



PASIR RIS CREST SECONDARY SCHOOL
End of Year Examination 2016
Secondary Three Express

CANDIDATE NAME

CLASS /

INDEX NUMBER

Biology

Paper 1

5158

12 October 2016

2 hr 15 min

Additional Materials: Objective Test Answer Sheet (OTAS)

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and register number on the answer sheet in the spaces provided.

There are **thirty** questions on this paper. Answer all questions. For each question, there are four possible answers 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 this booklet.

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| For Examiner's Use | |
| 30 | |
| Parent's Signature | |

This document consists of 16 printed pages.

[Turn over

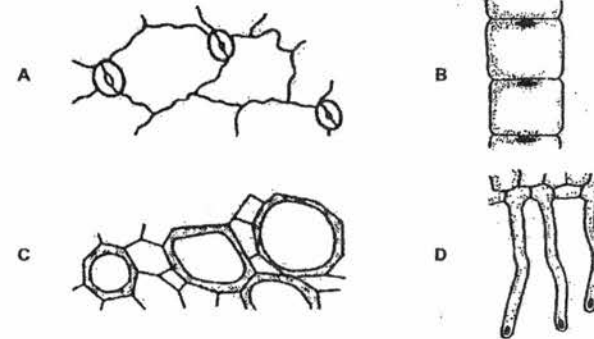
SECTION A [30 Marks]

Answer **ALL** questions. Shade your answers in the OTAS provided.

Questions 1 and 2 refer to the diagram below, which shows the side view of cells in part of a plant.



1. What diagram shows the same cells in cross section?

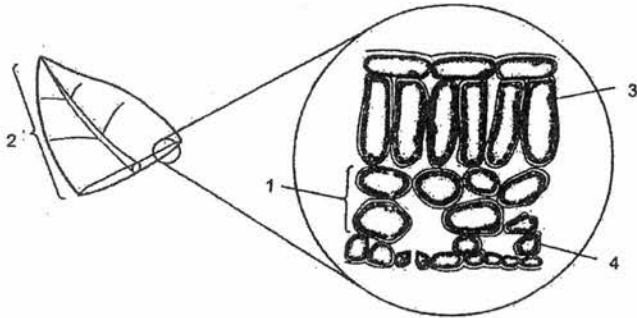


2. Which structures can be seen in the diagram?

| | cell membrane | cell wall | cytoplasm |
|---|---------------|-----------|-----------|
| A | ✓ | ✓ | ✓ |
| B | ✓ | x | x |
| C | x | ✓ | ✓ |
| D | x | ✓ | x |

key
✓ = can be seen
x = cannot be seen

3. The diagram below shows the structure of a leaf.



Which identifies a cell, tissue and an organ?

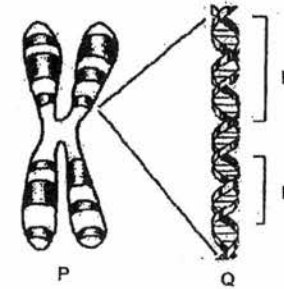
| | cell | tissue | organ |
|---|------|--------|-------|
| A | 1 | 4 | 3 |
| B | 2 | 3 | 1 |
| C | 3 | 2 | 4 |
| D | 4 | 1 | 2 |

4. Which of the following molecules would be coded for by genes on a human chromosome?

- 1: insulin
- 2: amylase
- 3: starch
- 4: haemoglobin

- A 1 only
- B 2 and 3 only
- C 1, 2 and 4 only
- D 1, 2, 3 and 4

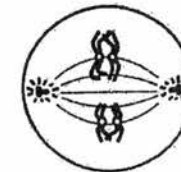
5. The diagram below shows the relationship between DNA, genes and chromosomes.



Identify the structures labelled P, Q and R.

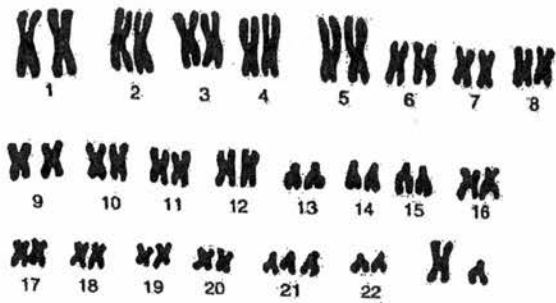
| | P | Q | R |
|---|------------|------------|------------|
| A | gene | DNA | chromosome |
| B | chromosome | DNA | gene |
| C | DNA | gene | chromosome |
| D | gene | chromosome | DNA |

6. What type of nuclear division and stage is shown in the diagram below?



| | nuclear division | stage |
|---|------------------|--------------|
| A | mitosis | metaphase |
| B | mitosis | anaphase |
| C | meiosis | metaphase I |
| D | meiosis | metaphase II |

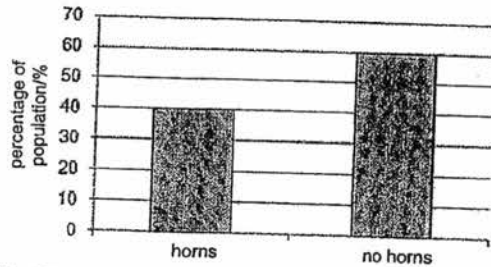
7. The diagram shows chromosomes from a human cell.



This person is

- A a female with Down's syndrome.
- B a female with sickle cell anemia.
- C a male with Down's syndrome.
- D a male with sickle cell anemia.

8. The bar chart shows the percentage of a cattle population with and without horns.

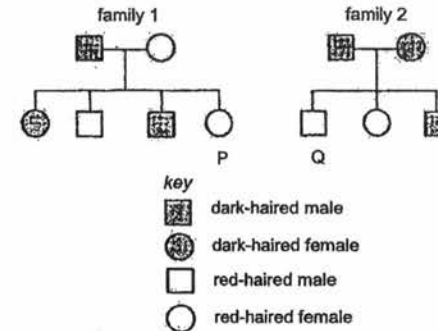


Which of the following statements **cannot** be made based on the information provided?

- A This is an example of discontinuous variation.
- B Cattle with horns are homozygous recessive.
- C Possessing horns is a genetic trait which is inherited.
- D The allele for no horns is more frequent in the population.

i+1

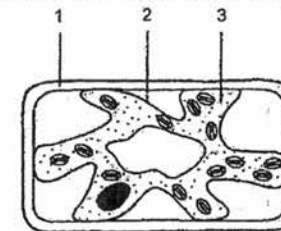
9. The diagram shows the pattern of the inheritance of dark hair and red hair in two families.



If individuals P and Q marry, what prediction can be made about their hair colour of their children?

