

Student name: _____

Teacher: _____

NORTH SYDNEY GIRLS HIGH SCHOOL



2019

Preliminary Course

Examination

BIOLOGY

General Instructions

- Reading Time – 5 minutes
- Working Time – 2 hours
- Write using black or blue pen
- Draw diagrams using pencil
- NESA approved calculators may be used
- Write your **teachers name and your own name** at the top of this booklet **AND** the multiple choice answer sheet.

Total Marks – 70

Section I – 20 Marks

- Attempt Questions 1- 20
- Allow about 35 minutes for this part

Record your answer on the Multiple Choice Answer Sheet

Section II – 50 marks

- Attempt questions 21-32
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Write your answers in the space provided.

Adequate lines have been provided.

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Attempt all questions

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Use the multiple-choice answer sheet provided for Questions 1-20.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

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If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

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correct

1. The structural components of an organism have a hierarchical organisation.

Which one of the following is the lowest in that hierarchy?

- (A) Organ
- (B) System
- (C) Organelle
- (D) Cell

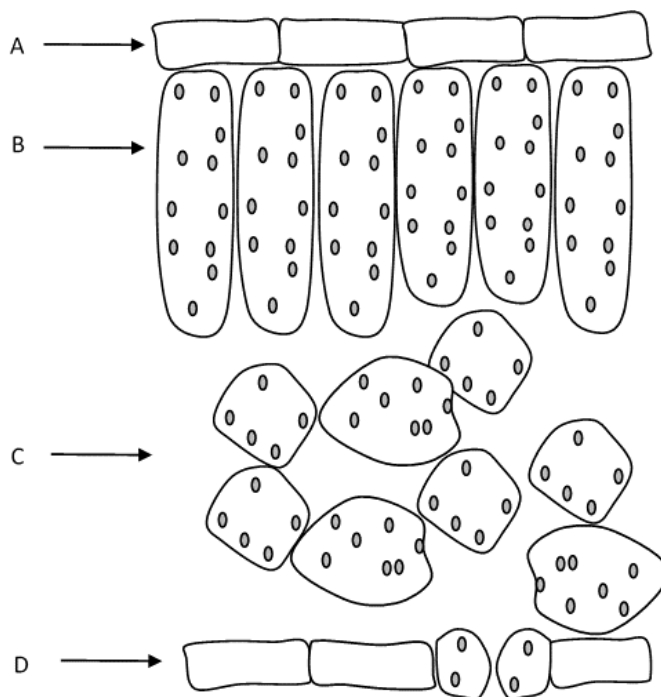
2. What is the main energy-carrying molecule used directly in cell processes?

- (A) ATP
- (B) DNA
- (C) Lipids
- (D) Complex carbohydrates

3. Cells are the basic structural unit of all living things. Cell membrane, DNA and ribosomes are important structural features of cells. Select the correct function for each structural feature.

	Cell membrane	DNA	Ribosomes
(A)	Responsible for the synthesis of proteins.	Separates the interior of the cell from the outside environment.	Carries the hereditary information and directs the cell's activity.
(B)	Separates the interior of the cell from the outside environment.	Carries the hereditary information and directs the cell's activity.	Responsible for the synthesis of proteins.
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(D)	Responsible for the synthesis of proteins.	Carries the hereditary information and directs the cell's activity.	Separates the interior of the cell from the outside environment.

4. Questions 4 and 5 refer to the drawing of a section through a leaf below.



Which tissue is the main site of photosynthesis?

- (A) A
- (B) B
- (C) C
- (D) D

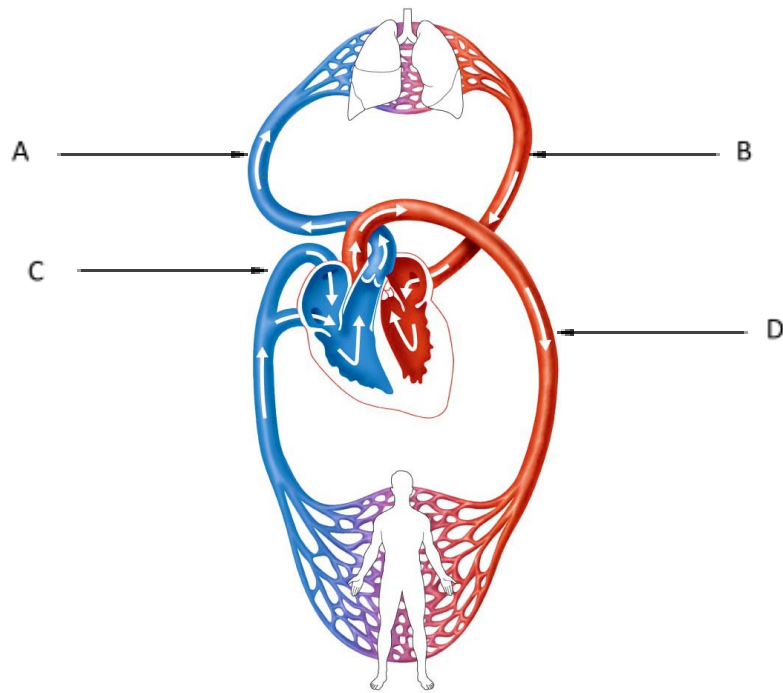
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6. Which list identifies only abiotic factors?

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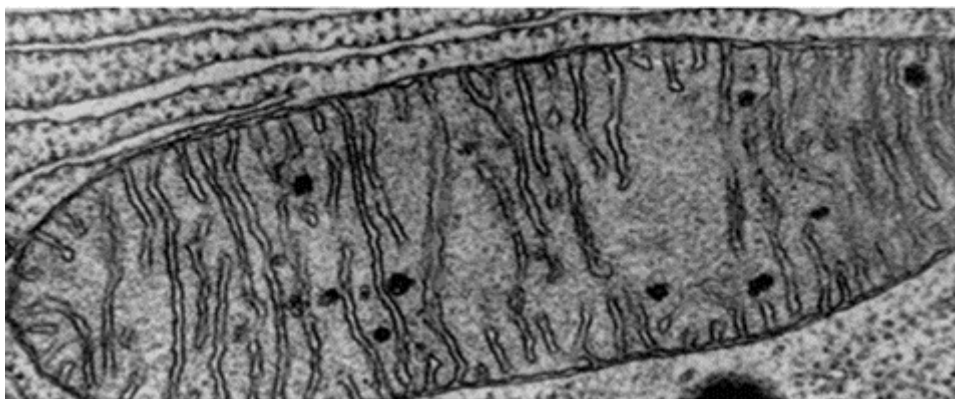
7. Refer to the picture of the human circulatory system below.



Four blood vessels are labelled A-D. Identify the pulmonary artery.

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8. The photomicrograph below shows a cell organelle.



Identify its main function within the cell.

- (A) Photosynthesis
- (B) Protein synthesis
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9. This word equation summarises the process of photosynthesis.

carbon dioxide + water $\rightarrow$ X + oxygen

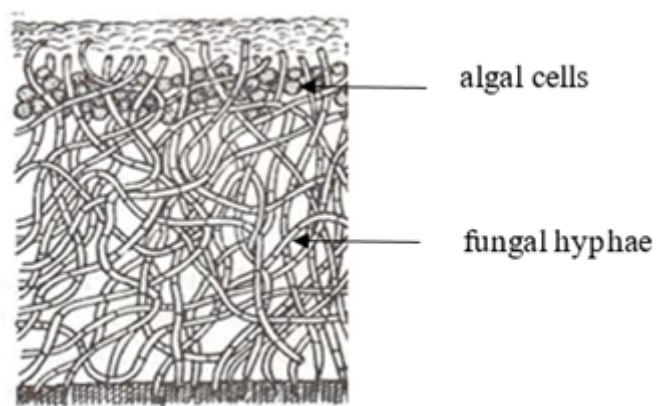
Which is the missing product X?

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10. Lichens are a widespread group of organisms which grow in many different environments.

Microscopic examination of a lichen shows that it consists of a fungus and an alga living in an association.

The diagram below shows the internal structure of a lichen.



There are two schools of thought amongst lichen biologists.

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	Group A	Group B
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commensalism

mutualism

11. Which one of the following lists contains just human-induced selection pressures which have the potential to lead to extinction of species?

- (A) habitat destruction, volcanic eruption, climate change.
- (B) water pollution, atmospheric warming, sea-level rise.
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12. Palaeontologists wishing to date bones from a fossil site, decide to employ C-14 dating.

