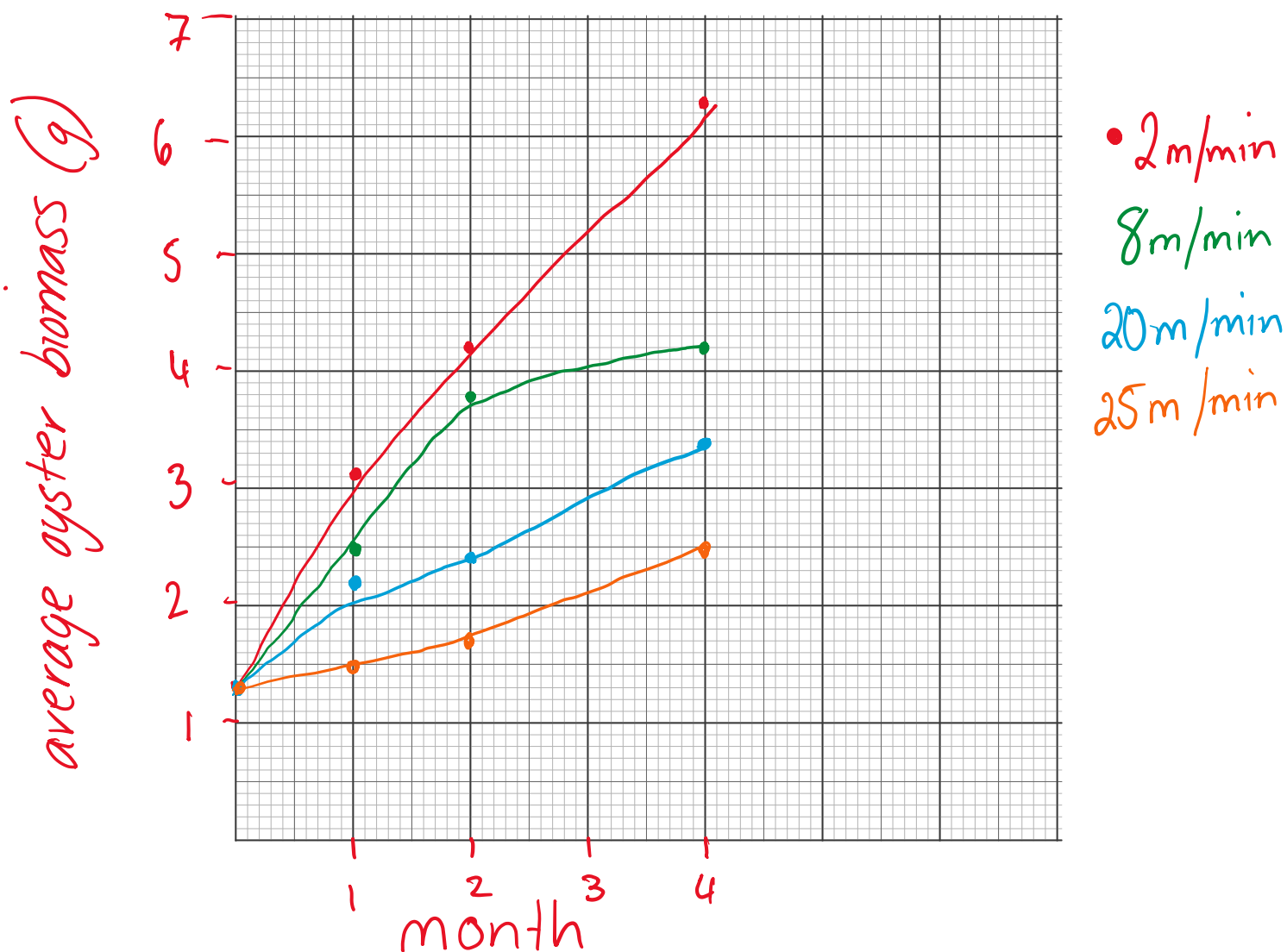
- (b) (i) Can the data collected in this investigation be considered reliable? Explain why. (2 marks)

Yes	1
Large sample size / 250 Oysters studied	1

(c) On the graph paper provided, plot the data obtained at 4 months.

(6 marks)

A spare grid is provided at the end of this booklet if you make an error and wish to have a second attempt. If you use the spare grid, clearly indicate that you have used it and cancel your work on this page.