- A red hair
- B dark hair
- C black hair
- D yellow hair

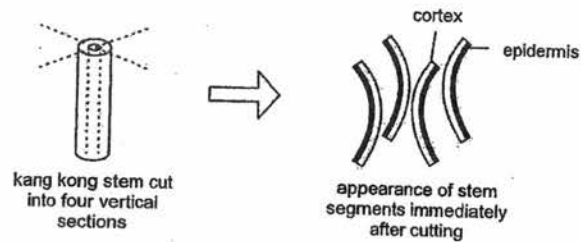
10. The diagram shows a typical plant cell after being placed in a concentrated salt solution.



Which numbered structure(s) are partially permeable?

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

Questions 11 and 12 refer to the experiment conducted on kang kong stems.



11. The epidermis is covered by a waxy, waterproof layer.

What is the name of this layer?

- A cuticle
- B mesophyll layer
- C xylem
- D phloem

12. One of the strips was placed in solution X. The diagram below shows the appearance of the kang kong strip after 20 minutes.



Which of the following explains the observation?

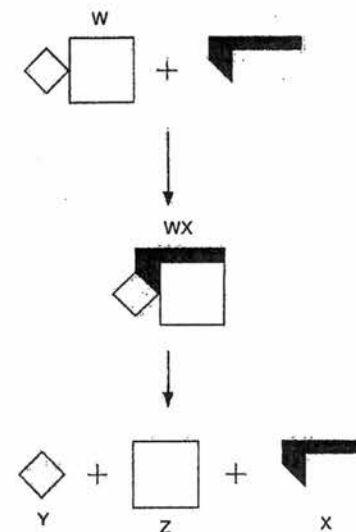
- A solution X has a lower water potential than the cell sap of kang kong cells
- B solution X has a higher water potential than the cell sap of kang kong cells
- C solution X has the same water potential as the cell sap of kang kong cells
- D solution X did not cause a change in the kang kong cells

17

13. Which processes can take place in a root hair cell when oxygen is not available?

- A active transport only
- B diffusion only
- C active transport and osmosis
- D diffusion and osmosis

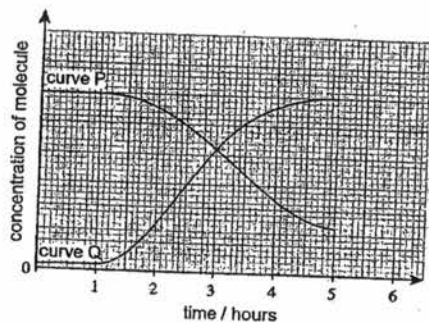
14. The diagram below represents the lock and key hypothesis of an enzyme reaction.



Which of the following represent the enzyme, substrate and products of the reaction?

| | enzyme | substrate | products |
|---|--------|-----------|----------|
| A | W | X | Y, Z |
| B | W | WX | X, Y, Z |
| C | X | W | X, Y, Z |
| D | X | W | Y, Z |

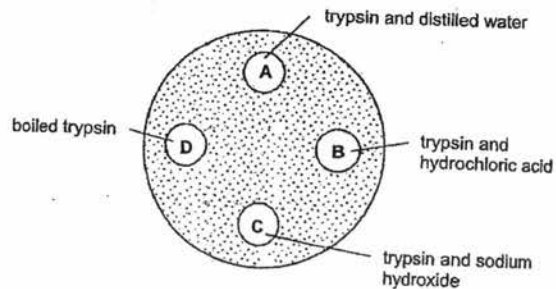
15. The following graph shows how the concentration of substances involved in an enzymatic reaction changes over a period of five hours.



What do the curves P and Q represent?

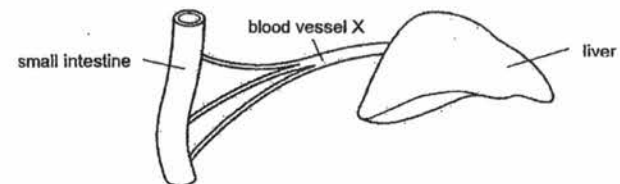
| | P | Q |
|---|-----------|-----------|
| A | enzyme | product |
| B | product | substrate |
| C | substrate | product |
| D | substrate | enzyme |

16. A dish was filled with agar jelly containing milk protein. Four holes were cut in the jelly and each hole was filled with the substances shown in the diagram. If protein digestion occurred, a clear zone would be observed around the hole. After 30 minutes, the size of the clear zone was observed.



Which hole would have the largest clear zone?

17. The diagram below shows blood vessel X, which transports nutrient rich blood from the small intestine towards the liver.

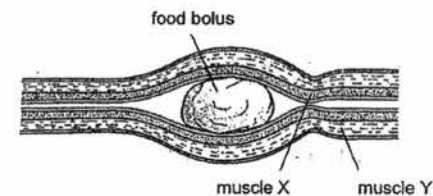


Which of the following substances are transported in blood vessel X?

- 1: glucose
- 2: amino acids
- 3: fatty acids
- 4: alcohol

- A 1 and 2 only
 B 1, 2 and 3 only
 C 1, 2 and 4 only
 D 1, 2, 3 and 4

18. The diagram below shows part of the alimentary canal.

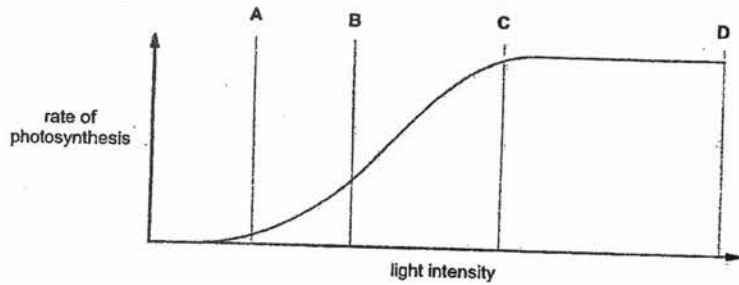


State the direction of movement of food bolus and what is occurring at muscle X and Y.

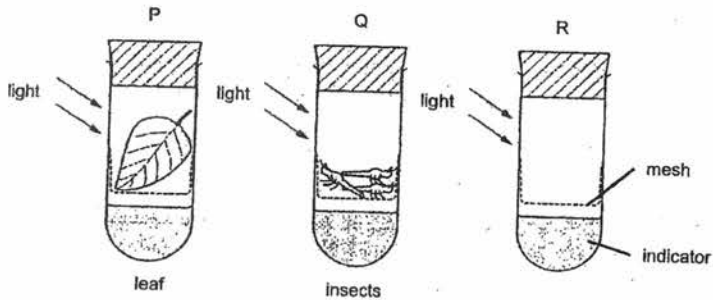
| | direction of movement of food bolus | muscle X | muscle Y |
|---|-------------------------------------|----------|----------|
| A | towards the right | contract | relax |
| B | towards the right | relax | contract |
| C | towards the left | contract | relax |
| D | towards the left | relax | contract |

19. The graph shows the rate of photosynthesis in a plant in an atmosphere containing 0.04% carbon dioxide at different light intensities.