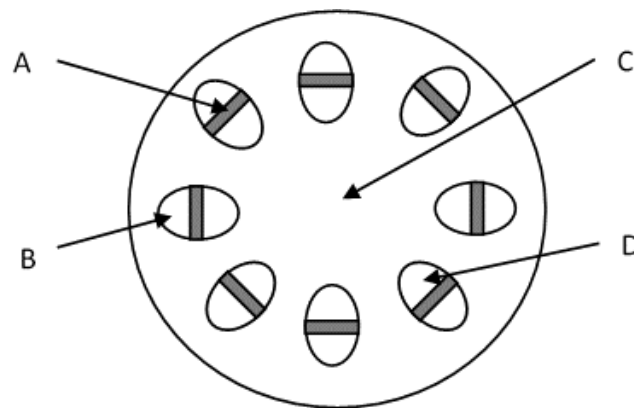
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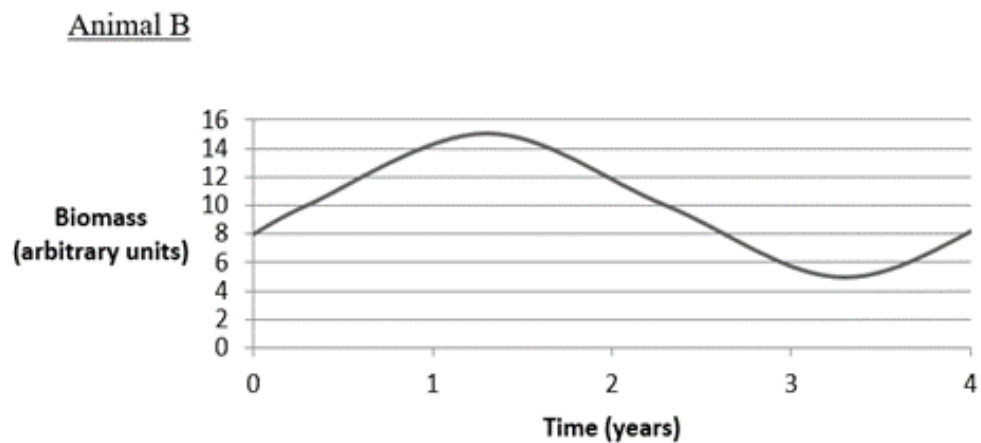
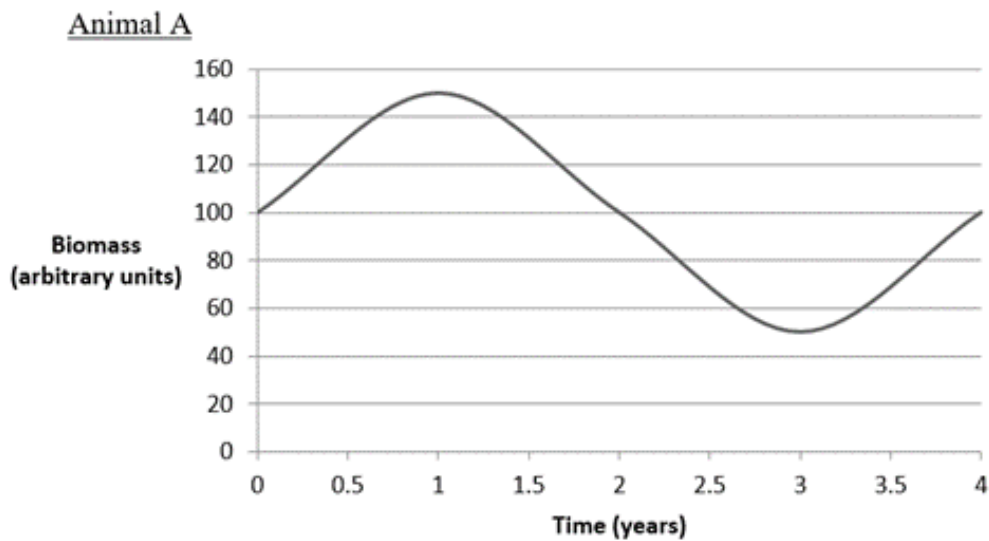


Which tissue is responsible for the transport of sugars throughout the plant?

- (A) A
- (B) B
- (C) C

(D) D

14. The graphs below show how the populations (represented as biomass) of two species of animal varied in a particular ecosystem over four years.



Which one of the following ecological relationships do these graphs most likely represent?

- (A) Competition between species A and B for nest sites.
- (B) Competition between species A and B for food.
- (C) Predator/prey, where species A is the predator and species B is the prey.
- (D) Predator/prey, where species B is the predator and species A is the prey.

15. Many bees, wasps and hornets have a similar yellow and black colouration.

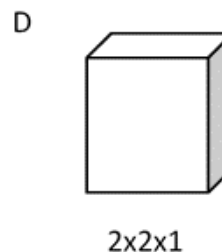
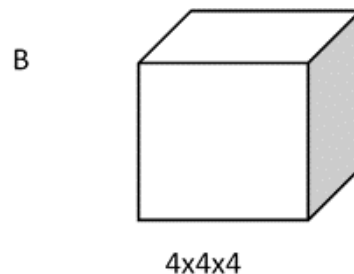
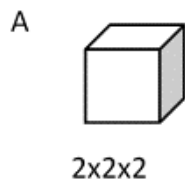
This colouration warns potential predators that if they attack the insect, they risk being stung.



Which one of the following is most likely the selecting agent that has brought about this uniformity of colouration?

- (A) The prevalence of yellow flowers.
- (B) The highly painful nature of their stings.
- (C) The presence of visually hunting predators.
- (D) The fact that most pollen is yellow.

16. The four drawings below represent four different cells.



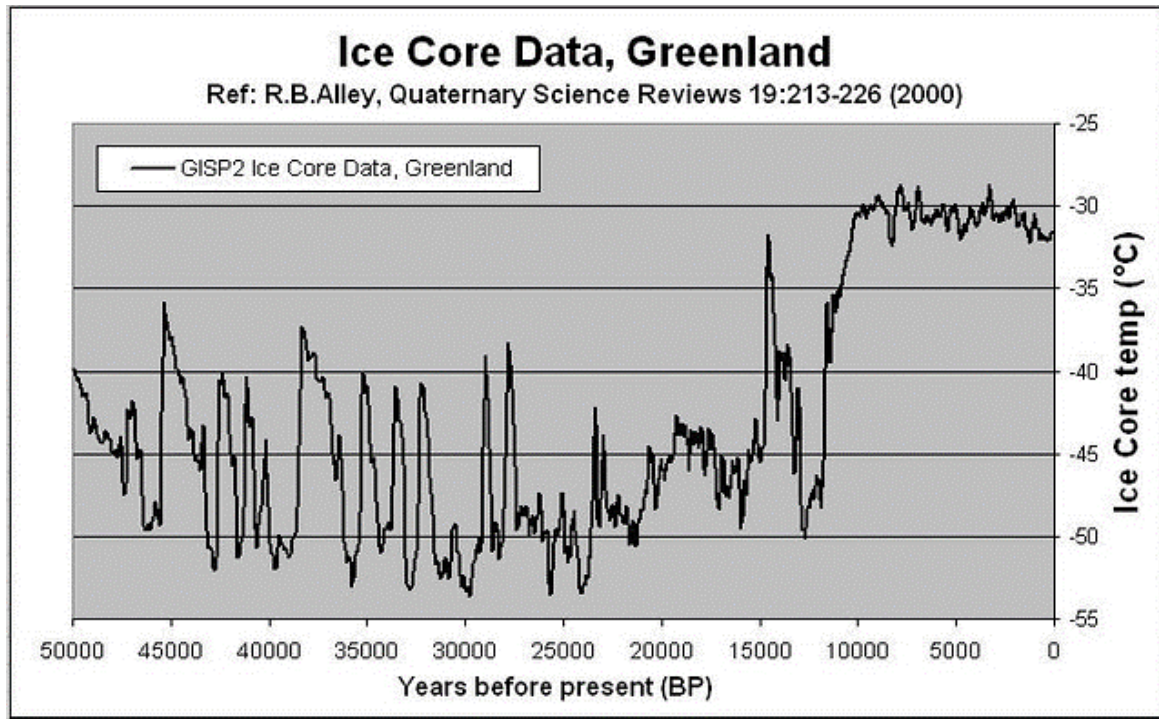
Their dimensions are given in arbitrary units.

Assuming that the requirements of a cell are a function of its volume, and the rate at which a cell can exchange materials with its environment is a function of its surface area, which cell would be able to most efficiently exchange materials with its environment?

- (A) A

- (B) B
- (C) C
- (D) D

17. The graph below shows Ice Core Temperature (°C) from data gathered in Greenland.



Which statement best identifies the trend shown in the graph?

- (A) Ice core temperature is constantly rising.
 - (B) Ice core temperature rises and falls in a cyclic manner.
 - (C) Ice core temperature peaks approximately every 15 000 years and averages 40 °C.
 - (D) Ice core temperature has significantly increased in the last 10 000 years and averages -32 °C during this time period.
18. The Sugar glider *Petaurus breviceps* is an Australian marsupial that has membrane structures between its forelimb and hindlimb used for gliding, similar to those found in the American placental mammal, the flying squirrel.

What concept from the Theory of Evolution best explains these similarities?

- (A) Both species have evolved from a common ancestor and retain the same vestigial structures.
- (B) Both species were subjected to similar environmental conditions that led to analogous structures being selected for.
- (C) Both species were subjected to the same environment that led to identical behaviours being developed.

- (D) Both species have evolved from a common ancestor and were required to escape the same species of predator.

19. Which of the following describes the functions of body systems listed?

<i>SYSTEM</i>			
	<i>Respiratory</i>	<i>Excretory</i>	<i>Circulatory</i>
(A)	Removal of wastes from the body	Produce energy by burning glucose in oxygen	Exchange of CO ₂ and O ₂
(B)	Exchange of CO ₂ and O ₂	Removal of wastes from the body	Produce energy by burning glucose in oxygen
(C)	Transportation of nutrients to and wastes away from cells	Exchange of CO ₂ and O ₂	Produce energy by burning glucose in oxygen
(D)	Exchange of CO ₂ and O ₂	Removal of wastes from the body	Transportation of nutrients to and wastes away from cells

20. A student is investigating the activity of enzymes in cells.

Which publication is most likely to be a valid and reliable source of information?

