



PASIR RIS CREST SECONDARY SCHOOL
End of Year Examination
Secondary Three Express

CANDIDATE
NAME

CLASS

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Biology

6093 / 01

Paper 1

10 October 2019

(Paper 1 and Paper 2): 2 hour 15 minutes

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on all the work you hand in.

Section A

There are **thirty** questions in this paper.

Answer **all** questions.

For each question there are four possible answer **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in the question booklet.

The use of an approved scientific calculator is expected, where appropriate.

| |
|---------------------------|
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| 30 |
| Parent's Signature |

This document consists of 12 printed pages.

2

Section A [30 marks]

Answer all questions. Choose the answer you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

- 1 The diagram below shows an electron micrograph of a cell.



What are the cellular structures labelled I, II and III?

| | I | II | III |
|---|---------|--------------|---------|
| A | nucleus | chloroplast | vacuole |
| B | nucleus | mitochondria | vacuole |
| C | vacuole | chloroplast | nucleus |
| D | vacuole | mitochondria | nucleus |

- 2 Ricin is a poison that inhibits protein synthesis in mammalian cells.

Which of the following cellular structures is likely to be where the poison acts on?

- A cell membrane
- B chloroplasts
- C Golgi body
- D rough endoplasmic reticulum

- 3 Consider the following diagram about polypeptide synthesis.



Which of the following options represent processes X and Y?

| | X | Y |
|---|---------------|---------------|
| A | transcription | translation |
| B | transcription | transpiration |
| C | translation | transcription |
| D | transpiration | translation |

[Turn over

- 4 Adenine forms two hydrogen bonds with its complementary base while guanine forms three hydrogen bonds with its complementary base. The greater the number of bonds formed, the greater the amount of energy released.

Which of the following sequences would release the highest amount of energy when it pairs up with its complementary sequence?

- A AACTCTAGCG
- B AATCAATCGA
- C CACGGTCGTA
- D TAGCTTAGCA

- 5 Leeches are parasitic oligochaetes that feed on the blood of other animals. When a leech attaches itself onto you, it is recommended to sprinkle salt on it and wait for it to shrink and detach by itself.

Which of the following statements explains this observation?

- A Salt decreases the water potential of the thin film of moisture on the leech's skin and causes water molecules to move out of the leech via osmosis.
- B Salt decreases the water potential of the thin film of moisture on the leech's skin and causes water molecules to move out of the leech via diffusion.
- C Salt increases the water potential of the thin film of moisture on the leech's skin and causes water molecules to move out of the leech via osmosis.
- D Salt increases the water potential of the thin film of moisture on the leech's skin and causes water molecules to move out of the leech via diffusion.

- 6 Consider the following statements about the movement of substances in biological systems.

1. A partially permeable membrane is required.
2. It occurs against a concentration gradient.
3. Respiration is involved.

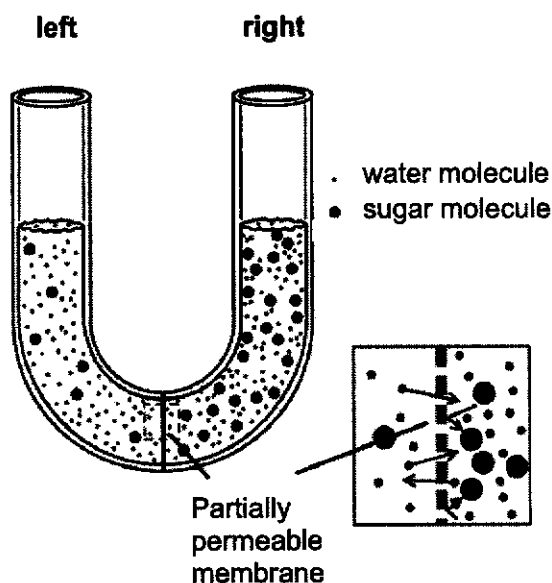
Which of the above statement(s) is/are true of active transport?

- A 1 and 2 only
- B 1, 2 and 3
- C 2 only
- D 2 and 3 only

[Turn over

4

- 7 A U-shaped tube was divided into two chambers by a partially permeable membrane. The left chamber was filled with 1% sugar solution while the right chamber was filled with 5% sugar solution as shown in the diagram below.



Which of the following correctly describes the net movement of sugar and water molecules after 10 minutes?

| | sugar molecules | water molecules |
|----------|-----------------|-----------------|
| A | no movement | right to left |
| B | no movement | left to right |
| C | right to left | right to left |
| D | right to left | left to right |

- 8 A student wishes to examine if the protein bar he consumes contains fats. After grinding the protein bar, he considers the following list of steps he could take.
1. add 2 cm³ of ethanol and shake
 2. add 2 cm³ of sodium hydroxide
 3. add copper (II) sulfate dropwise
 4. add water
 5. decant

What is the correct sequence of steps he should take?

- A** 1 → 2 → 3
B 1 → 5 → 4
C 2 → 3
D 2 → 4

[Turn over

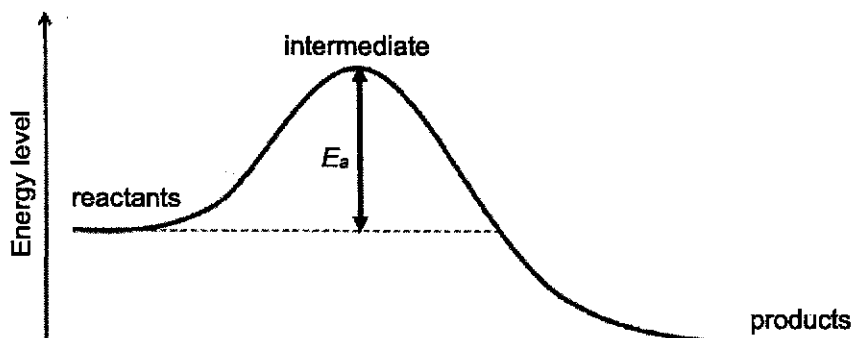
- 9 Sugarcane juice contains high amounts of sugars, including starch and sucrose.