At which point on the graph is carbon dioxide concentration a limiting factor?



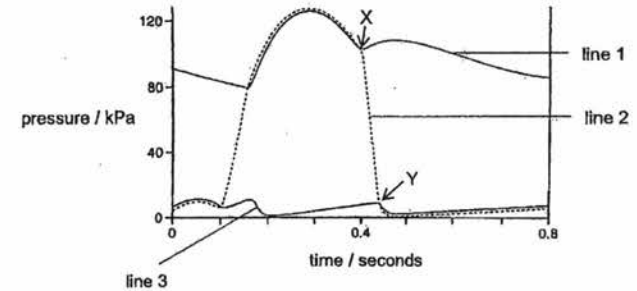
20. Three test tubes are set up as shown. At the start of the experiment, the indicator in each test tube is red. The indicator changes from red to yellow when exposed to increased levels of carbon dioxide.



What will be the colour of the indicator in each test tube after two hours?

| | P | Q | R |
|---|--------|--------|--------|
| A | red | red | yellow |
| B | red | yellow | red |
| C | yellow | red | red |
| D | yellow | yellow | yellow |

Questions 21 to 23 refer to the graph of the cardiac cycle of the left side of the heart.



21. What is represented by lines 1, 2 and 3?

| | line 1 | line 2 | line 3 |
|---|-------------------------|----------------------|---------------------------|
| A | aorta pressure | ventricular pressure | atrial pressure |
| B | pulmonary vein pressure | ventricular pressure | atrial pressure |
| C | ventricular pressure | atrial pressure | pulmonary artery pressure |
| D | ventricular pressure | atrial pressure | vena cava pressure |

22. What is the number of times this person's heart beats in one minute?

- A 80
- B 75
- C 70
- D 60

23. Between points X and Y, are the following valves open or closed?

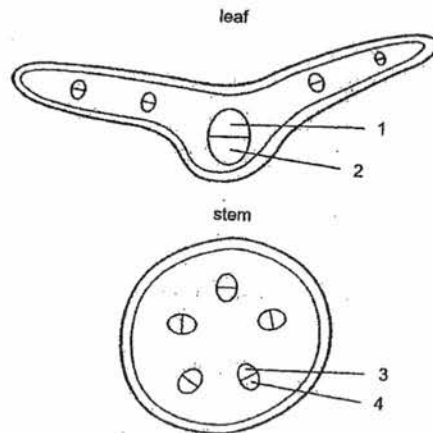
| | atrio-ventricular | semi-lunar |
|---|-------------------|------------|
| A | closed | open |
| B | open | close |
| C | close | close |
| D | open | open |

24. A certain disease in cows causes their small intestines to become completely smooth.

Which of the following is a likely consequence of the disease?

- A digestion of fats slow down
- B decreased absorption of water and mineral salts
- C constipation
- D malnutrition

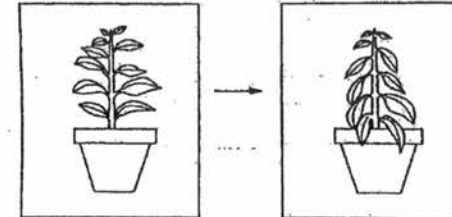
25. The diagram below shows the cross section of a stem and leaf.



Which regions represent the phloem tissue?

| | leaf | stem |
|---|------|------|
| A | 1 | 3 |
| B | 1 | 4 |
| C | 2 | 3 |
| D | 2 | 4 |

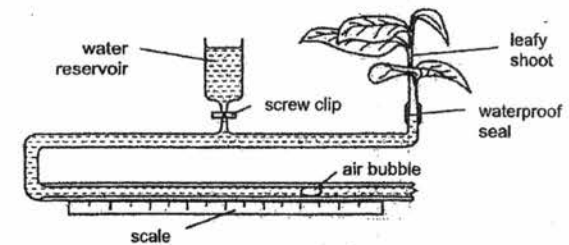
26. The diagram below shows the changes in a potted plant after a few hours.



Which conditions will result in this change?

| | humidity | light intensity | temperature | salinity of soil |
|---|----------|-----------------|-------------|------------------|
| A | high | high | high | high |
| B | high | low | low | low |
| C | low | low | low | low |
| D | low | high | high | high |

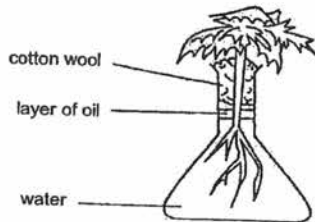
27. It is often said that the apparatus below measures the exact transpiration rate of a plant.



Why is this not entirely true?

- A some water take up is used during photosynthesis
- B some water taken up is used for respiration
- C leaks may occur in the apparatus causing inaccurate readings
- D bubbles may be introduced into the xylem tissue when plant is cut

28. Five plants were placed in a flask of water as shown in the diagram.



Some of the plants had their leaves coated with Vaseline (waterproof substance). Each plant was weighed in its flask at the start of experiment and again 2 days later. The results are shown in the table.

| | mass at the start of experiment / g | mass after 2 days / g |
|---------|-------------------------------------|-----------------------|
| plant 1 | 105 | 103 |
| plant 2 | 121 | 97 |
| plant 3 | 107 | 84 |
| plant 4 | 111 | 110 |
| plant 5 | 119 | 93 |

Which of the plants had their leaves coated with Vaseline?

- A 1 and 2 only
- B 1 and 4 only
- C 2 and 5 only
- D 2, 3 and 5 only

29. An oxygen debt occurs when

- A energy release exceeds energy demand.
- B gaseous exchange cannot keep up with oxygen requirements.
- C there is excess carbon dioxide in the body.
- D rate of photosynthesis is lower than respiration.

30. What is the role of cilia in the gaseous exchange system?

- A They increase the surface area for gas exchange.
- B They move air down the trachea.
- C They move mucus up the trachea.
- D They trap dust and bacteria.



PASIR RIS CREST SECONDARY SCHOOL
End of Year Examination 2016
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INDEX
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Biology

Paper 2

5158

12 October 2016

2 hr 15 min

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 B (40 marks)

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

Section C (30 marks)

Answer three questions in this section.

Question 10 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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2 Fig. 2 shows how "Bt corn", a transgenic crop plant is created.