	<i>Publication</i>	<i>Year last published</i>	<i>Reviewed by</i>	<i>Reference list</i>
(A)	Protos	2018	Science reporter and editor	Absent
(B)	Popular Biology	2001	Editor	Present
(C)	Molecular	2017	A panel of scientists	Present
(D)	Cell	1971	University lecturers	Present

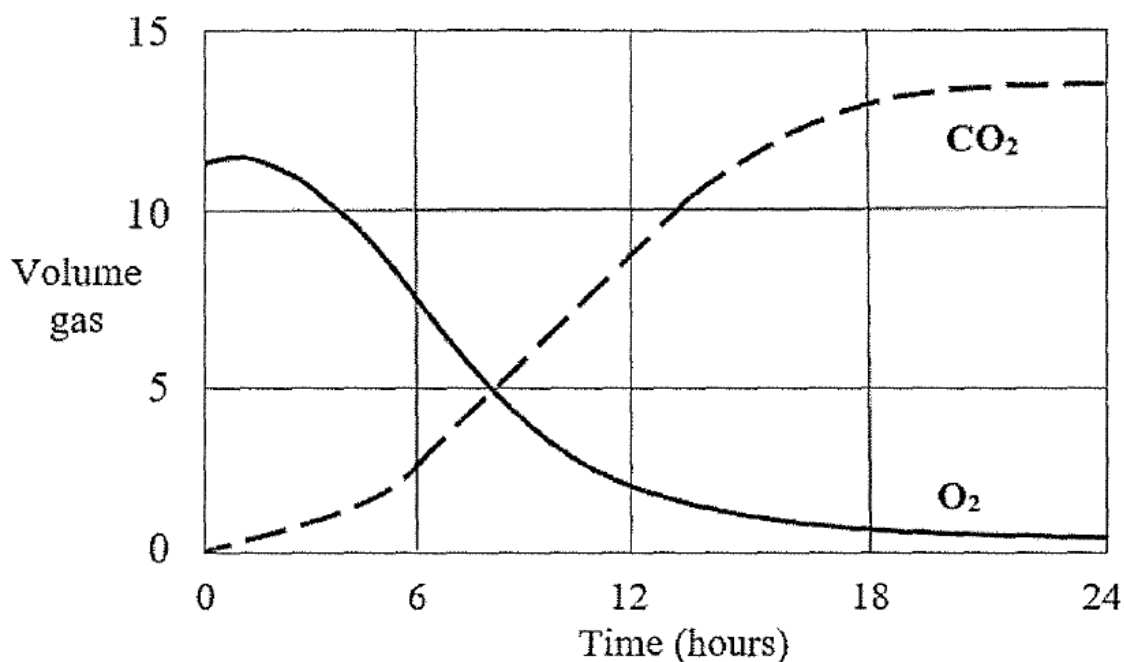
End of Section I

Section II - 50 Marks**Marks****Attempt Questions 21- 32****Allow about 1 hour and 25 minutes for this section.**

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

Question 21 (4 marks)

A group of nectar eating insects were placed into a flask along with some sugar. The flask was capped and after 24 hours all the sugar was gone. The levels of oxygen and carbon dioxide were monitored over this period. A graph of the results is shown below.



a) Describe the trends shown in the graph.

2

b) Explain the biological process represented in the graph.

2

Question 22 (3 marks)

Compare the structure and function of the vascular system in woody-stemmed plants to the circulatory system in humans.

3

Question 23 (3 marks)

A virus was used to kill a species known as *Bebbingtoni leviosa*. It was spectacularly successful, reducing *B. leviosa* numbers across the country by around 95%. The virus is still prevalent today but far fewer *B. leviosa* die from it.

Explain how this could have come about.

3

Question 24 (4 marks)

Ammonite fossils are commonly used as index fossils to determine the relative time periods of existence for particular organisms.



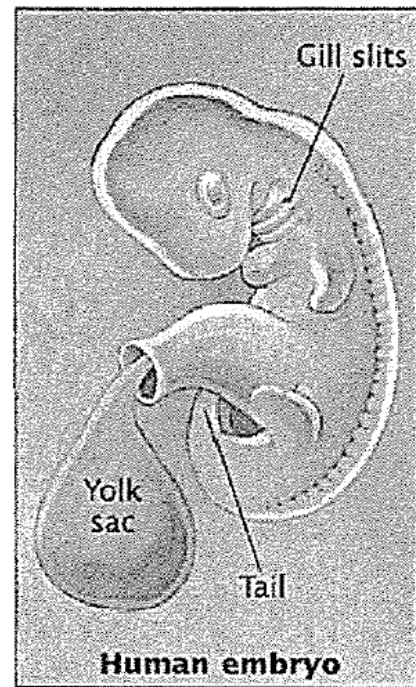
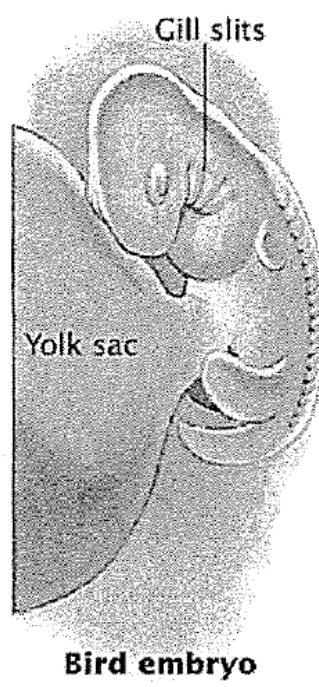
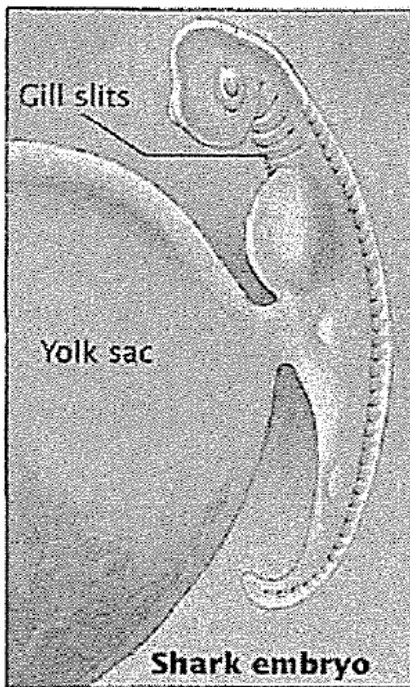
Distinguish between the use of index fossils in dating and the process of absolute dating for fossils.

4

Question 25 (3 marks)

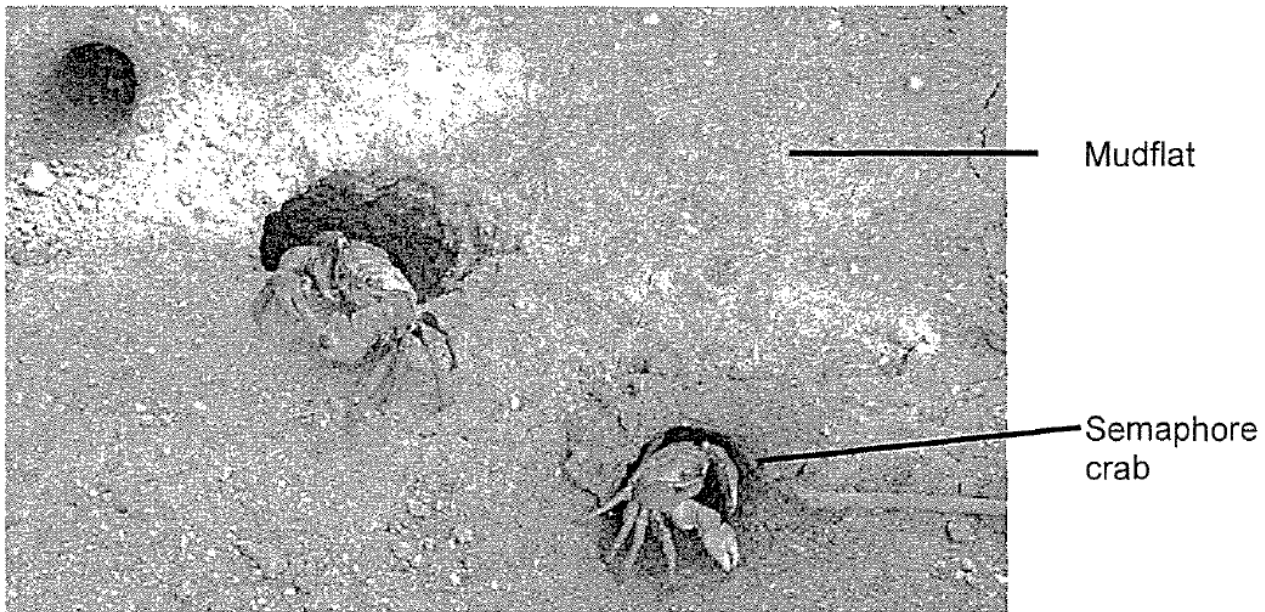
Explain the evolutionary significance of the three pictures shown below.

3



Question 26 (5 marks)

A group of students were taken on an excursion to a mangrove ecosystem that is inhabited by large numbers of semaphore crabs. These crabs build holes in the mud where they hide during high tide.



- a) Justify a sampling technique to measure the abundance of crabs in these mudflats.

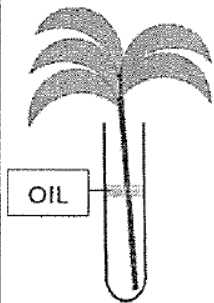
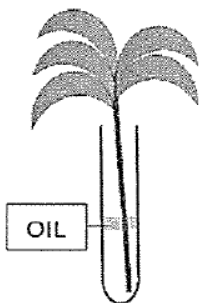
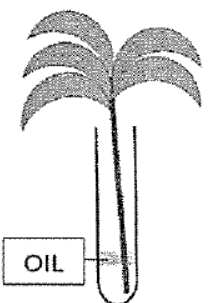
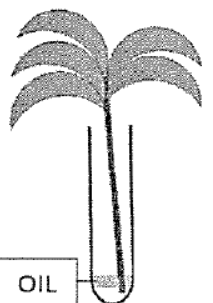
3

- b) Suggest how a named biotic factor might influence the distribution of crabs in these mud flats.

2

Question 27 (7 marks)

A student investigated the effect of temperature on transpiration in plants. All plants were the same size and contained the same number of leaves. One of each plant sample was held at a set temperature. All plants were given the same amount of water and a layer of oil was added to prevent evaporation. The water levels are shown after five days.

Temperature (°C)	10	20	30	40
Water Level				

a) Identify the independent variable.

1

b) Explain the results of this experiment with reference to transpiration.

3

3

c) Evaluate the validity and reliability of the experiment.

