Name: _____( ) Class: _____

WOODLANDS SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019

Level:	Sec 4 Express and 5 Normal (Academic)	Marks:	65
Subject:	Science (Biology)	Day:	Monday
Paper:	4	Date:	26 August 2019
Duration:	1 h 15 min	Time:	0800 – 0915

READ THESE INSTRUCTIONS FIRST

There are five questions in Section A. 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 the table on Page 2.

Answer any **two out of three** questions in Section B.
The number of marks is given in brackets [ ] at the end of each question or part question.

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

The use of calculators is allowed in this examination.

For Examiner's Use	
Paper 1	20
Section A	45
Section B	20
TOTAL:	**85**

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Section A (45 marks)

Answer **all** questions in the spaces provided on the question paper.

1 Fig. 1.1 shows different types of specialized plant cells, **A**, **B**, **C** and **D**.

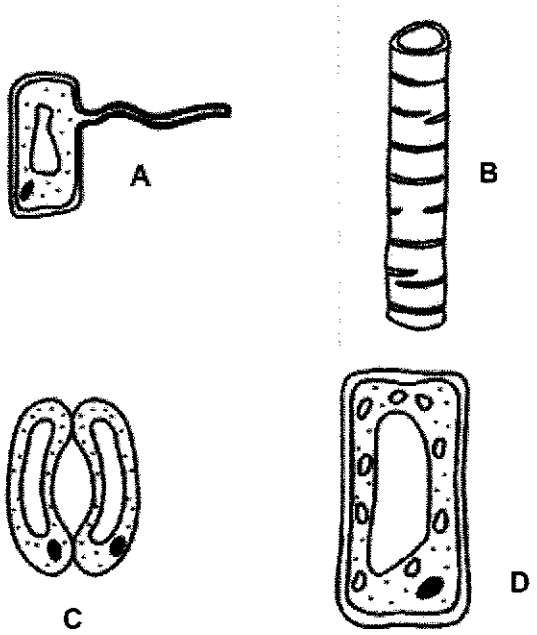


Fig. 1.1

(a) Contrast between the structures of the following pairs of plant cells.

(i) cells **A** and **D**

..... [1]

(ii) cells **B** and **D**

..... [1]

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(b) Fig. 1.2 shows a plant, with a magnified view of a leaf.
Using letters from Fig. 1.1, fill in each box with an appropriate letter to show which cells are found at the respective parts of the plant. Each letter may only be used **once**.

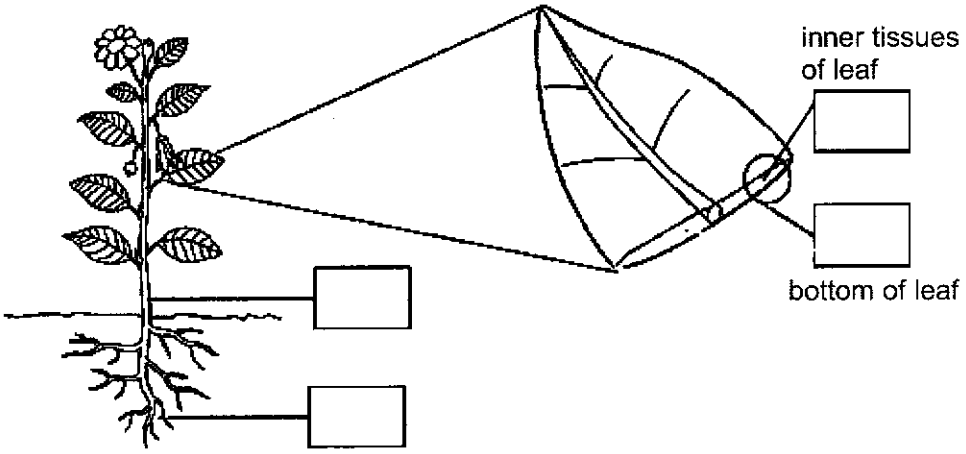


Fig. 1.2

[2]

[Total: 4]

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2 Fig. 2.1 shows an alveolus surrounded by the blood capillary in the human lung. The arrows show the path of inhaled oxygen as it moves from the alveolus into the blood.