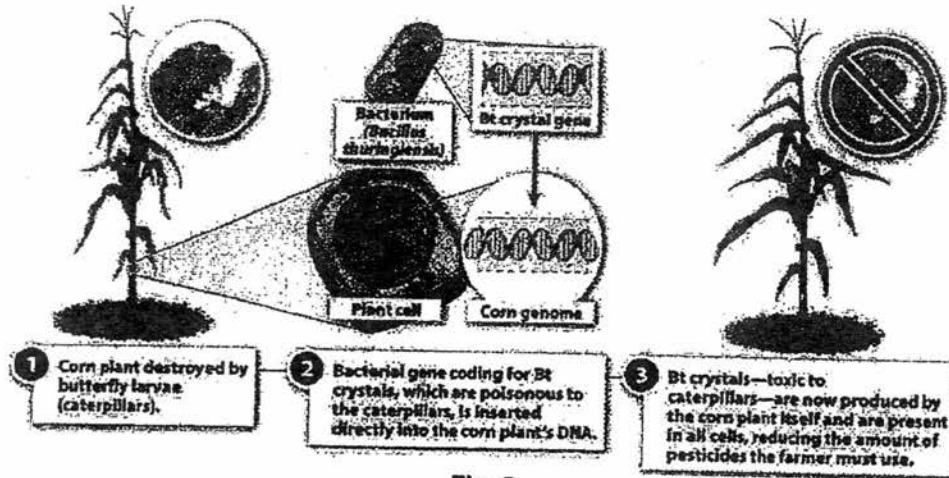


Fig. 2

The bacteria *Bacillus thuringiensis* produce a protein "Bt crystal protein", which is a toxin that kills the caterpillars. Transgenic "Bt corn" contain the "Bt crystal gene" and are able to produce the Bt toxin to kill caterpillars that feed on the corn.

(a) Why is "Bt corn" considered a *transgenic organism*?

.....

.....

.....

.....

.....

[2]

(b) Suggest how the "Bt gene" was isolated from the *Bacillus thuringiensis*?

.....

[1]

(c) Using the example of the "Bt corn", suggest **two** advantages and **one** disadvantage introducing an insecticide producing gene into plants.

.....

.....

.....

.....

.....

.....

[3]

[total marks: 6]

3 Fig. 3 shows two different stages of meiosis occurring in a cell.



Fig. 3

(a) Identify stage P and stage Q of meiosis. Explain your answer.

| diagram | stage of meiosis | explanation |
|---------|------------------|-------------|
| stage P | | |
| stage Q | | |

[2]

(b) What are the two stages in meiosis which genetic variation can be introduced into the daughter cells?

.....

[1]

(c) State the importance of mitosis in humans.

.....

[2]

(d) Differentiate between a *chromatin*, *chromatid* and *chromosome*.

.....

[2]

[total marks: 7]

4 Fig. 4 shows the simplified digestive system of a bird.

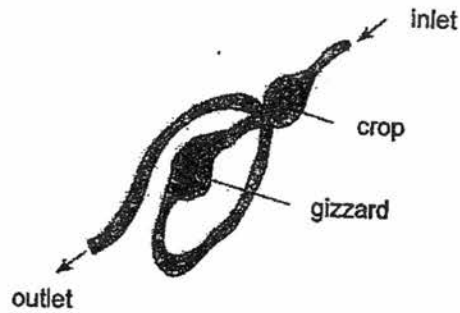


Fig. 4

- (a) A gizzard a specialised organ containing swallowed stones is shown in Fig. 4. The gizzard helps the bird grind food it eats.

State the advantage of grinding food to aid digestion.

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

[2]

- (b) In humans, which part of the digestive system performs the similar function as the gizzard?

.....

[1]

[total marks: 3]

- 5 (a) With the aid of a genetic diagram, show why there should be an equal chance of a baby being either a boy or girl.

[3]

- (b) Despite the genetic diagram drawn in (a), explain why in some families, all children are of the same sex.

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

[1]

[total marks: 4]

- 6 Ryan investigated the ability of amylase to digest starch under various conditions. He set up two water baths, one containing boiling water (100 °C) and the other containing water at 37 °C. Table 6 shows the set up the reaction mixtures.

Table 6

| test tube | contents in test tube |
|-----------|---|
| 1 | 1 cm ³ amylase (pre-treated at 100 °C) + 9 cm ³ distilled water |
| 2 | 1 cm ³ amylase (pre-treated at 37 °C) + 9 cm ³ distilled water |
| 3 | 1 cm ³ amylase (pre-treated at 100 °C) + 9 cm ³ starch |
| 4 | 1 cm ³ amylase (pre-treated at 37 °C) + 9 cm ³ starch |

After 15 minutes, Ryan tested the mixture in each test tube for reducing sugar using the Benedict's test.

- (a) Write a word equation to show the effect of amylase on starch.

..... [1]

- (b) Complete the table by predicting the observations for the Benedict's test for the following test tubes 1 to 4.

| test tube | observation for Benedict's test |
|-----------|---------------------------------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |

[4]

- (c) Which test tube shows that the digestion of starch has occurred?

Give one reason.

.....

 [1]

- (d) Explain what might have happened to the amylase in test tube 3.

.....

 [2]

[total marks: 8]

180

7 Fig. 7 shows a magnified view of the phloem under an electron microscope.....

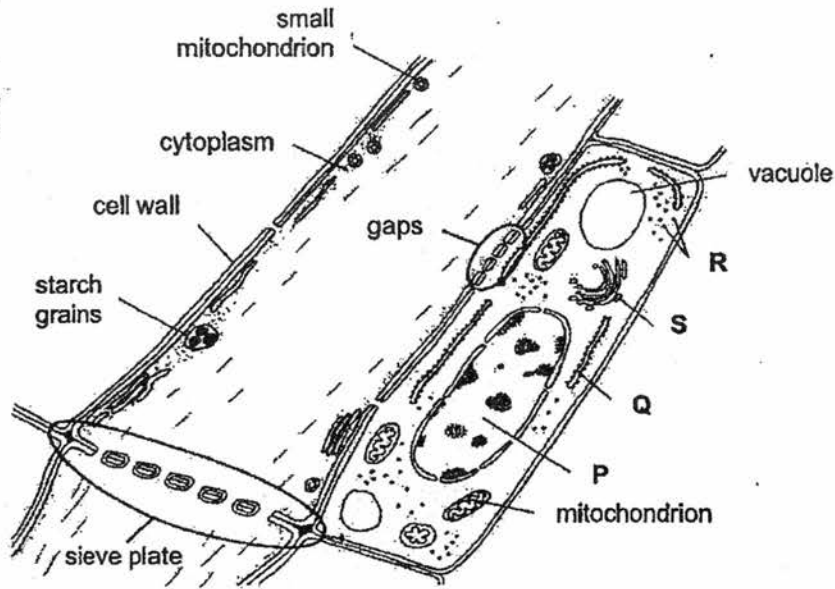


Fig. 7

(a) Identify organelles P, Q, R and S, and state their function in *protein synthesis* in a cell.