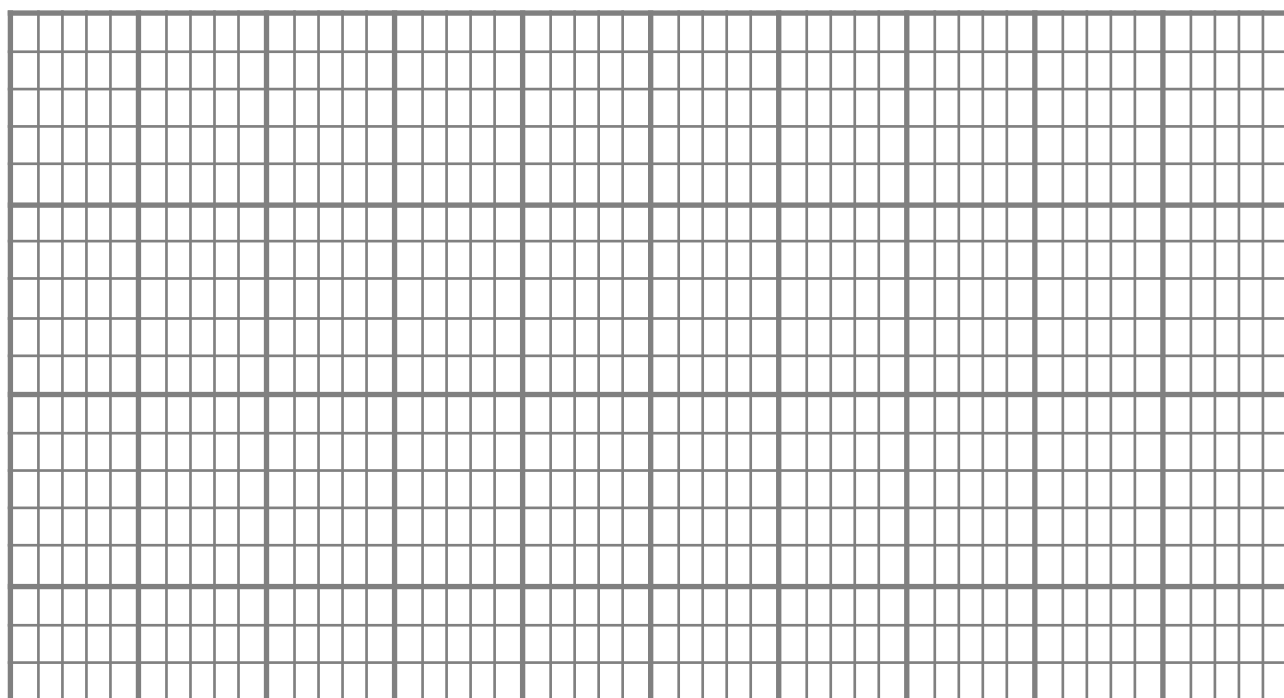
Question 28 (7 marks)

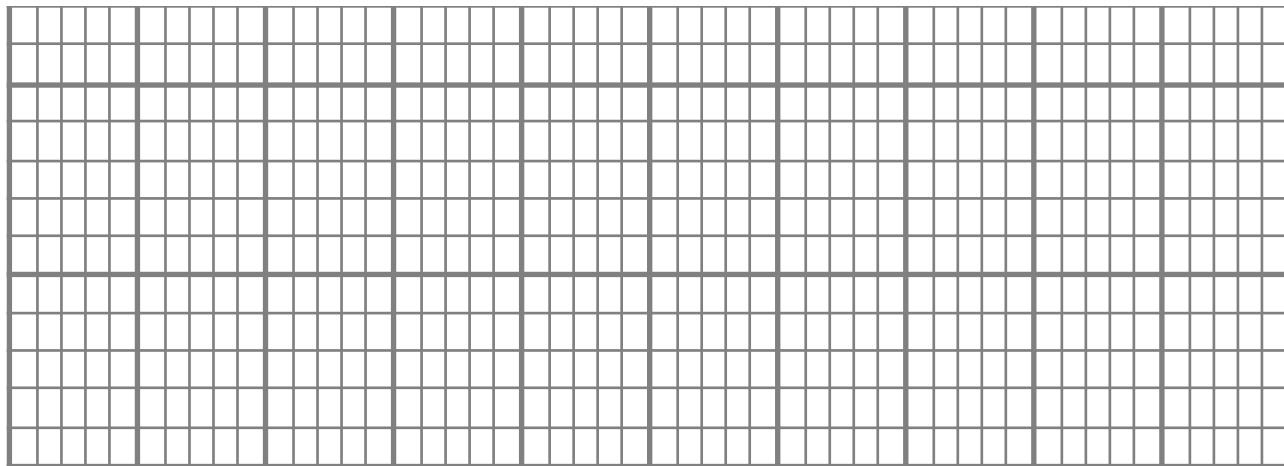
A student had two unlabelled vials. She knew the vials contained two different enzymes from around the body which act on the same substrate. She tested both samples with this substrate and her results are shown in the table below.

pH	Enzyme Activity (arbitrary units)	
	Enzyme 1	Enzyme 2
2	1	0
3	3	0
4	4.5	0
5	3	0
6	1	0
7	0.2	0.1
8	0	1.5
9	0	5.5
10	0	1.5
11	0	0.1
12	0	0

- a) Use the grid below to draw a line graph of this data.

3





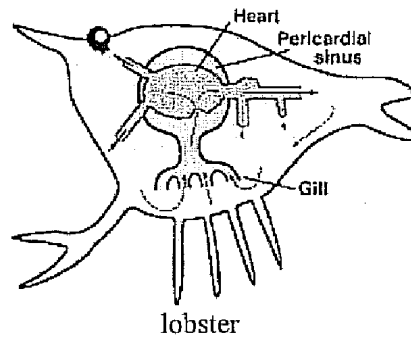
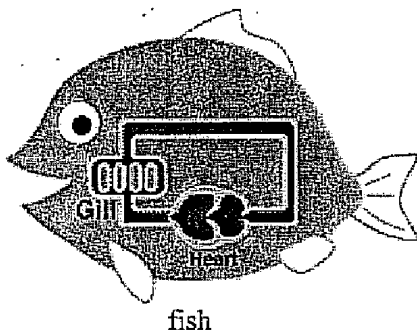
Question 28 continues on the next page

b) Explain the trends shown in the graph.

4

Question 29 (2 marks)

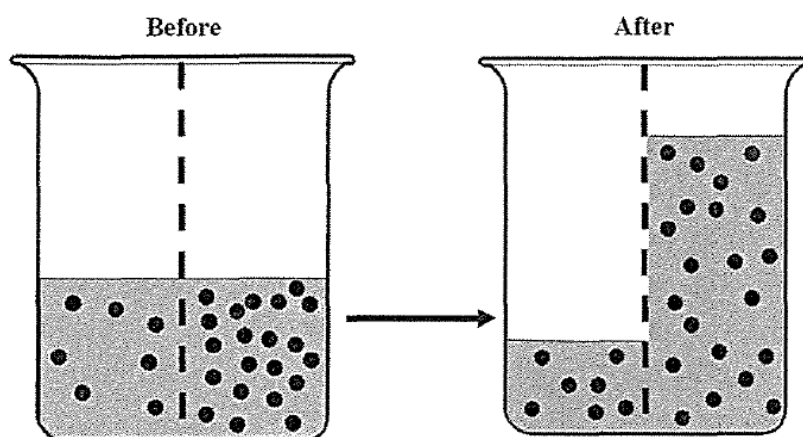
The diagrams below illustrate the closed circulatory system of a fish and the open circulatory system of a lobster.



Describe the differences between the circulatory systems in the above organisms.

Question 30 (4 marks)

A student performed an investigation to observe movement across a semi-permeable membrane. The images below represent the solutions before and after the experiment.



a) Identify the process.

b) Explain the results of this experiment.

Question 31 (4 marks)

NSW mining states in relation to rehabilitating land used for mining that:

“NSW mining wants the land we do mine to have a long and fruitful life when mining is complete, and there’s no reason why it cannot.

Before mining begins, we work with government authorities to determine the post-mining use of the land and develop a rehabilitation plan. A rehabilitation plan has objectives that are agreed upon by the community and government and lays out the post-mining use of the land.

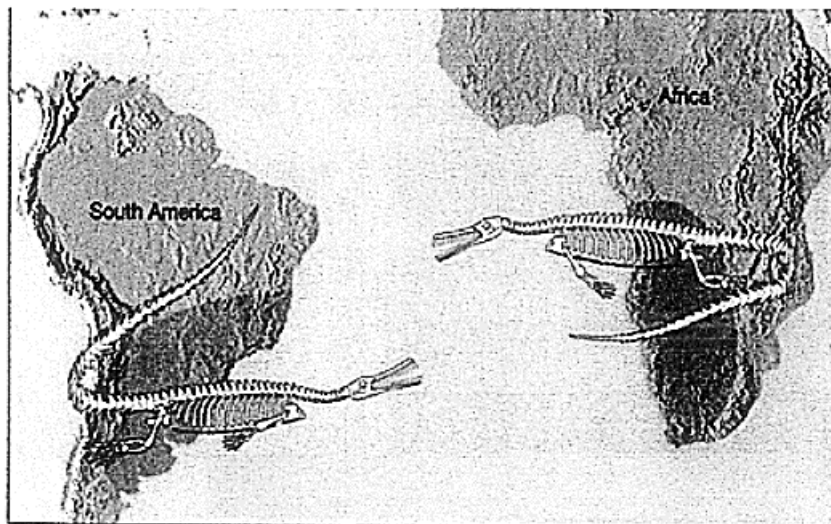
....on land previously used for agriculture, the aim might be to restore the land to its pre-mining level of productivity. For other land uses, the objective may be to restore the area as close to its original condition as possible. Sometimes the land is completely remodelled to a better condition than before mining, like converting a mined area to a wetland, habitat zone, recreational area or land suitable for urban development”.

For mined land or any other damaged ecosystem outline how TWO methods can be used to restore that environment.

4

Question 32 (4 marks)

The darkened shaded areas of this map shows the fossil locations of *Mesosaurus*, a freshwater reptile.



Assess the merits of EACH of the following explanations, in terms of their ability to account for the distribution shown.

The *Mesosaurus* is found in the above locations because:

(a) They swam across the ocean.

2

(b) Africa and South America were once joined.