- (d) Using data from the table or graph to support your answer, state a likely conclusion the farmer could draw from this investigation. (4 marks)

	Marks
Faster growth rates will occur in lower currents	1
At a current of 2.0 m/min the biomass of oysters reached 6.3 g, but	1
At a current of 25.0 m/min the biomass of oysters reached 2.5 g	1
The data shows a steady/constant decrease in oyster biomass between a current of 2.0 m/min and 25.0 m/min	1
Total	4

- (e) (i) Consider Tank 2. Calculate the average monthly growth rate of the oysters, over the four-month period of the investigation. Show your working. (2 marks)
- (ii) Consider Tank 2. Calculate the total biomass of the oysters in the tank, after the four-month period of the investigation. Show your working. (2 marks)

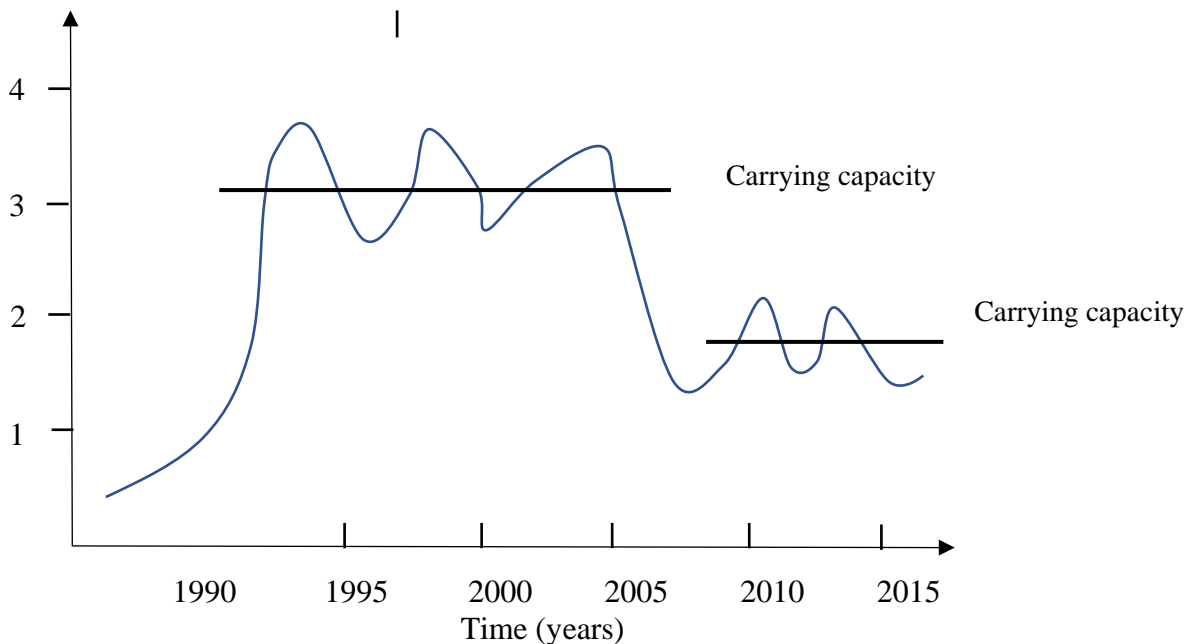
	Marks
(i) Average monthly growth rate = $(1.2 + 1.3 + 0.4) / 4$	1
Average monthly growth rate = 0.725 g	1
(ii) Total biomass = 250×4.20	1
Total biomass = 1,050 g	1
Total	4

Question 35

[19 marks]

During the 1980s, a team of biologists noted that a population of marsupial mice on the West Australian mainland were experiencing a drastic decline in numbers. It was decided to take a small sample of the population and introduce them into a nature reserve. Over the following 30 years the population size of the marsupial mice were monitored.

The population data for these mice is shown on the graph below. Use this data to answer parts (a) - (c) below.