.....

.....

.....

.....

.....

.....

[3]

(b) Fluid obtained from the sieve tube element was tested using Benedict's solution and iodine.

Complete the table showing the expected results and conclusion of the test.

| reagent | results | conclusion |
|---------------------|---------|------------|
| Benedict's solution | | |
| iodine | | |

[2]

[total marks: 5]

SECTION C [30 Marks]

Answer **THREE** questions in this section.

Question 10 is in the form of an **Either/Or** question. Only on part should be answered.

8. Nafees carried out an experiment to investigate the growth of floating water plants taken from a pond. Equal masses of the plants were placed into three separate glass containers **A**, **B** and **C**, similar to the one shown in Fig. 8.1

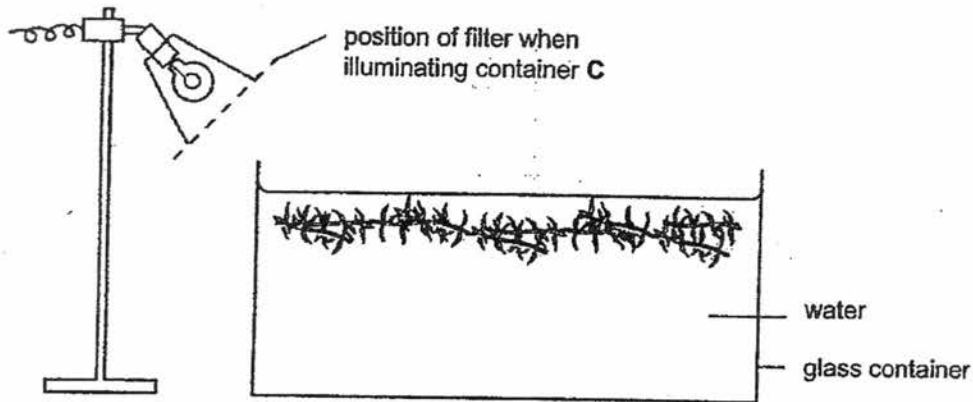


Fig. 8.1

Container **A** was lit by a 250 W bulb, **B** was lit by a 75 W bulb and **C** was lit by a 250 W bulb with a coloured filter in front of the lamp, as shown in Fig. 8.1.

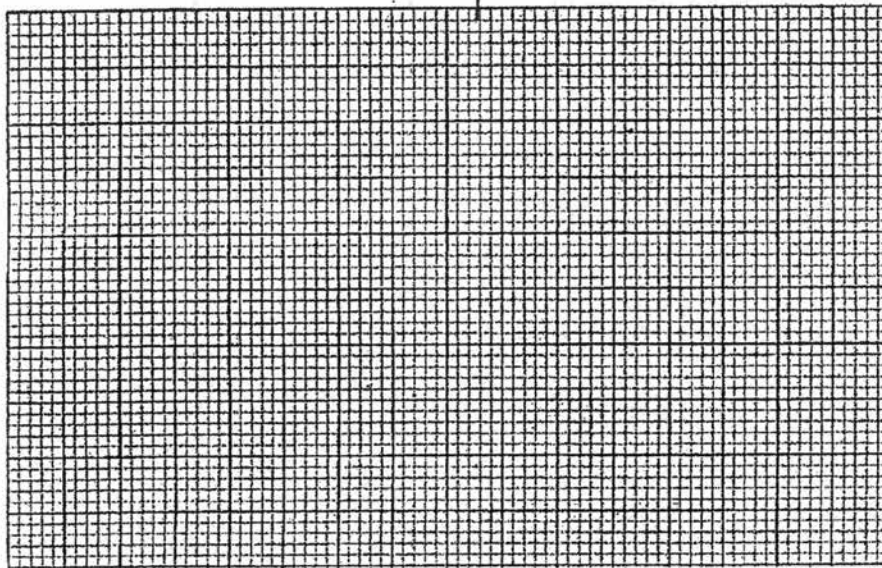
At weekly intervals, the plants were removed from each container in turn, gently dried, weighed and returned to the containers after their mass had been recorded.

Table 8 shows the results of the experiment.

Table 8

| time / weeks | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| mass of plant A / g | 150 | 240 | 350 | 400 | 430 | 450 | 420 | 380 | 370 |
| mass of plant B / g | 150 | 160 | 170 | 190 | 200 | 220 | 250 | 280 | 310 |
| mass of plant C / g | 150 | 150 | 150 | 140 | 130 | 120 | 110 | 110 | 100 |

- (a) Using the information in **Table 8**, plot a graph of the containers **A, B** and **C** of *mass/g* against *time/weeks*.



[4]

- (b) Suggest what factor may be limiting the rate of photosynthesis in container **B**.

Use data you have drawn from your graph in (a).

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

[2]

- (c) During the 8th week, which container contained the least amount of dissolved oxygen?

Explain your answer.

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

[2]

Fig. 8.2 shows the amount of light of different colours absorbed by chlorophyll.

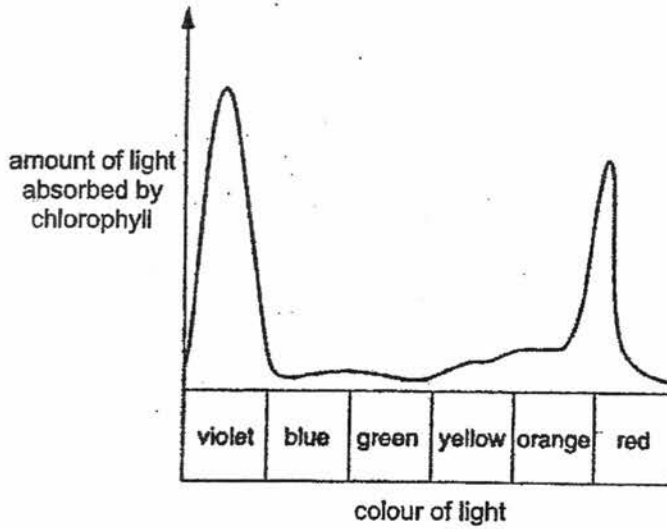


Fig. 8.2

- (d) The filter in front of the lamp for container C only allowed one colour of light to pass through to the water plants.

Suggest what colour of light passed through the filter.

Explain your answer.

.....

.....

.....

.....