2

END OF PAPER

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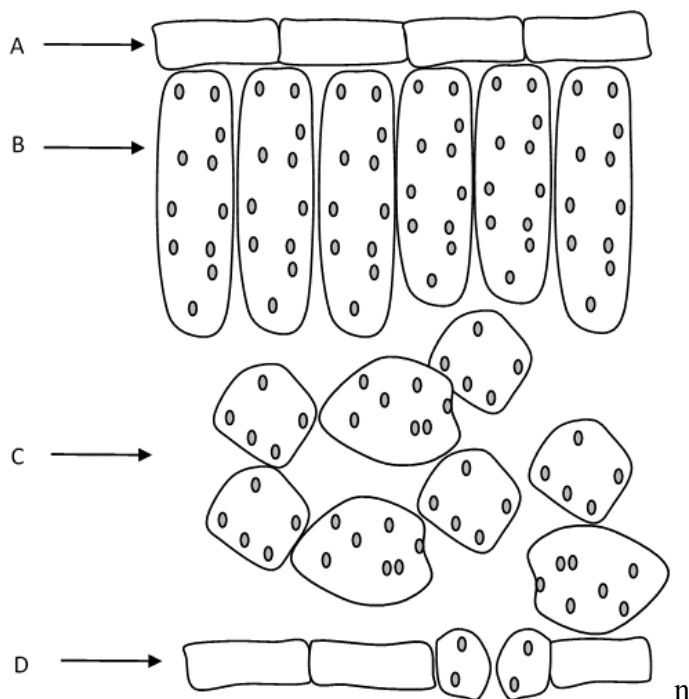
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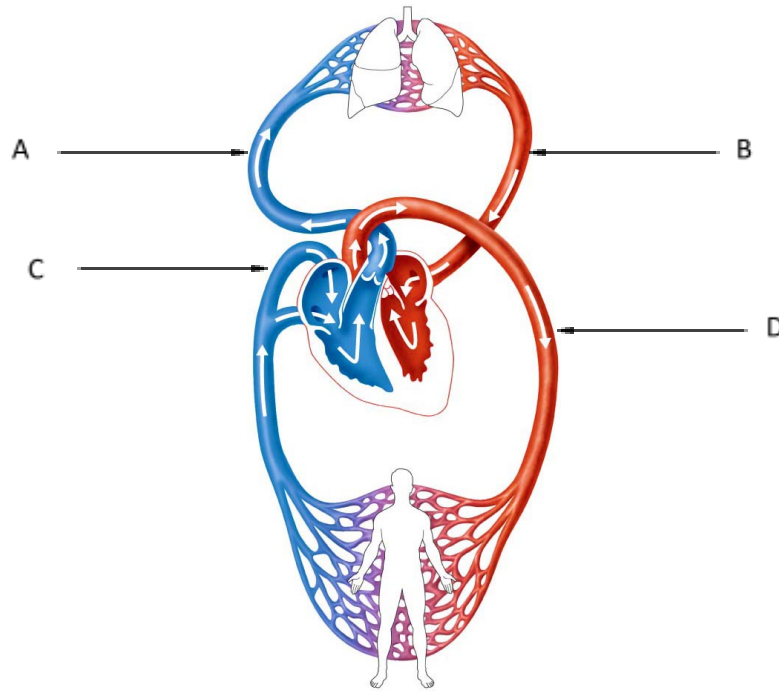
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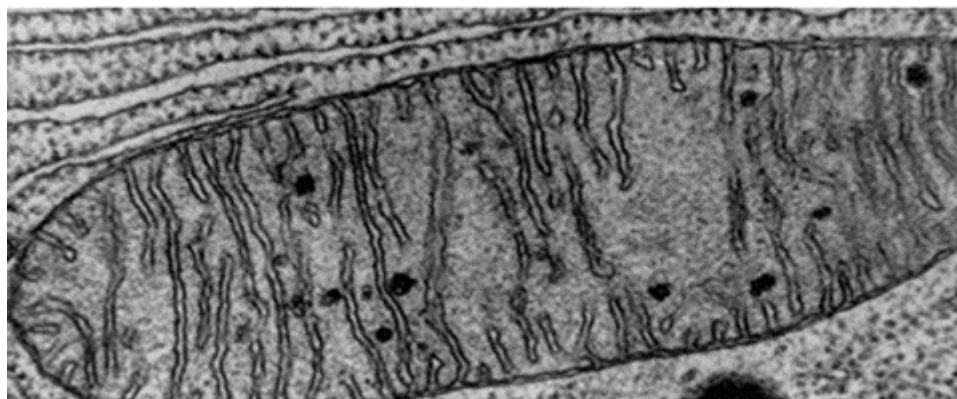
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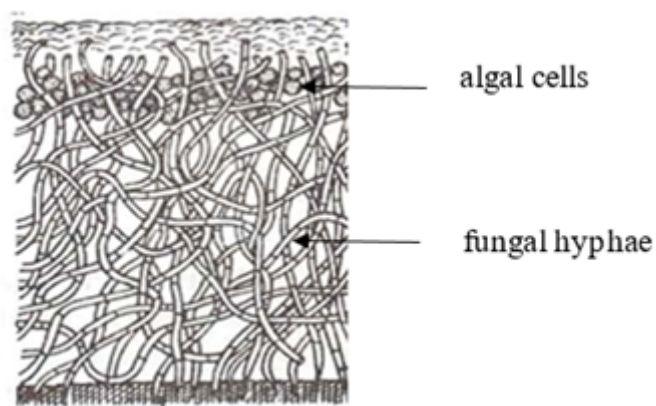
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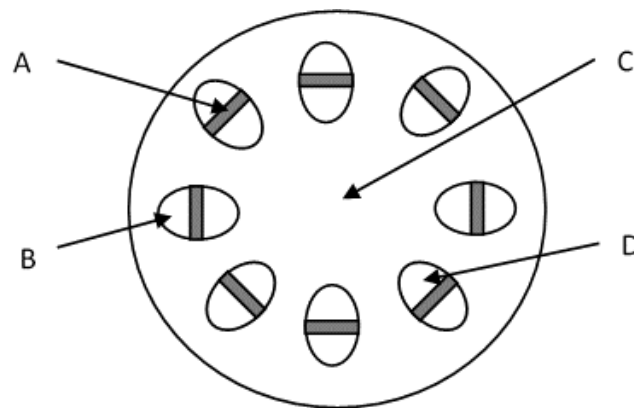
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13. The diagram below shows a transverse section through a stem.

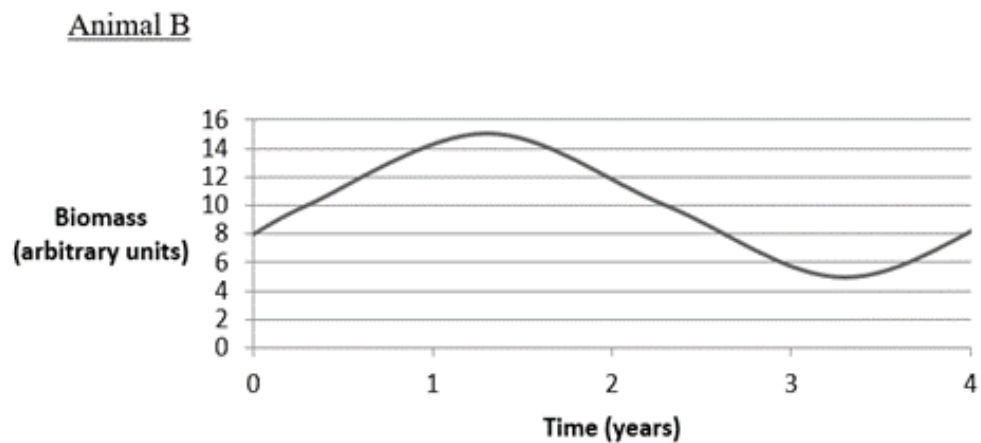
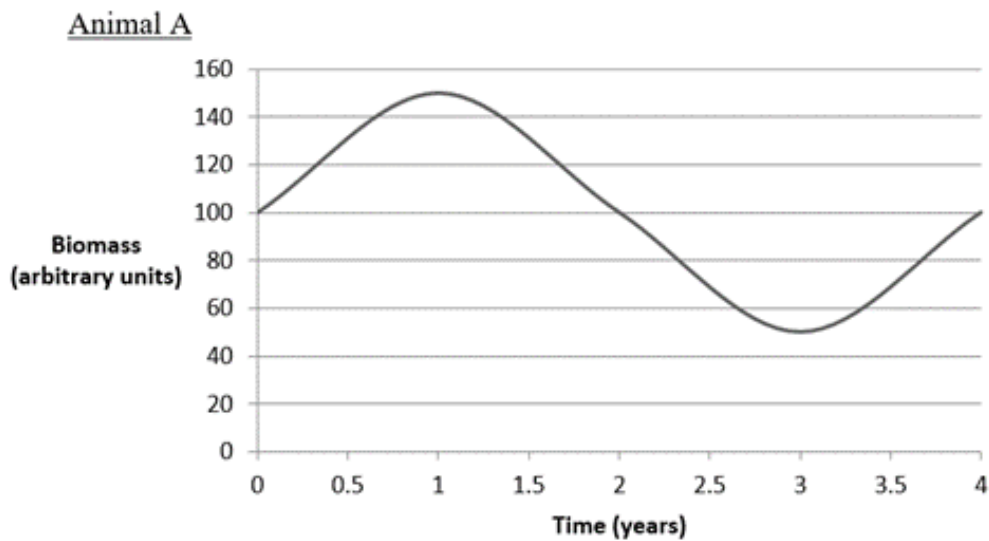


Which tissue is responsible for the transport of sugars throughout the plant?

- (A) A
- (B) B**
- (C) C

(D) D

14. The graphs below show how the populations (represented as biomass) of two species of animal varied in a particular ecosystem over four years.



Which one of the following ecological relationships do these graphs most likely represent?

- (A) Competition between species A and B for nest sites.
- (B) Competition between species A and B for food.
- (C) Predator/prey, where species A is the predator and species B is the prey.
- (D) Predator/prey, where species B is the predator and species A is the prey.**

15. Many bees, wasps and hornets have a similar yellow and black colouration.

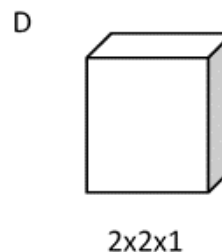
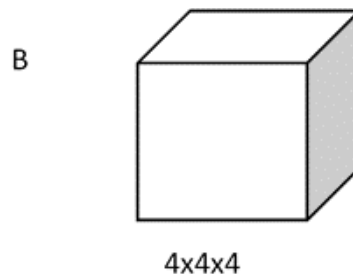
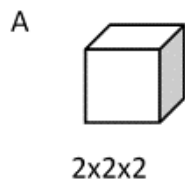
This colouration warns potential predators that if they attack the insect, they risk being stung.