- (a) Estimate the carrying capacity of the nature reserve between 1992 and 2005 and compare this to the carrying capacity of the nature reserve between 2007 and 2015. On the graph, indicate how you determined these values. (3 marks)

	Marks
Carrying capacity, 1992 – 2005 is between 300 - 310 mice	1
Carrying capacity, 2007 – 2015 is between 170 – 190 mice	1
Indicated on graph	1
Total	3

- (b) (i) List two **density dependent** factors that could lead to the population change indicated on the graph between 1990 and 1993. (2 marks)
- (ii) List two **density independent** factors that could lead to the population change indicated on the graph between 2005 and 2007. (2 marks)

	Marks
(i) Little competition, little predation, abundant territory, abundant resources	1 - 2
(ii) Natural disaster, emigration, extreme physical conditions, introduced predator	1 - 2
Total	4

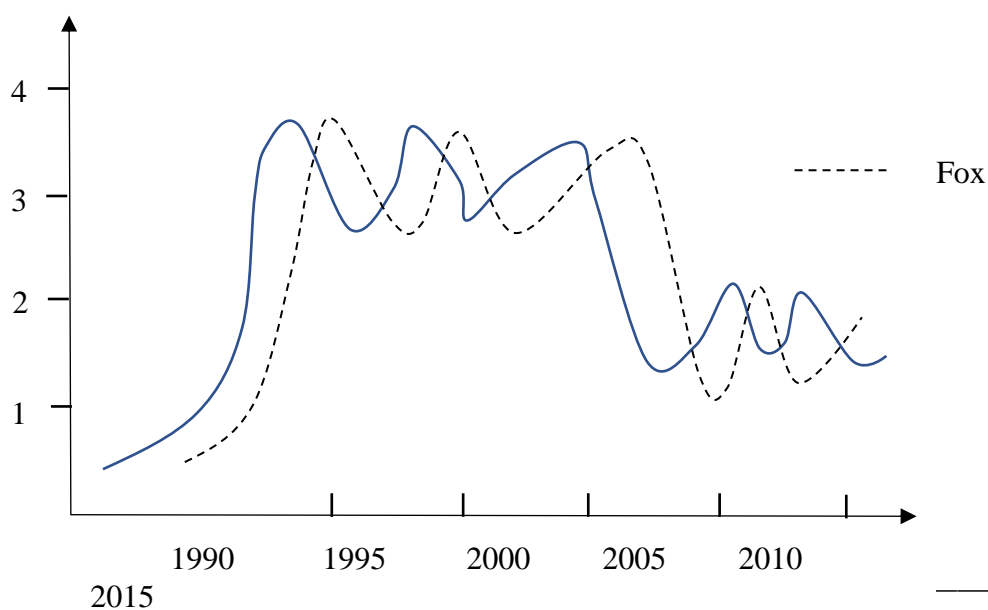
- :
- (c) Name and describe the sampling technique used to estimate the population size of the marsupial mice. (4 marks)

	Marks
Capture/Mark-Recapture Technique	1 - 4
Perform an initial capture	
Tag the initial capture	
Release initial capture	
Use formulae: $\frac{\text{No. first capture} \times \text{No. re-capture}}{\text{No. tagged in re-capture}}$	
Total	4

Over the period of the study, the biologists noted that predation by foxes was a significant factor that Influenced the size of the marsupial mice population.

- (d) (i) On the graph provided at the start of this question, indicate the likely size of the fox population in this nature reserve. (1 mark)
- (ii) Name and explain one strategy that could be employed to limit the effect of foxes. (3 marks)

	Marks
Fox population graphed correctly	1
Baiting	1
Shooting	1
Fencing nature reserve	1
Total	4



In studying the marsupial mice and their community, the biologists examined a variety of interactions between the species present in the nature reserve.

- (e) Consider the brief description of some of these interactions below and classify them as a biological relationship. (4 marks)

- (i) A number of jarrah trees were covered by large numbers of fungi. _____
- (ii) An examination of some marsupial mice revealed ticks buried in their skin. _____
- (iii) At times, the rocks used for shelter by marsupial mice were overtaken by Bobtail lizards. _____
- (iv) The foraging of the marsupial mice dislodged small beetles that were often eaten by small birds. _____

	Marks
(i) Saprophytism	1
(ii) Parasitism / Host-Parasite	1
(iii) Predator-Prey / Interspecific competition	1
(iv) Commensalism	1
Total	4

End of Section Two

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

Section Three consists of four questions.

This section contains four (4) questions. You must answer **two (2)** questions; one (1) from Unit 1 and one (1) 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.

Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

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 27– 30. When you have answered your first question, turn to page 31 and indicate the second question you will answer on that page.