[total marks: 10] [2]

☞ additional writing space ☞

)

A series of horizontal dotted lines for writing, starting from the second line below the header and ending at the second line above the footer. There are 25 dotted lines in total.

| Question | Answer |
|----------|--------|
| 1 | C |
| 2 | D |
| 3 | D |
| 4 | C |
| 5 | B |
| 6 | C |
| 7 | C |
| 8 | B |
| 9 | A |
| 10 | B |
| 11 | A |
| 12 | B |
| 13 | D |
| 14 | D |
| 15 | C |

| Question | Answer |
|----------|--------|
| 16 | C |
| 17 | C |
| 18 | C |
| 19 | D |
| 20 | B |
| 21 | A |
| 22 | B |
| 23 | C |
| 24 | D |
| 25 | D |
| 26 | D |
| 27 | A |
| 28 | B |
| 29 | B |
| 30 | C |

SECTION B [40 Marks]

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

1 Fig. 1 shows a pair of specialised plant cells.

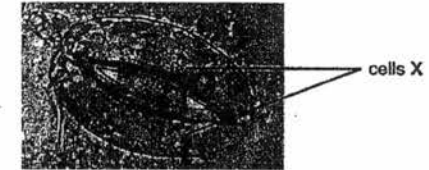


Fig. 1

(a) Identify cell X.

Guard cells

[1]

(b) (i) Name one structural difference between cell X and a typical plant cell.

Guard cells have uneven cell walls.

[1]

(ii) How does the difference stated in (b)(i) help in the function of these cells.

Any 3:

- Guard cells can become turgid/flaccid due to changes in water potential of cells
- Allows guard cells / stoma to open and close
- Which can control gaseous exchange
- Allowing carbon dioxide to enter during photosynthesis / oxygen to enter during respiration / prevent excessive water loss

[3]

(c) Suggest how these specialised cells X are different from a plant adapted to a hot and dry environment compared to a typical green plant.

Any 1:

- **Sunken stomata**
- **Few in number**
- **Remain closed during the hottest part of the day**

1m: elaboration/explanation of point

[2]

[total marks: 7]

2 Fig. 2 shows how "Bt corn", a transgenic crop plant is created.

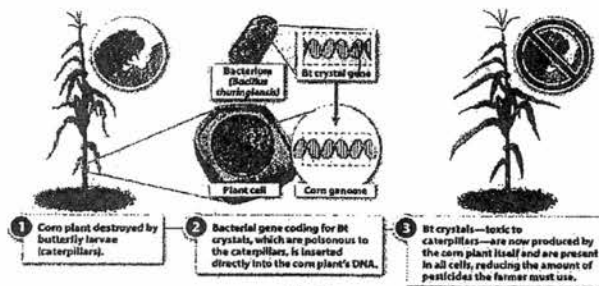


Fig. 2

The bacteria *Bacillus thuringiensis* produce a protein "Bt crystal protein", which is a toxin that kills the caterpillars. Transgenic "Bt corn" contain the "Bt crystal gene" and are able to produce the Bt toxin to kill caterpillars that feed on the corn.

(a) Why is "Bt corn" considered a transgenic organism?

- Contains genes from organism of different species / bacterial genes / not from its own genome.
- Created by genetic engineering / biotechnology

[2]

(b) Suggest how the "Bt gene" was isolated from the *Bacillus thuringiensis*?

- Cut from genome with a restriction enzyme.

[1]

(c) Using the example of the "Bt corn", suggest two advantages and one disadvantage introducing an insecticide producing gene into plants.

Advantages:

- Reduce usage of insecticides to remove pest insects
- Increase crop yield of corn

Disadvantages (any 1):

- Encourage easy introduction of other GMOs/transgenic organisms as crops.
- Bt corn lower yield than traditional corn
- Not v effective in killing pests.
- Super weed formation
- Allergic reactions in humans to Bt crystals.

[3]

[total marks: 6]

3 Fig. 3 shows two different stages of meiosis occurring in a cell.



Fig. 3

(a) Identify stage P and stage Q of meiosis. Explain your answer.

| diagram | stage of meiosis | explanation |
|---------|--------------------|---|
| stage P | anaphase I | <u>homologous chromosomes</u> are separated |
| stage Q | anaphase II | <u>sister chromatids</u> are separated |

[2]

(b) What are the two stages in meiosis which genetic variation can be introduced into the daughter cells?

prophase I & metaphase I

[1]

(c) State the importance of mitosis in humans.

- Growth: increase in cell number to increase the size of organism.
- Repair: regenerate/replace worn out and damaged cells

(reject: asexual reproduction)

[2]

(d) Differentiate between a *chromatin*, *chromatid* and *chromosome*.

- **Chromatin** is the decondensed version of a chromosome / chromatin will condense to form chromosomes
- **Chromatid** is a copy of the newly copied chromatid / chromosome joined to the other by the centromere

[2]

[total marks: 7]

4 Fig. 4 shows the simplified digestive system of a bird.

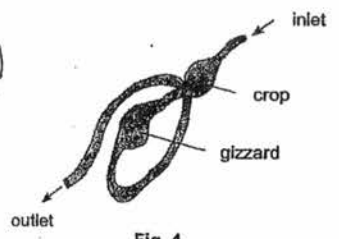


Fig. 4

(a) A gizzard a specialised organ containing swallowed stones is shown in Fig. 4. The gizzard helps the bird grind food it eats.

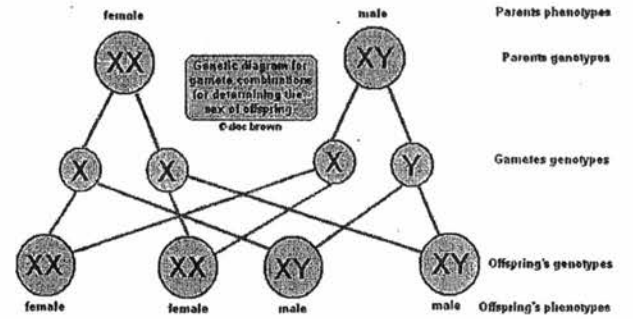
State the advantage of grinding food to aid digestion.

- Increases surface area of food / physical digestion
- Allows enzymes to digest food more quickly (reject: easily) into simpler substances [2]

(b) In humans, which part of the digestive system performs the similar function as the gizzard?