Which one of the following is most likely the selecting agent that has brought about this uniformity of colouration?

- (A) The prevalence of yellow flowers.
- (B) The highly painful nature of their stings.
- (C) The presence of visually hunting predators.**
- (D) The fact that most pollen is yellow.

16. The four drawings below represent four different cells.



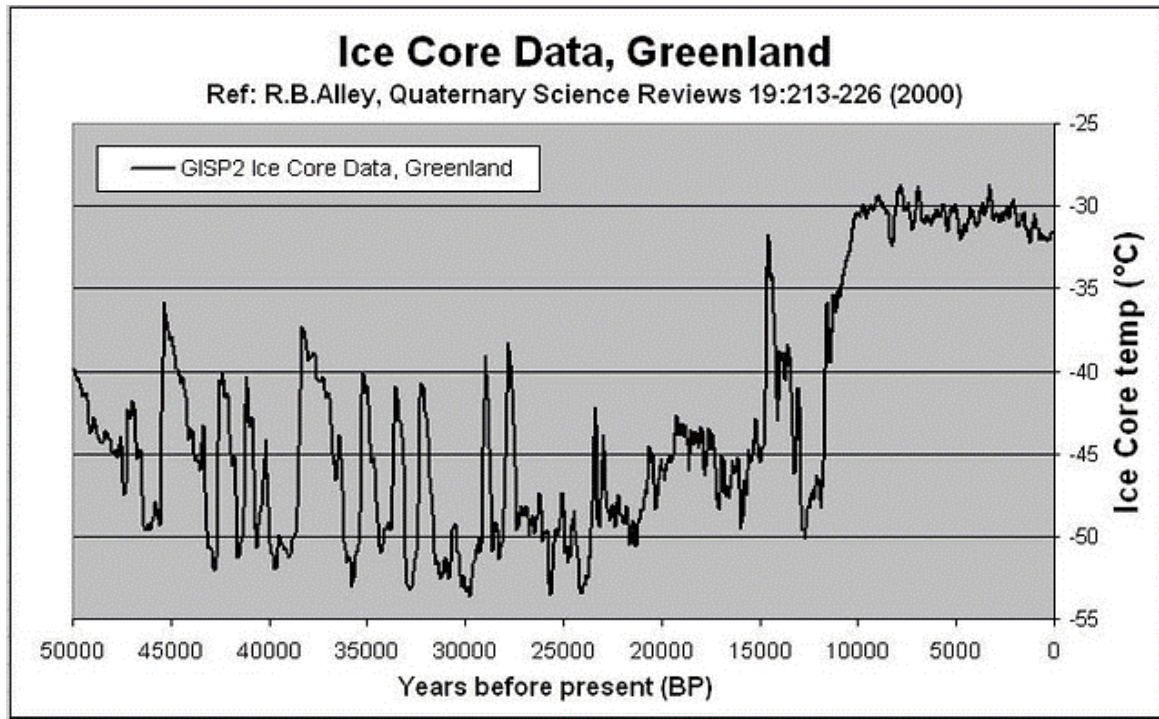
Their dimensions are given in arbitrary units.

Assuming that the requirements of a cell are a function of its volume, and the rate at which a cell can exchange materials with its environment is a function of its surface area, which cell would be able to most efficiently exchange materials with its environment?

- (A) A

- (B) B
- (C) C
- (D) D

17. The graph below shows Ice Core Temperature (°C) from data gathered in Greenland.



Which statement best identifies the trend shown in the graph?

- (A) Ice core temperature is constantly rising.
 - (B) Ice core temperature rises and falls in a cyclic manner.
 - (C) Ice core temperature peaks approximately every 15 000 years and averages 40 °C.
 - (D) Ice core temperature has significantly increased in the last 10 000 years and averages -32 °C during this time period.**
18. The Sugar glider *Petaurus breviceps* is an Australian marsupial that has membrane structures between its forelimb and hindlimb used for gliding, similar to those found in the American placental mammal, the flying squirrel.

What concept from the Theory of Evolution best explain these similarities?

- (A) Both species have evolved from a common ancestor and retain the same vestigial structures.
- (B) Both species were subjected to similar environmental conditions that led to analogous structures being selected for.**
- (C) Both species were subjected to the same environment that led to identical behaviours being developed.

- (D) Both species have evolved from a common ancestor and were required to escape the same species of predator.

19. Which of the following describes the functions of body systems listed?

<i>SYSTEM</i>			
	<i>Respiratory</i>	<i>Excretory</i>	<i>Circulatory</i>
(A)	Removal of wastes from the body	Produce energy by burning glucose in oxygen	Exchange of CO ₂ and O ₂
(B)	Exchange of CO ₂ and O ₂	Removal of wastes from the body	Produce energy by burning glucose in oxygen
(C)	Transportation of nutrients to and wastes away from cells	Exchange of CO ₂ and O ₂	Produce energy by burning glucose in oxygen
(D)	Exchange of CO ₂ and O ₂	Removal of wastes from the body	Transportation of nutrients to and wastes away from cells

20. A student is investigating the activity of enzymes in cells.

Which publication is most likely to be a valid and reliable source of information?

	<i>Publication</i>	<i>Year last published</i>	<i>Reviewed by</i>	<i>Reference list</i>
(A)	Protos	2018	Science reporter and editor	Absent
(B)	Popular Biology	2001	Editor	Present
(C)	Molecular	2017	A panel of scientists	Present
(D)	Cell	1971	University lecturers	Present

End of Section I

Section II - 50 Marks

Marks

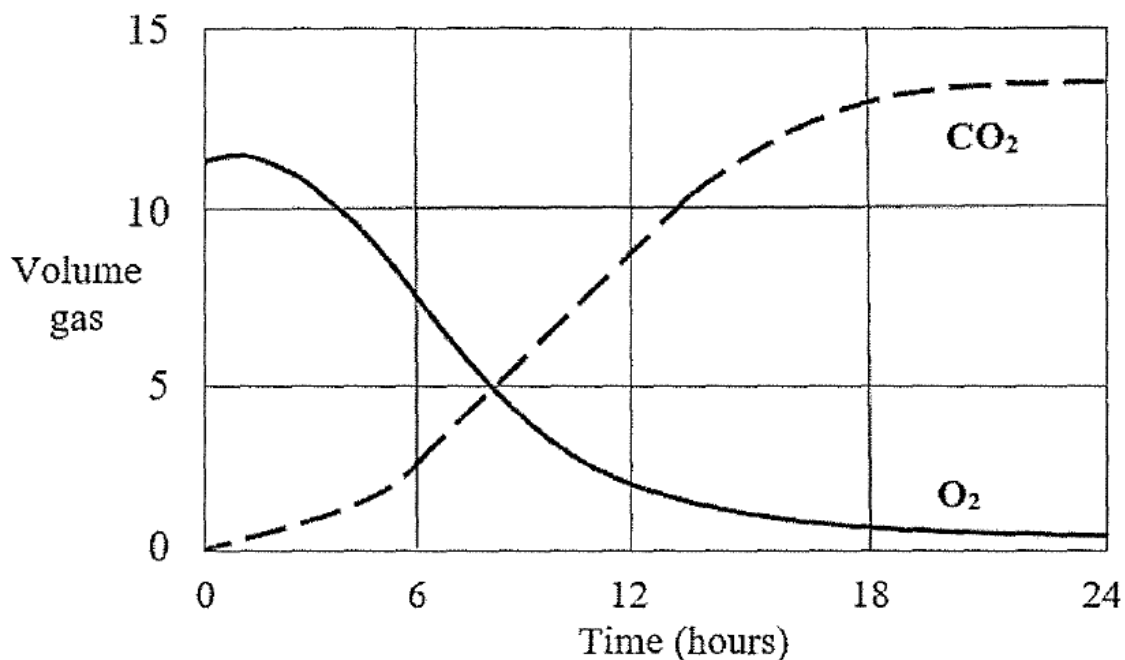
Attempt Questions 21- 32

Allow about 1 hour and 25 minutes for this section.

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

Question 21 (4 marks)

A group of nectar eating insects were placed into a flask along with some sugar. The flask was capped and after 24 hours all the sugar was gone. The levels of oxygen and carbon dioxide were monitored over this period. A graph of the results is shown below.



a) Describe the trends shown in the graph.

2

CO₂ increases as O₂ decreases (1)

Both lines plateau at about 20 hrs (1).

Most students gave detailed descriptions of trends – good practice. However some terms were used incorrectly, eg: exponentially, steadily

b) Explain the biological process represented in the graph.

2

- The insects eat the sugar in order for their cells to undergo respiration.
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2$. (Word equations/descriptions also accepted.)
- This process consumes oxygen and produces carbon dioxide at an equal rate.
- Hence, carbon dioxide volume in the flask increases as the oxygen volume decreases OR the process continues until all the sugar [or oxygen] is consumed, and carbon dioxide production stops.

Deductions if any steps in explanation skipped.

Question 22 (3 marks)

Compare the structure and function of the vascular system in woody-stemmed plants to the circulatory system in humans.

3

Comparison of structure (1)

Comparison of function (1)

Additional point of comparison for either aspect (1)

Very few students actually provided comparisons. It was not sufficient to simply describe the vascular system in plants followed by the circulatory system in humans. This approach, if accompanied by any minor errors, could not yield more than 1 out of 3 marks.

Note 1: Do not refer to ‘the vascular system’ as if only woody-stemmed plants have one. A vascular system is any system contains vessels – for example, the circulatory system!

Note 2: Plants do indeed have transport media. Phloem does not transport chunks of solid glucose.

Note 3: Blood transports nutrients, hormones, ammonia, etc, not just gases – but the circulatory system alone does not REMOVE wastes.