Question 36
(20 marks)

Ecosystems are dependent on an energy source, energy transformations and transfers between trophic levels. In most ecosystems, the primary source of energy is solar.

- (a) Explain how energy enters, moves through and exits ecosystems. Include a discussion of three ways that energy is used in the bodies of living things (10 marks)

Description	Marks
Enters ecosystem	
<ul style="list-style-type: none"> Light energy is used to build energy rich carbohydrates 	1
Moves through	
<ul style="list-style-type: none"> Passed from one trophic level to the next in the form of food. 10% passed on through feeding relationships. 	1-2
Energy is used	
Energy is used for organisms to do work	1
More detail on three of the following points <ul style="list-style-type: none"> Movement Active transport Cellular reproduction Thermoregulation 	1-3
Exits ecosystem	
<ul style="list-style-type: none"> 90% is lost as the organism goes about essential life processes Provides at least one example for how energy is lost - for example, urine, faeces, skin, hair. Ultimately all energy that comes in as light energy is lost in the form of heat 	1-3
Total	10

Many biologists consider the loss of biodiversity on a global scale is the most pressing environmental issue of our generation.

- (b) Outline the causes of this biodiversity loss and outline possible solutions that could be implemented to slow this loss. (10 marks)

	Marks
Loss of biodiversity can be due to:	1 - 5
Pollution that degrades environment	
Industrial wastes / Heavy metals that degrade water and soil	
Habitat destruction	
As a result of mining / housing / agricultural activities	
Introduction of non-native species that out-compete / prey upon native species	
Hunting / poaching activities	
Global warming leading to rising sea levels / altered climates	
Strategies to reduce loss of biodiversity can include:	1 - 5
The creation of national parks and refuges	
Reduce hunting/fishing seasons	
Improved technology regarding recycling	
Reforestation	
Captive breeding programs	
Gene/seed banks	
Public awareness campaigns	
Global agreements and treaties to protect the environment	
Legislation that controls habitat destruction	
Development of renewable energy sources	
Total	10

OR

**Question 37****(20 marks)**

All biomass contains carbon, hydrogen and oxygen. Other elements, including nitrogen and phosphorus, are also frequently contained.

- (a) Using carbon as an example, explain the movement of biomass through the living and non-living components of ecosystems. (10 marks)

Description	Marks
Biomass defined	
<ul style="list-style-type: none">Dry mass of carbon rich matter locked in the bodies of organisms	1
Carbon uptake into ecosystems.	
<ul style="list-style-type: none">Producers/autotrophs use light energy and the process of photosynthesisTo build organic energy rich carbohydrate compounds (these contain C)From inorganic carbon dioxide (contains C) and waterCarbohydrates may then be converted to other carbon rich organic compounds including nucleic acids, fats and proteins.	1-3
Carbon moves through living component of ecosystems.	
<ul style="list-style-type: none">Passed from one trophic level to the next in the form of foodThrough feeding relationships/ via consumptionSome carbon rich materials are not eaten directly, enter detritivore food chain.Some carbon rich materials are not eaten directly, are food for decomposers.	1-3
Carbon released into abiotic component of ecosystems.	
<p>This is a result:</p> <ul style="list-style-type: none">of cellular respirationdecompositionburningacid breakdown of CaCO_3 rich compounds in water bodies	1-3
Total	10

"Fire is a dynamic factor that may have positive or adverse impacts on the environment."

- (b) Considering the Australian context, discuss the above statement and the impacts fire can have on biodiversity. (10 marks)

Description	Marks
Fire is a dynamic factor	
<ul style="list-style-type: none"> It can lead to considerable change within ecosystems. The impact of fire is very dependent on weather conditions. Abiotic factors such as windspeed, precipitation and topography impact fires dynamic nature Fuel factors (moisture content, particle size, vegetation height, fuel bulk, amount of dead/dry organic matter) also impact fires dynamic nature. 	1-4
Three negative impacts in the Australian context are discussed.	
<ul style="list-style-type: none"> Generalised loss of biodiversity. Loss of animals. Destruction of habitat. Destruction of fire sensitive plant species. Increased release of carbon into atmosphere and reduced uptake of carbon from atmosphere. 	1-3
Three positive impacts in the Australian context are discussed.	
<ul style="list-style-type: none"> Removes slow growing dominant trees and shrubs Clears space for other organisms Returns/recycles nutrients into the soil Leads to germination of plant species - open up seed pods, leads to establishment of grasses Attracts new mobile species into the area May reduce pests/pathogens Encourages fire tolerant species 	1-3
Total	10