Teeth (reject: mouth) / stomach [1]
[total marks: 3]

5 (a) With the aid of a genetic diagram, show why there should be an equal chance of a baby being either a boy or girl.



probability of a child being born female = 50%
probability of a child being born male = 50%

1m: genotype of parents
1m: chromosomes in sperm and egg
1m: probability of male/female stated as ½ or 50% [3]

(b) Despite the genetic diagram drawn in (a), explain why in some families, all children are of the same sex.
• Small sample size / few children in families [1]

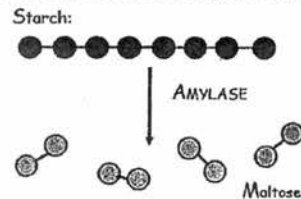
[total marks: 4]

- 6 Ryan investigated the ability of amylase to digest starch under various conditions. He set up two water baths, one containing boiling water (100 °C) and the other containing water at 37 °C. Table 6 shows the set up the reaction mixtures.

| test tube | contents in test tube |
|-----------|---|
| 1 | 1 cm ³ amylase (pre-treated at 100 °C) + 9 cm ³ distilled water |
| 2 | 1 cm ³ amylase (pre-treated at 37 °C) + 9 cm ³ distilled water |
| 3 | 1 cm ³ amylase (pre-treated at 100 °C) + 9 cm ³ starch |
| 4 | 1 cm ³ amylase (pre-treated at 37 °C) + 9 cm ³ starch |

After 15 minutes, Ryan tested the mixture in each test tube for reducing sugar using the Benedict's test.

- (a) Write a word equation to show the effect of amylase on starch.



[1]

- (b) Complete the table by predicting the observations for the Benedict's test for the following test tubes 1 to 4.

| test tube | observation for Benedict's test |
|-----------|---|
| 1 | remains blue |
| 2 | remains blue |
| 3 | remains blue |
| 4 | brick red precipitate (reject: brick red) |

[4]

- (c) Which test tube shows that the digestion of starch has occurred? Give one reason.

Test tube 4: **Maltose** is the end product of **starch digestion**, which is a **reducing sugar** causing the Benedict's solution to form a brick red precipitate.

[1]

- (d) Explain what might have happened to the amylase in test tube 3.

- Amylase was **denatured by high temperature**
- **Active site deformed/changed shape** and no longer bind **substrate** / **starch**.

[total marks: 8]

- 7 Fig. 7 shows a magnified view of the phloem under an electron microscope.

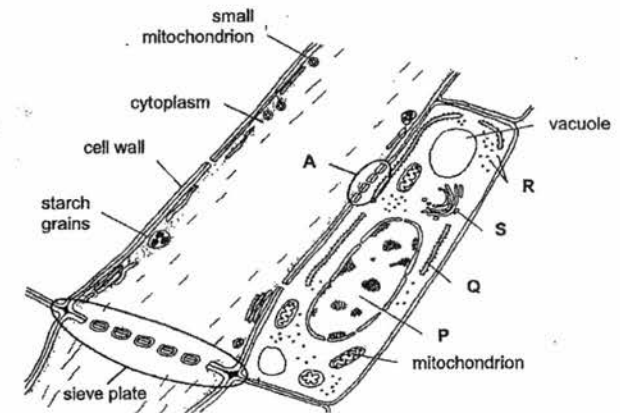


Fig. 7

- (a) Identify organelles P, Q, R and S, and state their function in *protein synthesis* in a cell.

- P is the **nucleus** which contains **genetic information** / **DNA** / **chromosomes**.
- Q is the **rough endoplasmic reticulum** / R are **ribosomes**, which are able to **synthesise proteins** from information from genes.
- S is the **golgy body**, which **modifies** / **packages proteins**.

[3]

- (b) Fluid obtained from the sieve tube element was tested using Benedict's solution and iodine.

Complete the table showing the expected results and conclusion of the test.

| reagent | results | conclusion |
|---------------------|---------------|-----------------------|
| Benedict's solution | remains blue | reducing sugar absent |
| iodine | remains brown | starch absent |

[2]

[total marks: 5]

SECTION C [30 Marks]

Answer **THREE** questions in this section.

Question **10** is in the form of an **Either/Or** question. Only on part should be answered.

- 8 Nafees carried out an experiment to investigate the growth of floating water plants taken from a pond. Equal masses of the plants were placed into three separate glass containers **A**, **B** and **C**, similar to the one shown in Fig. 8.1

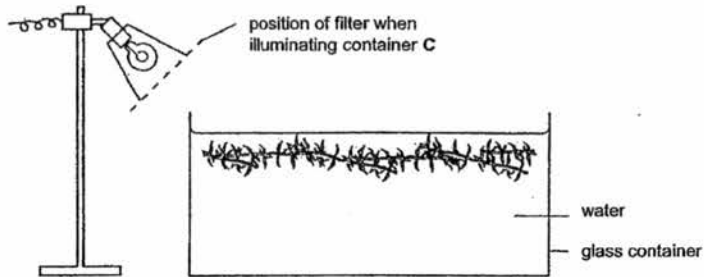


Fig. 8.1

Container **A** was lit by a 250 W bulb, **B** was lit by a 75 W bulb and **C** was lit by a 250 W bulb with a coloured filter in front of the lamp, as shown in Fig. 8.1.

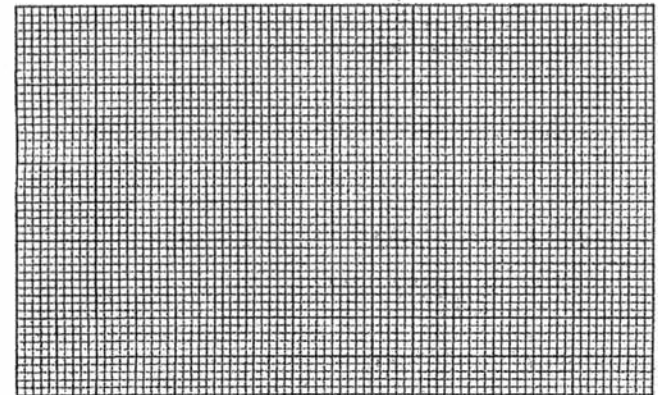
At weekly intervals, the plants were removed from each container in turn, gently dried, weighed and returned to the containers after their mass had been recorded.

Table 8 shows the results of the experiment.

Table 8

| time / weeks | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| mass of plant A / g | 150 | 240 | 350 | 400 | 430 | 450 | 420 | 380 | 370 |
| mass of plant B / g | 150 | 160 | 170 | 190 | 200 | 220 | 250 | 280 | 310 |
| mass of plant C / g | 150 | 150 | 150 | 140 | 130 | 120 | 110 | 110 | 100 |

- (a) Using the information in Table 8, plot a graph of the containers **A**, **B** and **C** of \dots mass/g against time/weeks.



[4]

1m: axis labelled with correct units
 1m: points correctly plotted for A
 1m: points correctly plotted for B
 1m: points correctly plotted for C

Deduct 1m for wrong scale.

- (b) Suggest what factor may be limiting the rate of photosynthesis in container B.

Use data you have drawn from your graph in (a).

- Light intensity
- With the 75W bulb instead of 250 W bulb in A, mass of plant increased more slowly as compared to A (quote data) [2]

- (c) During the 8th week, which container contained the least amount of dissolved oxygen?

Explain your answer.