Question 23 (3 marks)

A virus was used to kill a species known as *Bebbingtoni leviosa*. It was spectacularly successful, reducing *B. leviosa* numbers across the country by around 95%. The virus is still prevalent today but far fewer *B. leviosa* die from it.

Explain how this could have come about.

3

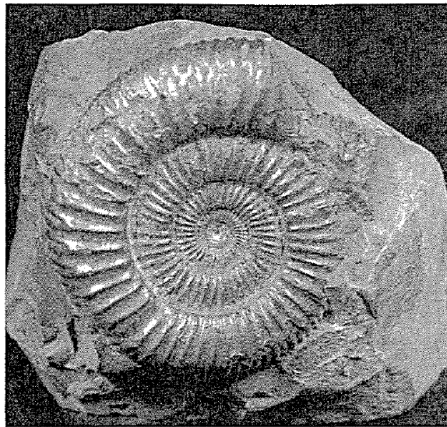
- Survivors of the initial virus release likely possessed some form of genetic resistance (or traits that allowed them to survive) (1)
- Hence *B. leviosa* individuals with genetic resistance became a large proportion of the population OR hence, *B. leviosa* with genetic resistance are more likely to pass on their traits than non-resistant individuals (1)
- Hence, later generations will have a large percentage of individuals that are resistance to the virus and unlikely to die. (1)

Note 1: answer needed to give the impression that the student recognized this process would take multiple generations.

Note 2: survivors may not necessarily have been ‘immune’ to the virus – just more likely to survive it.

Question 24 (4 marks)

Ammonite fossils are commonly used as index fossils to determine the relative time periods of existence for particular organisms.



Distinguish between the use of index fossils in dating and the process of absolute dating for fossils.

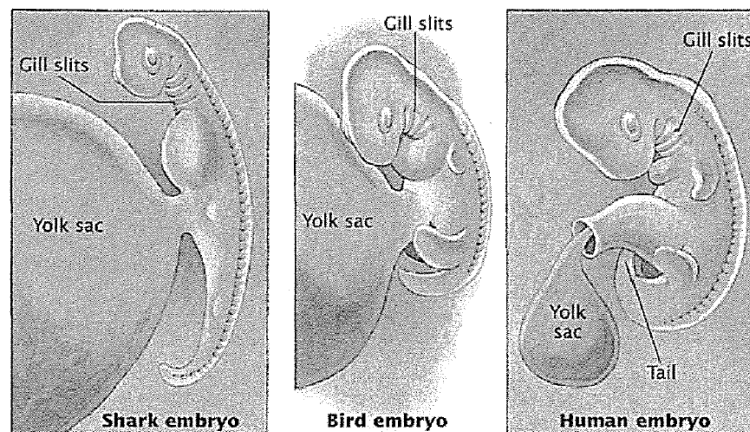
- Outline what an index fossil is. (1)
- Define absolute dating. (1)
- Give an example of absolute dating (eg: radiometric dating, carbon-14) (1)
- Answer communicates difference between relative vs absolute dating. (1)

4

Question 25 (3 marks)

Explain the evolutionary significance of the three pictures shown below.

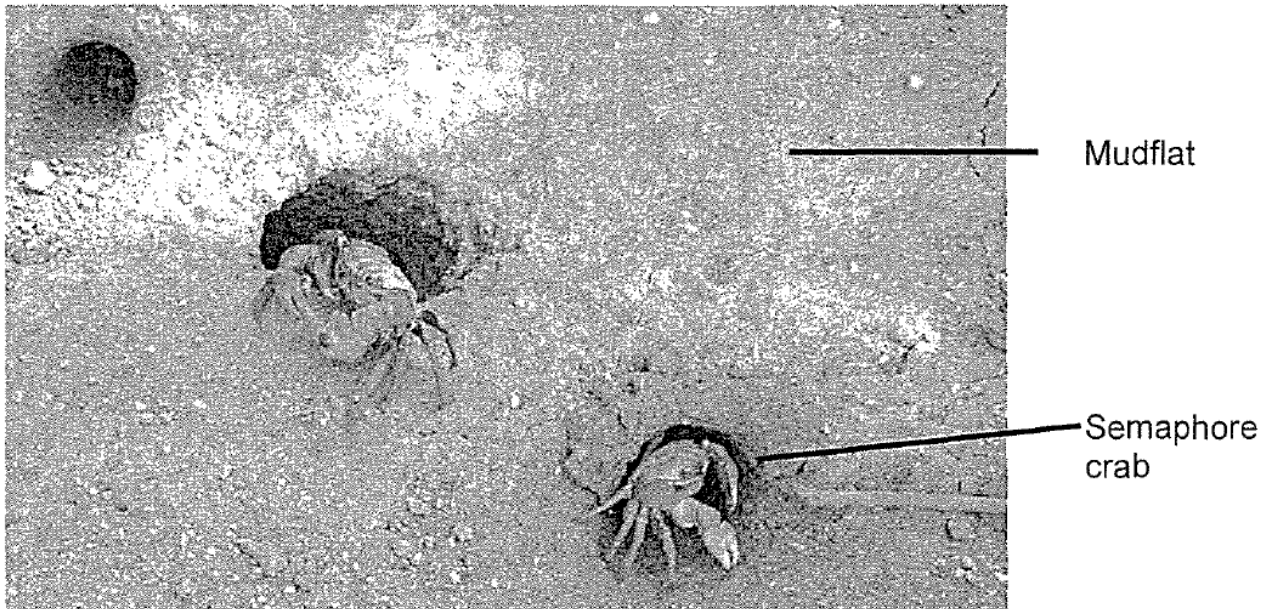
3



- Shark, bird and human embryos have very similar features (many students referred to specifics from diagram – this was good) (1)
- However their ADULT forms are very different (1)
- Common ancestor / divergent evolution (1)

Question 26 (5 marks)

A group of students were taken on an excursion to a mangrove ecosystem that is inhabited by large numbers of semaphore crabs. These crabs build holes in the mud where they hide during high tide.



- a) Justify a sampling technique to measure the abundance of crabs in these mudflats.

3

1 mark for a correct sampling technique

1 mark for relation between technique and abundance

1 mark for how it measures crabs

- b) Suggest how a named biotic factor might influence the distribution of crabs in these mud flats.

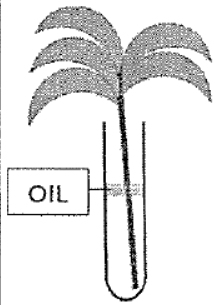
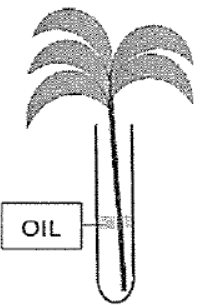
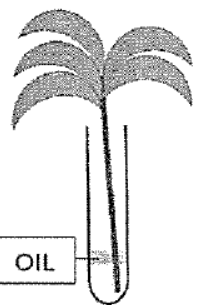
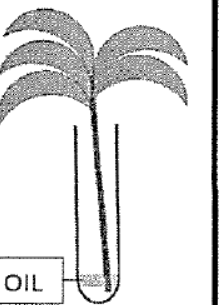
2

1 mark for correct biotic factor

1 mark for description of influence

Question 27 (7 marks)

A student investigated the effect of temperature on transpiration in plants. All plants were the same size and contained the same number of leaves. One of each plant sample was held at a set temperature. All plants were given the same amount of water and a layer of oil was added to prevent evaporation. The water levels are shown after five days.

Temperature (°C)	10	20	30	40
Water Level				

a) Identify the independent variable.

1

The temperature each sample was kept at

b) Explain the results of this experiment with reference to transpiration.

3

1 mark description of results

1 mark description of transpiration

1 mark for explanation of water loss and link to transpiration stream

c) Evaluate the validity and reliability of the experiment.

3

½ mark per evaluation

1 mark for justification for validity

1 mark for justification for reliability

The experiment is highly valid due to the control of variables such as number of leaves, same size plant and initial volume of water. The experiment was not reliable as there was no repetition.

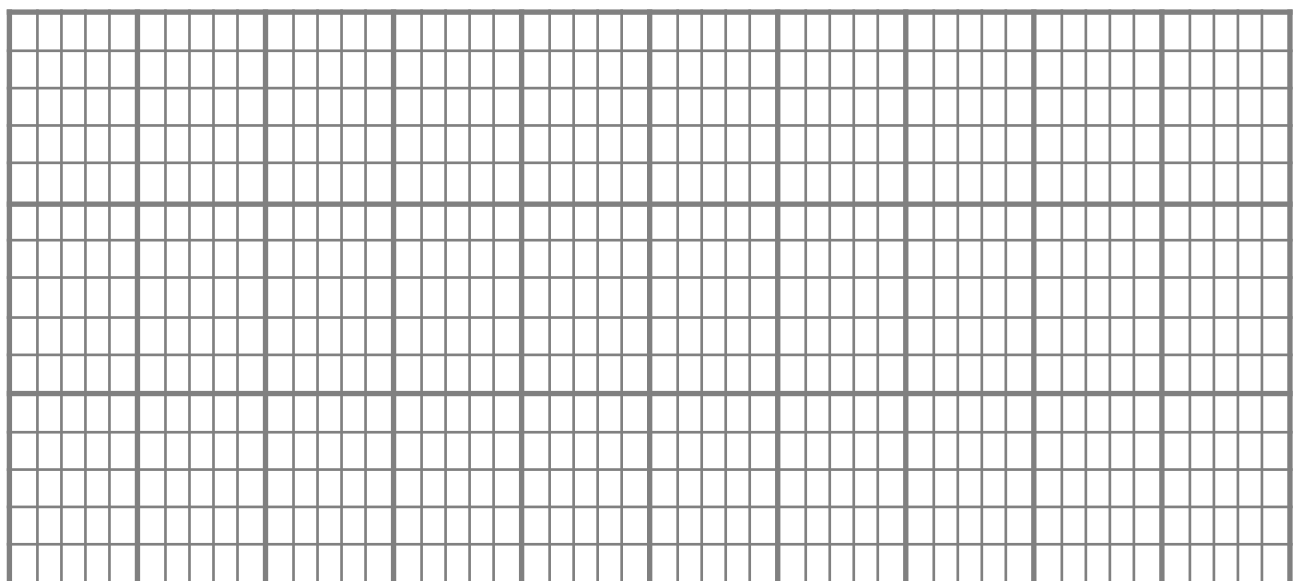
Question 28 (7 marks)