A student took a sample of sugarcane juice and added it into a test-tube containing some amylase. After allowing the test-tube to stand for a few hours, he conducted three different food tests on it.

Which of the following options indicate the observed results of the various food tests performed, assuming that the enzymatic reaction in the test-tube has gone to completion?

| | iodine test | biuret test | Benedict's test |
|----------|-----------------------------------|-----------------------------|--------------------------------|
| A | iodine solution remained brown | solution remains blue | brick-red precipitate observed |
| B | iodine solution remained brown | violet colouration observed | brick-red precipitate observed |
| C | iodine solution turned blue-black | solution remains blue | solution remained blue |
| D | iodine solution turned blue-black | violet colouration observed | solution remained blue |

- 10 The diagram below shows the energy level profile of a reaction. E_a represents the activation energy of the reaction.

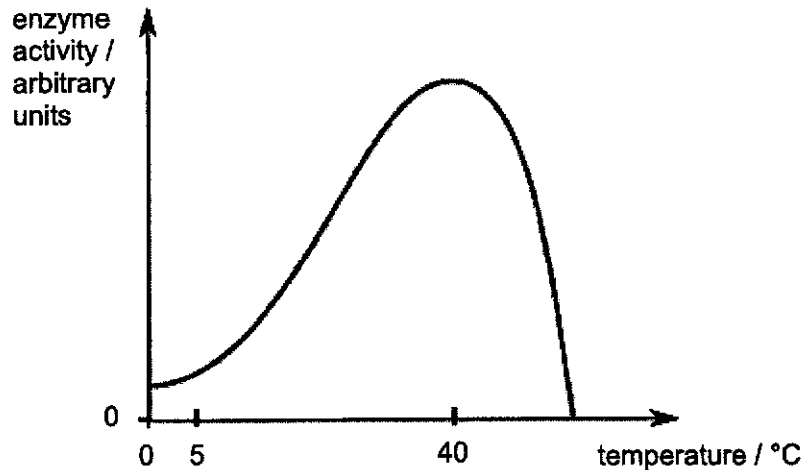


Which of the following actions will result in a decrease in E_a ?

- A** A decrease in the concentration of reactants.
- B** An increase in the concentration of products.
- C** An increase in the temperature of the reaction.
- D** The addition of an organic catalyst.

[Turn over

- 11 The diagram below shows the rate of an enzymatic reaction at different temperatures.



Which of the following statements accounts for the rate of reaction at 5°C?

- A Enzymes are denatured at low temperatures and are unable to form enzyme-substrate complexes with the substrate.
 - B Enzymes remain chemically unchanged at the end of reactions and are able to catalyse further reactions.
 - C The low concentration of enzymes and molecules results in a low number of enzyme-substrate complexes formed per unit time.
 - D The low kinetic energy of enzyme and substrate molecules results in a low number of enzyme-substrate complexes formed per unit time.
- 12 Photosynthesis consists of a series of enzyme-catalysed reactions. One such reaction is shown below.

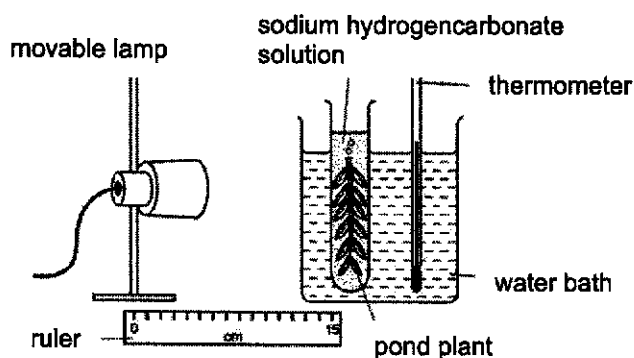


Based on the 'lock and key' hypothesis, which is the lock and which is the key?

| | 'lock' | 'key' |
|---|-----------|------------|
| A | aconitase | citrate |
| B | aconitase | isocitrate |
| C | citrate | citrate |
| D | citrate | isocitrate |

[Turn over

- 13 Which of the following organs in the human digestive system are involved in the digestion of fat?
1. liver
 2. pancreas
 3. small intestine
 4. stomach
- A 1, 2 and 3 only
 B 1, 2 and 4 only
 C 1, 3 and 4 only
 D 2, 3 and 4 only
- 14 Which of the following is/are functions of the small intestine?
1. absorption of glucose and amino acids
 2. absorption of fatty acids and glycerol
 3. absorption of water
- A 1 only
 B 1 and 2 only
 C 1, 2 and 3
 D 2 and 3 only
- 15 Which of the following is an example of a social implication of excessive alcohol consumption?
- A family violence
 B liver cirrhosis
 C slurred speech
 D stomach ulcers
- 16 A student prepared an experimental set-up as follows.



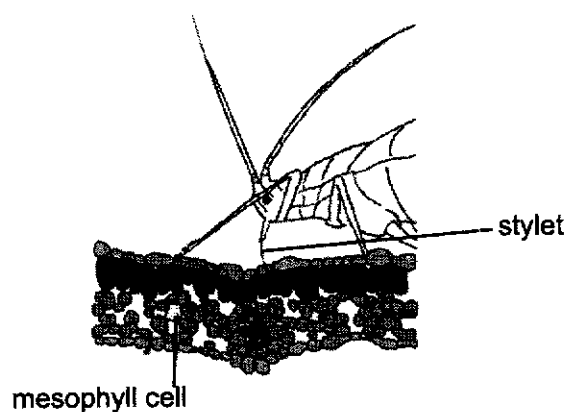
During the experiment, she adjusted the distance of the lamp from the pond plant and measured the number of bubbles produced in the first two minutes.