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) Chloroplasts are complex organelles with distinct compartments that carry out the different phases in photosynthesis. Identify these compartments and outline the photosynthetic processes that occur in each one. (10 marks)

	Marks
Light dependent phase / Light phase	1 - 5
Occurs in grana of chloroplast	
Light energy captured	
Water molecule split	
Oxygen is given off as by-product	
ATP produced	
Hydrogen used in dark phase to produce glucose	
Light independent phase / Dark phase	1 - 5
Occurs in stroma of chloroplast	
CO ₂ from atmosphere	
Hydrogen from light phase	
Energy stored as ATP from light phase is released	
Used to synthesis glucose from carbon, oxygen and hydrogen	
Total	10

- (b) Compare and contrast the digestive system of a sea anemone, a sheep, and a dog.
(10 marks)

	Marks
Sea Urchin:	
One body opening	1
Gastro-vascular cavity	1
In which food is digested, absorbed and then expelled	1
Sheep:	
Two body openings	1 - 4
Very long complex digestive system with different organs	
Diet of plant matter/cellulose that requires extensive mechanical and chemical digestion	
Therefore, there are a number of stomachs and very long intestines / microbiol digestion in long caecum.	
Dog:	
Two body openings	1
Long, complex digestive system with different organs	1
Less complex than herbivore	
Because diet requires the breakdown of large organic food substances, mainly meat.	1
Total	10

OR

Question 39
(20 marks)

- (a) While it is important that substances move in and out of cells, the rate at which this occurs is impacted by the surface area to volume ratio, concentration gradient differential, and the chemical or physical nature of the materials being exchanged.

Using examples, explain how each factor impacts the movement of substances.

(10 marks)

Description	Marks
Surface area to volume ratio	
<ul style="list-style-type: none"> The larger the surface area to volume ratio the faster the exchange of substances. Large surface area to volume ratio is achieved by cells being very small. Large surface area to volume ratio is achieved by cells being very flattened or having folded surfaces. Student provides a supporting example of a material that is exchanged more readily by having a large surface area to volume ratio. 	1-4
Concentration gradient differential	
<ul style="list-style-type: none"> The larger the concentration gradient differential the more readily substances will passively move from one side of a membrane to another. Uses a suitable example 	1-2
Chemical nature of the materials being exchanged	
<ul style="list-style-type: none"> Certain chemical compounds are moved more favourably across membranes. For example, lipid soluble molecules become dissolved in the phospholipid bilayer and move through this pathway with ease. For example, larger water-soluble molecules (such as glucose) move by facilitated diffusion through the channel proteins. 	1-2
Physical nature of the materials being exchanged	
<ul style="list-style-type: none"> For example, very small molecules can diffuse readily through gaps in the phospholipid molecule, while larger molecules will move more slowly via endo or exocytosis 	1-2
Total	10

- (b) The transport of materials within a multi-cellular animal's internal environment is enabled by open or closed transport systems.

Identify animals that have open systems and others that have closed systems. Describe the structural characteristics of each system, and explain the positives and negatives associated with each system. (10 marks)

Description	Marks
Relevant examples	
<ul style="list-style-type: none"> Open System - Chooses an appropriate example, e.g an Insect and closed System - Chooses an appropriate example, e.g a Vertebrate 	1
Structural characteristics	
<ul style="list-style-type: none"> Both have a fluid that is pumped around Known as haemolymph in animals with open systems and blood in animals with closed systems Both have one or more hearts, these act as pumps. Both have valves in the hearts to prevent backflow of blood Animals with open systems have an incomplete network of blood vessels, animals with closed systems have a complete network of blood vessels and blood is kept within these at all times. Animals with closed systems keep blood flowing in a constant direction via a pathway of arteries, capillaries and veins 	1-6
Positives	
<ul style="list-style-type: none"> Open systems are less complex systems that would 'cost' the body less to build 	1
Negatives	
<ul style="list-style-type: none"> Open systems are relatively inefficient compared with closed systems due to high levels of mixing. This means animals cannot be as active. This means animals cannot grow to the same size as those with open systems 	1-2
Total	10

End of question