- Container **C** has least amount of mass
- Least amount of photosynthesis, least amount of oxygen produced. [2]

Fig. 8.2 shows the amount of light of different colours absorbed by chlorophyll.

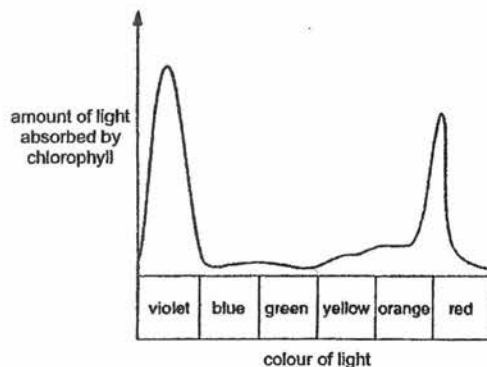


Fig. 8.2

(d) The filter in front of the lamp for container C only allowed one colour of light to pass through to the water plants.

Suggest what colour of light passed through the filter.

Explain your answer.

- Blue / green / yellow are not absorbed by chlorophyll in plants
- Cannot be used to carry out photosynthesis thus plant cannot grow / mass did not increase. [2]

[total marks: 10]

9 (a) With the aid of Fig. 9, describe how the leaf is structurally adapted to carry out its function.

Any 6 points (negative marking applies to wrong answers):

1. Broad lamina, increases surface area of leaf, which increases the amount of sunlight that is trapped for photosynthesis.
2. Petiole/stalk of leaf positions leaf in optimal position to obtain maximal amount of sunlight.
3. A large and dense network of veins is present on the leaf. The veins consist of xylem vessels which transport water to the leaf, which is required for photosynthesis.
4. The veins also consist of phloem which transport sugars formed during photosynthesis away from the leaf.
5. A cuticle is present on the upper surface of the upper epidermis. It is made up of a waxy and waterproof substance which reduces the amount of water loss from the upper surface of the leaf.
6. The upper epidermis of the leaf lack chloroplasts and are colourless and transparent. They allow sunlight to easily pass through them to reach the palisade mesophyll cells.
7. The palisade mesophyll cells are the main photosynthesizing cells in the leaf. They contain large numbers of chloroplasts inside the leaf, which ensures maximum amount of sunlight that is absorbed.
8. The cells in the palisade mesophyll are tightly packed together allowing as much sunlight to be trapped. [6]
9. The cells in the palisade mesophyll are closer to surface of leaf, where there is more sunlight present to be trapped for photosynthesis.
10. The spongy mesophyll cells are loosely packed, and contain many intercellular air spaces. The air spaces allow the quick and easy diffusion of gases within the leaf, allowing carbon dioxide required for photosynthesis to enter the cells. (reject: diffusion of gases from atmosphere into leaf).
11. Spongy mesophyll cells have a layer of moisture on the surface of cells for gases to dissolve into the cells easily.
12. The guard cells are specialised lower epidermal cells, where a pair of them forms the stoma. Stomata are openings on the lower epidermis that allow gaseous exchange, where carbon dioxide can diffuse into the leaf during photosynthesis.

- (b) Describe how the structure of a leaf taken from a plant adapted to grow under low light conditions may differ from a leaf taken from a plant adapted to grow under bright light.

Depending on answer:

- The cuticle is thinner in the shady plant and thicker in the sunny plant.
- Plant under sunlight tends to lose more water to surroundings / thick cuticle helps to reduce water loss from upper surface of leaf.
- There are fewer layers of palisade mesophyll in shady plant / more layers of cells in sunny plant. (as there is less light to be trapped)
- ***
- The palisade mesophyll has fewer chloroplasts in the shady plant / larger number of chloroplasts in sunny plant.
- This allows the sunny plant to trap as much sunlight for photosynthesis / less light available for photosynthesis for shady plant. [4]
- *** (or)
- The palisade mesophyll has more chloroplasts in the shady plant.
- This allows the shady plant to trap as much sunlight for photosynthesis.

10 Either

Fig. 10 shows the pressure of blood as it completes one circulation of the body (excluding the lungs).

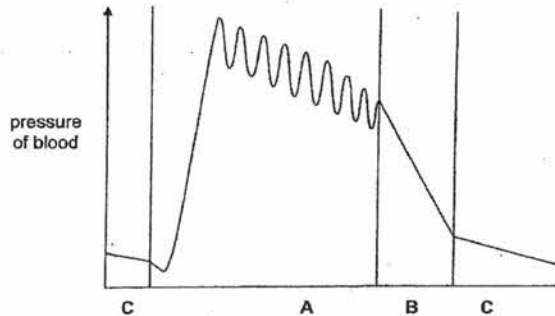


Fig. 10

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- (a) Using information from Fig. 10, identify blood vessels A, B and C.

A: artery
B: capillary
C: vein

[1]

- (b) Explain how the structure of blood vessels A, B and C are adapted to carry out their function.

- Arteries have thick / muscular walls with a lot of elastic tissue
- The elastic tissue allows the artery to withstand high blood pressures due to the beating of the heart / the elastic tissues allows wall to stretch and recoil help to maintain a high blood pressure
- The muscular walls can constrict and dilate to control the amount / volume of blood flowing through the blood vessel.
- Veins have thinner, less muscular walls with less elastic tissues.
- The blood pressure in veins is lower / veins only need to withstand lower blood pressures.
- Semi-lunar valves are present to prevent the backflow of blood in veins.
- Capillaries are one-cell thick.
- This is a short distance, which allows quick diffusion of substances between the blood and body cells
- Large network / many capillaries creates a large surface area for exchange of substances.

[9]

[total marks: 10]

10 Or

(a) Explain how air is made to exit the lungs.

1. Air is forced out the lungs during exhalation.
2. During exhalation, the external intercostal muscles relax while the internal intercostal muscles contract (antagonistic muscles).
3. This causes the rib cage to move in an inward and downward direction.
4. The diaphragm (sheet of muscle) relax, which results in the curving upwards of the diaphragm.
5. This causes the pressure in the lungs (reject: thoracic cavity) to increase, and become higher than the surroundings, causing air to move out the lungs.
6. Volume of air decreases during exhalation

[6]

(b) Describe how a molecule of oxygen in the air breathed in reaches a muscle cell in the wall of the left ventricle.

1. Oxygen enters the lungs and oxygenated blood/red blood cell/oxyhaemoglobin is carried towards the heart via the pulmonary vein.
2. Blood enters the left atrium and is pumped to the left ventricle when the muscle of the heart contracts. (reject: atrium contracts / ventricle contracts)
3. Blood exits the heart via the aorta, which branches into the coronary artery.
4. Coronary artery branches into capillaries, where oxygen molecules diffuse from RBC via tissue fluid into the muscle cells.

[4]

[total marks: 10]