Which of the following hypothesis was she testing?

- A If chlorophyll is required for photosynthesis.
 B If light is required for photosynthesis.
 C The effect of light intensity on the rate of photosynthesis.
 D The effect of temperature on the rate of photosynthesis.

[Turn over

- 17 The diagram below shows an aphid feeding on the leaf of a plant.



The aphid was anaesthetised using carbon dioxide and the stylet was cut. Which of the following nutrients were found in the stylet?

1. amino acid
2. glucose
3. sucrose
4. water

- A** 1 and 2 only
B 1 and 3 only
C 1, 3 and 4 only
D 2 and 3 only
- 18 Which of the following statements about blood vessels is true?
- A** The blood vessel with the highest blood pressure is the aorta.
B The capillaries are one-cell thick to allow for faster exchange of substances.
C The hepatic portal vein transports glucose, amino acids and fats from the small intestine to the liver.
D The lumen of capillaries is wider than the lumen of veins.

[Turn over

- 19 W, X, Y and Z represent four different individuals.

Consider the following statements.

1. W can donate blood to X and Y.
2. X cannot donate blood to Y as agglutination will occur.
3. X can donate blood to Z.

Which of the following options describe the possible ABO blood groups of individuals W, X, Y and Z?

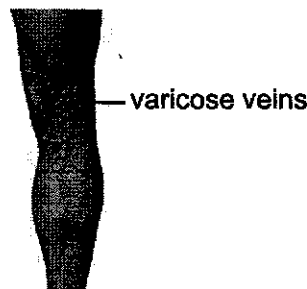
| | W | X | Y | Z |
|---|----|---|---|----|
| A | AB | A | A | O |
| B | AB | A | B | O |
| C | O | A | A | AB |
| D | O | A | B | AB |

- 20 At the arterial end of capillaries, high hydrostatic pressure forces plasma and other small molecules out of the capillaries to form tissue fluid. However, the volume of fluid that enters the veins is the same as the volume of blood that enters the capillaries due to re-entry of water molecules at the venous end of the capillaries.

Which two factors contribute to the movement of water molecules from tissue fluid back into the capillaries at the venous end?

| | plasma water potential | capillary blood pressure |
|---|------------------------|--------------------------|
| A | high | low |
| B | high | high |
| C | low | low |
| D | low | high |

- 21 Varicose veins are veins under the skin that have become enlarged due to the accumulation of venous blood.



Consider the following events:

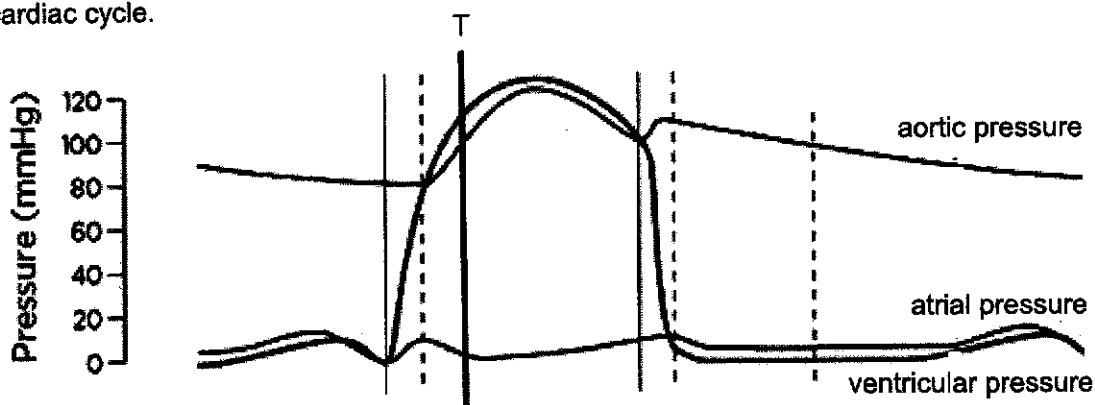
1. Lowered pressure of blood leaving the heart.
2. Lowered water potential of blood.
3. Valves in veins are damaged.

Which of the above events can lead to the appearance of varicose veins?

- A 1 only
- B 1 and 2 only
- C 1, 2 and 3
- D 3 only

[Turn over

- 22 The diagram below shows the pressure changes in the left side of the heart in a normal cardiac cycle.



A patient suffers from mitral insufficiency, in which the bicuspid valve is unable to close completely.

Which of the following accurately describes how this patient's cardiac cycle diagram will differ from normal at time point T?

| | aortic pressure | ventricular pressure | atrial pressure |
|---|-----------------|----------------------|-----------------|
| A | lower | remains the same | lower |
| B | lower | remains the same | higher |
| C | higher | lower | lower |
| D | higher | lower | higher |

- 23 Consider the following statements about anaerobic respiration.

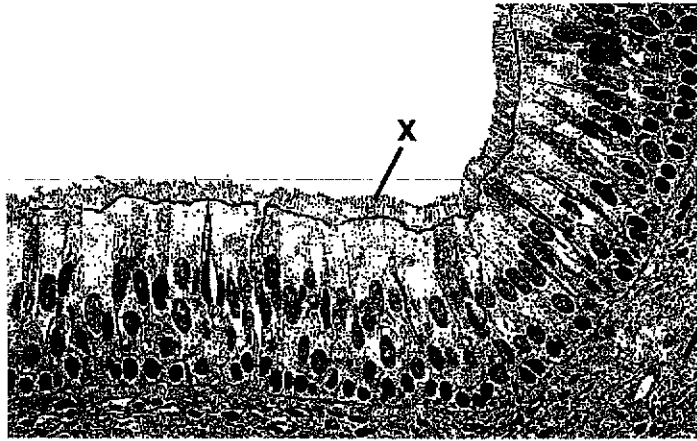
1. Anaerobic respiration cannot occur in a muscle cell that receives oxygenated blood.
2. Anaerobic respiration releases small amounts of energy.
3. Anaerobic respiration utilises glucose as a substrate.