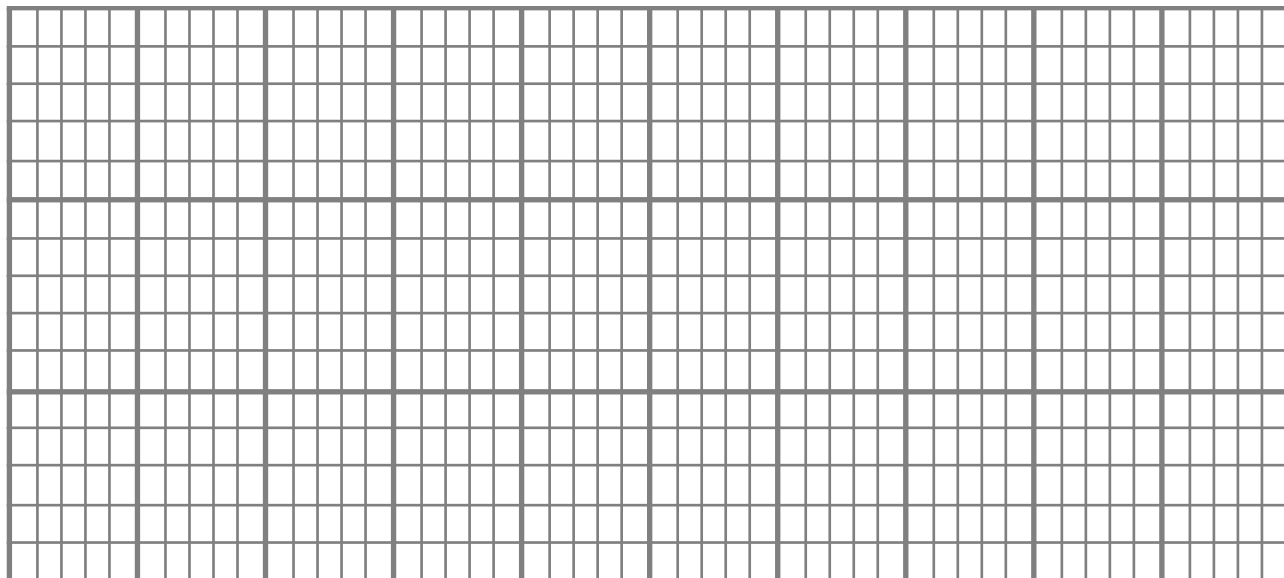
A student had two unlabelled vials. She knew the vials contained two different enzymes from around the body which act on the same substrate. She tested both samples with this substrate and her results are shown in the table below.

pH	Enzyme Activity (arbitrary units)	
	Enzyme 1	Enzyme 2
2	1	0
3	3	0
4	4.5	0
5	3	0
6	1	0
7	0.2	0.1
8	0	1.5
9	0	5.5
10	0	1.5
11	0	0.1
12	0	0

a) Use the grid below to draw a line graph of this data.

3





Question 28 continues on the next page

4

1 per points and line

1 mark for y axis with units

b) Explain the trends shown in the graph.

1 mark for description of shape

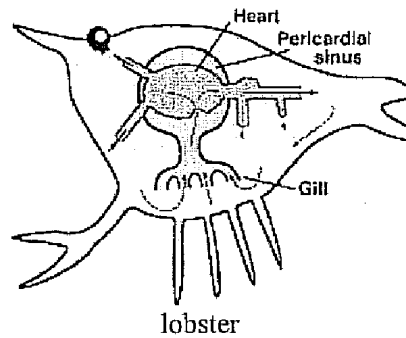
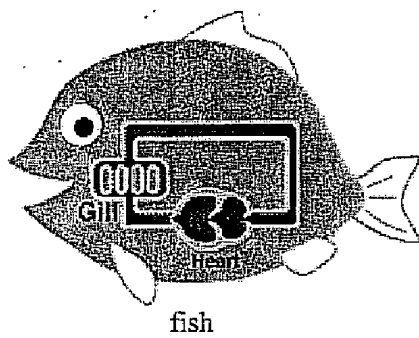
1 mark for optimal pH's

1 mark for denatured outside of range

1 mark for link to the body

Question 29 (2 marks)

The diagrams below illustrate the closed circulatory system of a fish and the open circulatory system of a lobster.



2

Describe the differences between the circulatory systems in the above organisms.

1 mark: description of correct feature of circulatory system for fish

e.g. transport fluid always contained within vessels

1 mark: description of correct equivalent feature of circulatory system for lobster

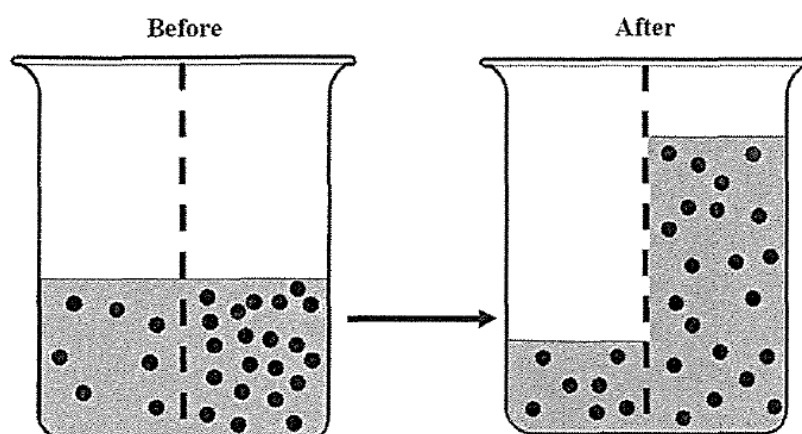
e.g. transport fluid not contained within vessels for some or all parts of the system

Students should not spend 3 lines repeating information given to you in the stem – ie repeating that fish has a closed system and lobster has an open system

Did not accept answers stated information from the pictures e.g. lobster has a pericardial sinus and fish does not

Question 30 (4 marks)

A student performed an investigation to observe movement across a semi-permeable membrane. The images below represent the solutions before and after the experiment.



a) Identify the process.

1 mark: osmosis

1

b) Explain the results of this experiment.

1 mark: movement of **water** from low solute concentration to high solute concentration across a **semi permeable membrane** (all parts needed for this mark)

1 mark: reason for why water moves – water moves down concentration gradient OR to achieve equal concentration of solutes on either side

1 mark: reason for why solute does not move – solute does not move because it is too large to pass through the pores of the membrane

When referring to concentration or particle, always include WHAT it is (solute or water)

Question 31 (4 marks)

NSW mining states in relation to rehabilitating land used for mining that:

“NSW mining wants the land we do mine to have a long and fruitful life when mining is complete, and there’s no reason why it cannot.

Before mining begins, we work with government authorities to determine the post-mining use of the land and develop a rehabilitation plan. A rehabilitation plan has objectives that are agreed upon by the community and government and lays out the post-mining use of the land.

....on land previously used for agriculture, the aim might be to restore the land to its pre-mining level of productivity. For other land uses, the objective may be to restore the area as close to its original condition as possible. Sometimes the land is completely remodelled to a better condition than before mining, like converting a mined area to a wetland, habitat zone, recreational area or land suitable for urban development”.

For mined land or any other damaged ecosystem outline how TWO methods can be used to restore that environment.

4

1 mark: for each correct method given (2 max)

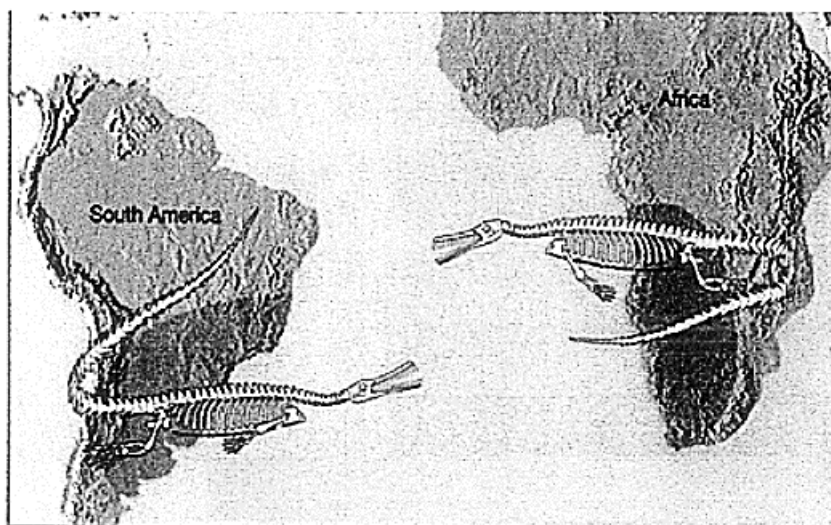
1 mark: outline of HOW method can restore ecosystem

Answers could include:

- Fill in hole with dirt
- Plant native vegetation
- Clean up contaminants
- Restore soil quality
- Recolonise fauna

Question 32 (4 marks)

The darkened shaded areas of this map shows the fossil locations of *Mesosaurus*, a freshwater reptile.



Assess the merits of EACH of the following explanations, in terms of their ability to account for the distribution shown.

The *Mesosaurus* is found in the above locations because:

- (a) They swam across the ocean.

2

1 mark: assessment – this explanation is implausible/not likely

1 mark: reason – reptile is freshwater, sea is saltwater, very long distance

- (b) Africa and South America were once joined.

2

1 mark: assessment – this explanation is possible/plausible/likely

1 mark: reason linked to evidence given above – coastline of South America and Africa match and regions where the fossils are found also match up

Assessments of each explanation should be stronger – some students provided arguments for both sides and were not awarded reason mark - only provide reason that supports your assessment

END OF PAPER