Which of the above statements is **true** about anaerobic respiration in humans?

- A 1 only
- B 1 and 2 only
- C 2 and 3 only
- D 1, 2 and 3

[Turn over

- 24 The diagram below shows a tissue from the respiratory system that was stained and viewed under an electron microscope.



What is the identity of structure X?

- A cilia
 - B flagella
 - C microvilli
 - D root hair
- 25 Which of the following statements about red blood cells is true?
- A Each red blood cell contains one haemoglobin protein molecule that binds to one oxygen molecule.
 - B Oxygenated red blood cells are only found in the arteries of the circulatory system.
 - C Red blood cells are involved in the transport of carbon dioxide from body tissues to the lungs.
 - D There are numerous mitochondria in each red blood cell to release energy from glucose for DNA replication.
- 26 Which of the following chemicals is responsible for an individual's addiction to smoking?
- A carbon monoxide
 - B formaldehyde
 - C nicotine
 - D tar
- 27 Which of the following structures receives blood from the efferent arteriole?
- A afferent arteriole
 - B glomerulus
 - C proximal convoluted tubule
 - D renal vein

[Turn over

- 28 Which of the following excretory structures contain cells with relatively high numbers of mitochondria?
- A glomerulus
 - B afferent arteriole
 - C proximal convoluted tubule
 - D Bowman's capsule
- 29 Which of the following molecules is/are not selectively reabsorbed into the bloodstream at the kidney tubules?
- A amino acids
 - B glucose
 - C urea
 - D water
- 30 Tolvaptan inhibits the effects of anti-diuretic hormone.
- What would be the consequence of administering Tolvaptan to a healthy individual?
- A A smaller volume of urine will be produced.
 - B The person will become dehydrated.
 - C The urine produced would have a higher concentration of urea.
 - D There would be more proteins present in the urine.

END OF PAPER



PASIR RIS CREST SECONDARY SCHOOL
End of Year Examination
Secondary Three Express

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Biology

Paper 2

6093 / 02

10 October 2019

(Paper 1 + Paper 2): 2 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your candidate name, class and index number on all the work you hand in.

Write in dark blue or black pen.

You may use an 2B pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Section A (40 marks)

Answer all the questions. Write your answers in the spaces provided in the question paper.

Section B (30 marks)

Answer **three** questions in this section.

Question 8 is in the form of an **Either/Or** question. Only one part should be answered.

Write your answers in the spaces provided in the question paper.

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|---------------------------|
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| Parent's Signature |

This document consists of 14 printed pages.

[Turn over

SECTION A [40 Marks]

Answer **ALL** questions. Write your answers in the spaces provided.

- 1 A cell was immersed in a 0.5 mol dm^{-3} sucrose solution and left for several hours. Fig. 1.1 below shows the cell after immersion.

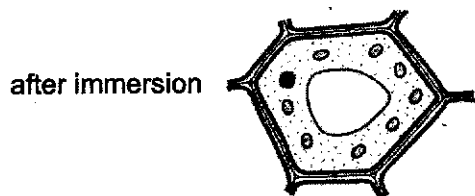


Fig. 1.1

- (a) With reference to **two** observable features in Fig. 1.1, state and explain if the cell used in the experiment was an animal cell or a plant cell.

.....

.....

..... [2]

- (b) (i) The cell in Fig. 1.1 was then placed in a 1.0 mol dm^{-3} sucrose solution. In the space provided below, make a **labelled** drawing of the cell after 3 hours.

[2]

(ii) Explain the appearance of your cell in (b)(i).

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[3]
Total: [7]

2 Bromelain is a biological molecule present in the pineapple fruit. Bromelain is responsible for the stinging sensation felt on tongues when raw pineapple slices are consumed. This stinging sensation is absent if the pineapple slices were boiled before consumption.

(a) (i) State which nutrient class bromelain belong to.

..... [1]

(ii) Explain your answer in (a)(i).

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..... [2]

(b) Bromelain has been used in patients to reduce blood clot formation in surgical operations.

With reference to named molecules, describe the process of blood clotting.

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..... [3]

Total: [6]

3 Sickle cell anemia is a genetic disease characterised by the sickling of red blood cells. Fig. 3.1 shows a blood smear from an individual affected by sickle cell anemia.

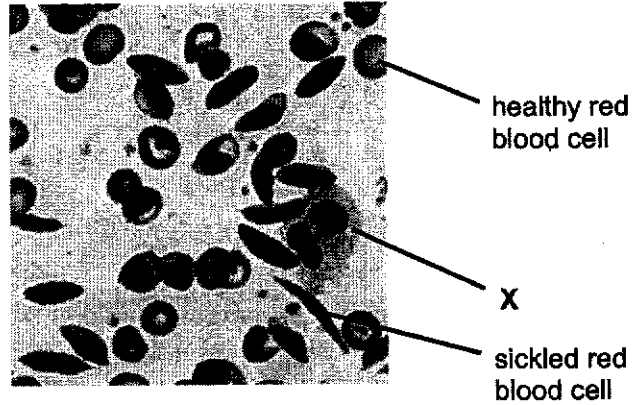


Fig. 3.1

(a) (i) Explain why the centre of a healthy red blood cell appears paler than the rest of the cell.

.....
..... [1]

(ii) Individuals suffering from sickle cell anemia often experience fatigue. Describe how the sickling of red blood cells brings about this fatigue.

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..... [3]

(b) (i) State the identity of the cell labelled X.

..... [1]

(ii) Describe how X protects an individual from foreign pathogens.

.....
..... [1]

- (c) The haemoglobin gene is found on chromosome 11 in humans. The partial sequences of the haemoglobin gene in a healthy individual and an individual with sickle cell anemia are shown below.

Healthy individual: CCT GAG GAG
Individual with sickle cell anemia: CCT GTG GAG

- (i) Define the term *gene*.

.....
.....
.....

[2]

- (ii) Describe how a change in the sequence of the haemoglobin gene can lead to the sickling of a red blood cell.

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[3]

Total: [11]

4 Fig. 4.1 shows an experimental setup used to investigate the effect of light intensity on the rate of transpiration in a leafy shoot.

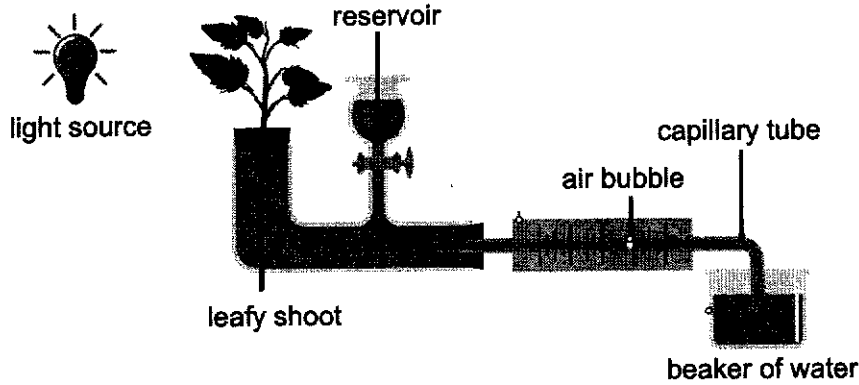


Fig. 4.1

(a) Define the term *transpiration*.

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..... [1]

(b) Describe how the above experimental setup shown in Fig. 4.1 can be used to estimate the rate of transpiration of the leafy shoot.

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..... [4]

(c) State the function of the reservoir.

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..... [1]

(d) The experiment was carried out at two different light intensities, 100 cd (lower light intensity) and 300 cd (higher light intensity). Table 4.2 shows the results of the two experiments, P and Q.

(i) Indicate the light intensity for experiments P and Q in Table 4.2.

Table 4.2

| | | |
|---|----------|----------|
| Experiment | P | Q |
| Light intensity / cd | | |
| Rate of transpiration / arbitrary units | 1 | 10 |

[1]

(ii) Explain your answer for experiment Q.

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[4]

Total: [11]

5 Individuals that have lost the functions of both kidneys have to undergo dialysis on a regular basis to remove metabolic waste products from their body. The arrows in Fig. 5.1 show the flow of blood and dialysis fluid through a dialysis machine.

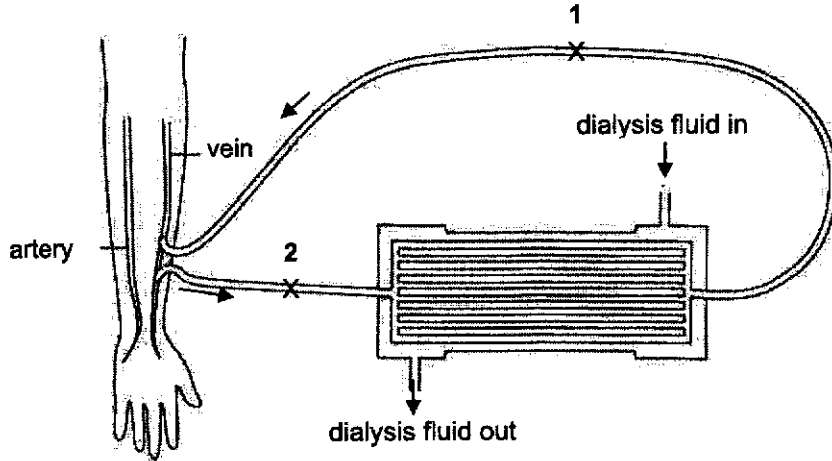


Fig. 5.1

(a) Describe and explain the relative concentration of the following molecules in the blood present at points 1 and 2.

(i) urea

.....

.....

..... [2]

(ii) glucose

.....

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..... [2]

(b) Suggest why blood for dialysis is taken from the vein instead of the artery.

.....

..... [1]

Total: [5]

SECTION B [30 Marks]

Answer **THREE** questions in this section.

Question 8 is in the form of an **Either/Or** question. Only one part should be answered.

6 (a) Describe how air is made to enter the lungs during inspiration.

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[6]

(b) Carbon monoxide is a chemical present in cigarette smoke.
Explain how high levels of carbon monoxide in the blood can lead to death.

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[3]

Total: [9]

7 A student decided to investigate the effects of carbon dioxide concentration on the rate of photosynthesis in *C. caroliniana* plants. The steps of the experiment are as follows:

1. He obtained five leaves from a single *C. caroliniana* plant.
2. He prepared five solutions of different sodium hydrogencarbonate (NaHCO_3) concentrations.
3. A probe was used to measure the concentration of dissolved oxygen (O_2) in the NaHCO_3 solutions.
4. A leaf was submerged into each of the NaHCO_3 solutions.
5. After 15 minutes, he used the probe to measure the concentration of dissolved O_2 in each of the NaHCO_3 solutions.

(a) State the purpose of using solutions of different NaHCO_3 concentration in this experiment.

..... [1]

(b) Suggest how the student can maintain a constant temperature for the setup throughout the experiment.

.....
 [1]

(c) Using the absolute concentrations of dissolved O_2 , the student calculated the percentage change in dissolved O_2 after submerging the leaf for 15 minutes. Table 7.1 shows the results of the experiment.

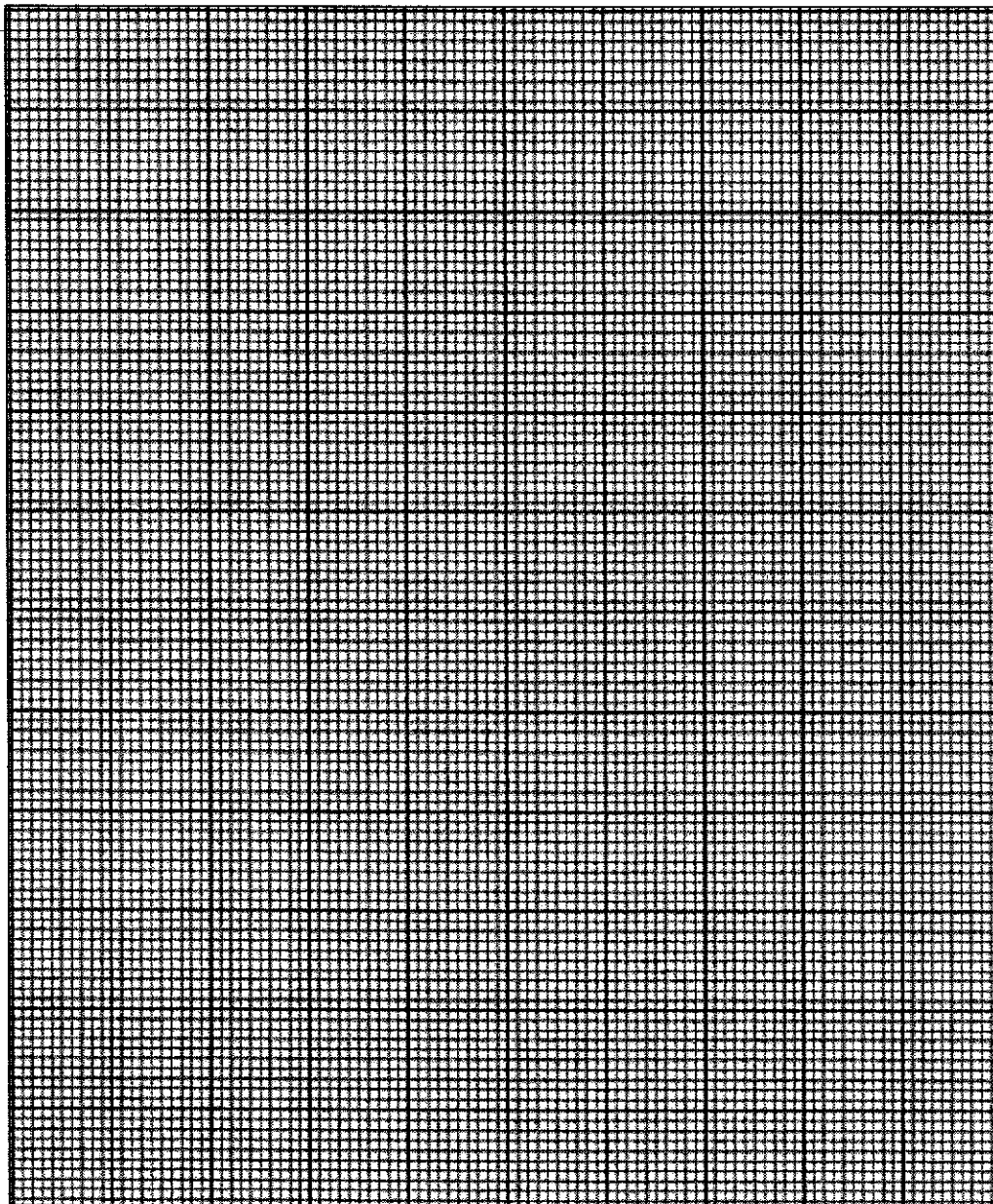
Table 7.1

| Concentration of NaHCO_3 / g L^{-1} | 0 | 20 | 40 | 60 | 80 |
|--|---------|--------|-------|-------|-------|
| Initial concentration of dissolved O_2 / mg L^{-1} | 13.24 | 13.47 | 12.98 | 13.31 | 13.68 |
| Final concentration of dissolved O_2 / mg L^{-1} | 11.49 | 12.62 | 15.59 | 16.82 | 17.42 |
| % change in concentration of dissolved O_2 | - 13.21 | - 6.32 | | 26.37 | 27.32 |

(i) Using the values provided in Table 7.1, calculate the percentage change in the concentration of dissolved oxygen when 40 g L^{-1} NaHCO_3 was used. Show your working.

percentage change = _____ [1]

- (ii) Using your answer in (c)(i) and the values provided in Table 7.1, plot a graph of the percentage change in the concentration of dissolved O_2 against the concentration of $NaHCO_3$.



[4]

- (iii) Explain why there was a decrease in the final concentration of dissolved O_2 when $20 \text{ g L}^{-1} \text{ NaHCO}_3$ was used.

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[3]

- (d) The student repeated the experiment using $100 \text{ g L}^{-1} \text{ NaHCO}_3$ and found that there was no significant increase in the rate of photosynthesis.

Suggest a factor that was limiting the rate of photosynthesis when $100 \text{ g L}^{-1} \text{ NaHCO}_3$ was used.

..... [1]

Total: [11]

EITHER

8 (a) With reference to **named** structures of the heart and blood vessels, describe the flow of blood in the left side of the heart in a single cardiac cycle.

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[7]

(b) Individuals with advanced heart failure have the option of getting a heart transplant. A simple blood test can be performed to help doctors detect potential cases of organ rejection.

Using your knowledge on the protective function of blood, suggest how organ rejection occurs. State **two** ways to reduce the probability of organ rejection.

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[3]

Total: [10]

OR

8 (a) Outline how carbon dioxide from respiring tissues is excreted from the body.

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[7]

(b) Distinguish between the processes of respiration and breathing.

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.....

[3]

Total: [10]

3E Pure Biology EOY 2019
Mark scheme

Paper 1

| | | | | | | | | | |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| A | D | A | C | A | B | B | B | B | D |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| D | A | A | C | A | C | C | A | D | C |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| D | B | C | A | C | C | D | C | C | B |

| | | | | | |
|----------|-----|--|---|--|---|
| 1 | (a) | <ul style="list-style-type: none"> • <u>plant cell</u>; • (any two) large, central vacuole/ presence of chloroplasts/ presence of cell wall; | Total: [2] | 2 correct: [1] 1/0 correct: [0] R: regular shape (unable to compare to other cells) | |
| | (b) | (i) | <ul style="list-style-type: none"> • large drawing of plasmolysed cell (vacuole shrunk, cytoplasm pulled in); • cell membrane, vacuole and cytoplasm are labelled; | Total: [2] | Max [-1] for drawing errors (lines not smooth and continuous, label lines not straight, label with arrows) |
| | | (ii) | <ul style="list-style-type: none"> • <u>water potential</u> of cell sap <u>higher</u> than water potential of 1.0 mol sucrose solution; • <u>osmosis</u> occurred; • <u>net movement</u> of <u>water molecules</u> out of the cell sap through <u>partially permeable membrane</u>; • <u>vacuole</u> and cytoplasm <u>shrinks</u> and <u>cell membrane pulls away from cell wall</u>; | Max: [3] | Students must describe plasmolysis as the pulling of cell membrane from cell wall, no marks awarded if student wrote cell becomes plasmolysed (mark for plasmolysed cell awarded in (b)(i)) |

| | | | | | |
|---|-----|------|--|------------|---|
| 2 | (a) | (i) | <ul style="list-style-type: none"> • <u>protein</u> | Total: [1] | R: Enzyme, amino acids because these are not nutrient classes |
| | | (ii) | <ul style="list-style-type: none"> • at high temperature, bromelain <u>does not catalyse the reaction</u> that leads to stinging sensation; • as bromelain is <u>denatured</u> and shape of active site is changed; • <u>shape of active site is no longer complementary to shape of substrate</u>; • <u>enzyme-substrate complex</u> not formed, reaction does not proceed; | Max: [2] | |
| | (b) | | <ul style="list-style-type: none"> • damaged tissues triggers <u>platelets</u> to release <u>thrombokinase</u>; • thrombokinase catalyses the <u>conversion of prothrombin into thrombin</u> in the <u>presence of calcium ions</u>; • thrombin catalyses the conversion of <u>soluble fibrinogen into insoluble threads of fibrin</u>; • insoluble fibrin threads form a <u>mesh</u> that <u>traps blood cells</u>. | Max: [3] | R: calcium ions not mentioned |

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| 3 | (a) | (i) | <ul style="list-style-type: none"> • RBC is <u>biconcave</u> in shape, centre of RBC has <u>less haemoglobin</u>, more light can pass through; | | |
| | | (ii) | <ul style="list-style-type: none"> • sickled RBC have <u>lower surface area to volume ratio</u>; • uptake of oxygen at the lungs by diffusion <u>slower</u>; • <u>less oxygen</u> is transported to body cells; • for <u>respiration</u> to release energy; | Max: [3] | R if student said lower surface area. A: lesser uptake of oxygen |
| | (b) | (i) | <ul style="list-style-type: none"> • <u>phagocyte</u>; | | R: lymphocyte R: white blood cell |
| | | (ii) | <ul style="list-style-type: none"> • <u>engulf, ingest and digest</u> disease-causing microorganisms; | | |
| | (c) | (i) | <ul style="list-style-type: none"> • <u>unit of inheritance</u>; • a <u>sequence of nucleotides as part of a DNA molecule</u> that codes for a <u>polypeptide</u> | | A: protein |
| | | (ii) | <ul style="list-style-type: none"> • change in nucleotide sequence results in <u>change in mRNA sequence</u>; | | |

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| | | <ul style="list-style-type: none"> • which leads to a <u>different sequence of amino acids</u> in polypeptide chain; • results in the production of a polypeptide/protein with a <u>different conformation/shape</u>; • (that forms <u>long, inflexible chains</u> resulting in a sickled-shaped red blood cell); | Max: [3] | |
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| 4 | (a) | <ul style="list-style-type: none"> • loss of <u>water vapor</u> from a plant through the aerial parts of the plant, <u>mainly the stomata of the leaves</u>; | | R: water |
| | (b) | <ul style="list-style-type: none"> • the <u>loss of water vapor/transpiration</u> from the leaves creates <u>transpiration pull</u> in the <u>xylem</u>; • water is <u>drawn into/taken up</u> by the plant as a <u>result of transpiration pull</u>; • <u>air bubble moves</u> as water is drawn into the plant; • rate of transpiration is <u>proportional</u> to the rate of water uptake; | | R: osmosis (no roots in leafy shoot) |
| | (c) | <ul style="list-style-type: none"> • to <u>reset the position of the air bubble</u> across experiments; | | |
| | (d) | (i) | P: 100 Q: 300 | A if students included units (cd) |
| | | (ii) | <ul style="list-style-type: none"> • when light intensity is high, <u>rate of photosynthesis in guard cells is high</u>; • <u>glucose produced</u> during photosynthesis is used in respiration to <u>release large amounts of energy</u>; • energy is used in <u>active transport of ions</u> into vacuole of guard cells; • <u>lowering water potential</u>, water enters the guard cells via <u>osmosis</u>, • due to <u>uneven thickness of cell wall</u> of guard cell, <u>stoma opens wider/more stomata open</u>, more water vapor is lost per unit time | Max [2] if students accurately explain results for 'P'. No marks awarded if d(i) is labelled wrongly |

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| 5 | (a) | (i) | <ul style="list-style-type: none"> • blood at point 2 has <u>higher concentration of urea</u> than blood at point 1; • urea <u>diffuses</u> from a region of higher concentration (blood) to a region of lower concentration (dialysis fluid); | | |
| | | (ii) | <ul style="list-style-type: none"> • blood at point 2 has the <u>same concentration of glucose</u> as blood at point 1; • concentration of glucose in blood 2 is the same as dialysis fluid, <u>no net movement</u> of glucose molecules; | | |
| | (b) | <ul style="list-style-type: none"> • <u>lower pressured blood</u> in vein, blood will not spurt out when vein is pierced / AW; | | R: venous blood is deoxygenated | |

Section C

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| 6 | (a) | <ul style="list-style-type: none"> • during inspiration, <u>diaphragm muscles contracts and diaphragm flattens</u>; • external intercostal muscles contract, internal intercostal muscles relax; • rib cage moves <u>outwards and upwards</u>; • volume of thoracic cavity increases, pressure decreases; • lungs inflate, lungs increase in volume and decrease in pressure; • pressure of external environment is higher than pressure of lungs; • air is <u>forced</u> into the lungs; | Max: [6] | |
| | (b) | <ul style="list-style-type: none"> • carbon monoxide has <u>higher affinity with haemoglobin</u> / carbon monoxide <u>binds irreversibly</u> with haemoglobin; • high levels of carbon monoxide <u>reduces the levels of oxyhaemoglobin</u>; • body cells <u>do not receive enough oxygen for respiration</u>; <p>OR</p> <ul style="list-style-type: none"> • carbon monoxide increases the rate of <u>fatty deposit in coronary arteries</u>; • <u>reduced blood/oxygen supply to cardiac muscles</u>; • leading to <u>lesser energy released</u> due to <u>reduced rate of respiration</u>, heart unable to pump blood to rest of the body; | | |

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| 7 | (a) | to vary the <u>concentration of carbon dioxide</u> available to the plant; | | |
| | (b) | use a <u>water bath</u> ; | | R if student mentioned measuring the temperature of the NaHCO_3 solution and adjusting by adding in new NaHCO_3 (as it |

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| | | | | will affect dissolved O ₂ concentration) |
| | (c) | (i) | 16.74% | R if working not shown R if more than 2 dp given R if units not given. |
| | | (ii) | <ul style="list-style-type: none"> x- and y- axis correctly labelled with units; points plotted correctly (ECF); curve of best fit; appropriate scale (graph > 2/3 of grid provided); | |
| | | (iii) | <ul style="list-style-type: none"> at 20 g L⁻¹ NaHCO₃, <u>rate of photosynthesis is low</u>; <u>rate of respiration is higher than rate of photosynthesis</u>; oxygen <u>taken up</u> during respiration more than oxygen <u>produced</u> by photosynthesis; | |
| | (d) | | <ul style="list-style-type: none"> (any 1) temperature/pH/enzyme concentration/substrate concentration/light intensity; | |
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| 8E | (a) | <ul style="list-style-type: none"> during <u>atrial systole</u>, the <u>walls of the left atrium</u> contracts, atrial pressure increases; when <u>atrial pressure > ventricular pressure</u>, blood is forced from the <u>left atrium</u> into the <u>left ventricle</u> through the <u>bicuspid valves</u>; atrial diastole occurs: <u>walls of the atrium relaxes</u>, atrium pressure drops; ventricular systole occurs: <u>walls of the left ventricle contract</u> and pressure of left ventricle increases; when pressure of left ventricle > pressure of left atrium, <u>bicuspid valves close to prevent backflow of blood</u>; pressure of left ventricle increases further such that <u>pressure of left ventricle > pressure of aorta</u>; blood is forced into the <u>aorta</u> through the <u>semilunar valves</u>; <u>ventricular diastole</u> occurs: walls of left ventricle relax and pressure drops below aorta pressure; | Max: [7] | |
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| | | <ul style="list-style-type: none"> backflow of blood in aorta into left ventricle prevented by closing of <u>semilunar valves</u>; | | |
| | (b) | <ul style="list-style-type: none"> antibodies in blood plasma may recognise the antigens on foreign organs, <u>tagging them for phagocytes</u> to engulf and digest / <u>AW</u>; use of <u>genetically similar</u> organs for transplant; consumption of <u>immunosuppressive drugs</u>; | | |
| 80 | (a) | <ul style="list-style-type: none"> carbon dioxide <u>diffuses</u> from <u>body cells</u> into <u>tissue fluid</u> and into the <u>blood in capillaries</u>; carbon dioxide <u>enters red blood cells</u>; carbon dioxide is converted to <u>carbonic acid</u> by <u>carbonic anhydrase</u>; carbonic acid is then converted to <u>hydrogencarbonate ions</u> that <u>diffuse out of red blood cells</u> and carried to the lungs via the plasma; at the lungs, <u>hydrogencarbonate ions</u> is taken up by the <u>red blood cells</u>; <u>hydrogencarbonate ions</u> react with <u>hydrogen ions</u> to form <u>carbonic acid</u>; the conversion of carbonic acid into <u>carbon dioxide and water</u> by <u>carbonic anhydrase</u>; carbon dioxide <u>diffuses</u> out of the <u>red blood cells</u> (higher concentration) and into the <u>alveoli</u> (lower concentration); where it is <u>expelled/forced out</u> during expiration; | Max: [7] | |
| | (b) | <ul style="list-style-type: none"> respiration is a <u>chemical/biochemical/metabolic reaction</u> while breathing is a <u>physical process</u>; energy is <u>released</u> during respiration, energy is <u>used up</u> during breathing; respiration is a <u>cellular reaction</u>, breathing is an <u>extracellular reaction</u>; respiration involves <u>all cells/tissues/organs</u>, breathing involves only <u>respiratory system</u>; | Max: [3] | A is energy is not released during breathing |