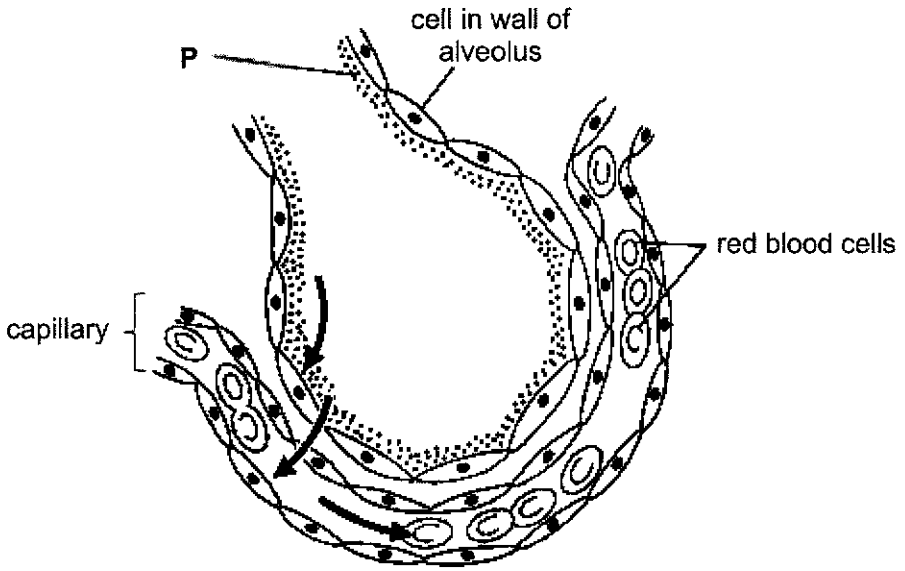


Fig. 2.1

(a) Name and describe the process by which oxygen molecules move in the direction shown by the arrows in Fig. 2.1.

.....

.....

.....

..... [2]

(b) Describe **P**, an adaptation of the alveolus, and explain how it enables efficient gas exchange.

.....

.....

.....

..... [2]

[Total: 4]

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3 Fig. 3.1 shows an experiment investigating the effect of pH on digestion of egg albumin by enzyme **X**. Egg albumin contains proteins.

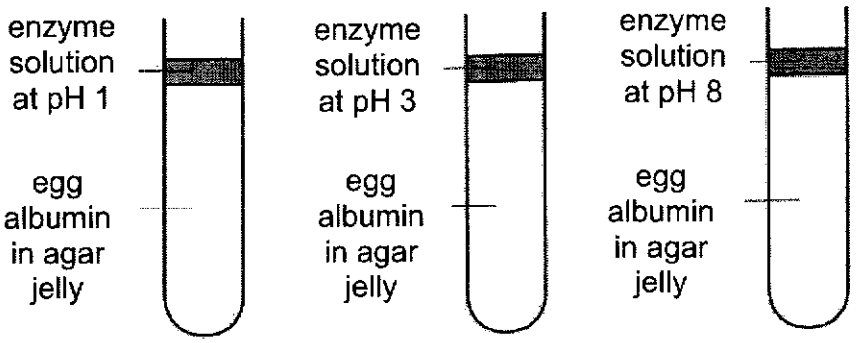


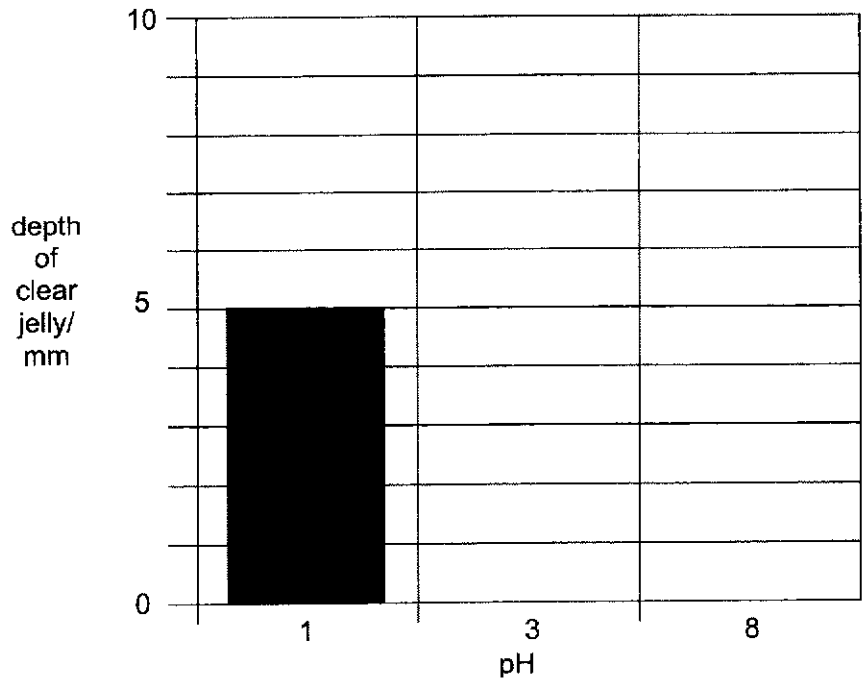
Fig. 3.1

In this experiment, egg albumin was mixed into agar jelly in each test tube to give a cloudy, white appearance. When proteins in the egg albumin is digested, the jelly turns clear. The test tubes were incubated at 37 °C. After 24 hours, the depth of the clear jelly in the test tube was measured and recorded in Table 3.1.

Table 3.1

pH	1	3	8
depth of clear jelly in test tube /mm	5	9	1

(a) Using the results in Table 3.1, complete the bar graphs in Fig. 3.2 below.



[2]

Fig. 3.2

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(b) Refer to the results in Table 3.1.

(i) Compare between the depth of clear jelly in the test tubes at pH 3 and 8.

..... [1]

(ii) Explain the answer for **(b)(i).**

.....

.....

.....

..... [2]

(c) Enzyme **X** is obtained from the human digestive system. Identify enzyme **X**.

..... [1]

[Total: 6]

4 Fig. 4.1 shows how increasing light intensity affects photosynthesis in two different plant species, **C** and **D**. One of the species grows better in the shade while the other grows better in the sun. The rate of aerobic respiration remains constant for each plant throughout the day.

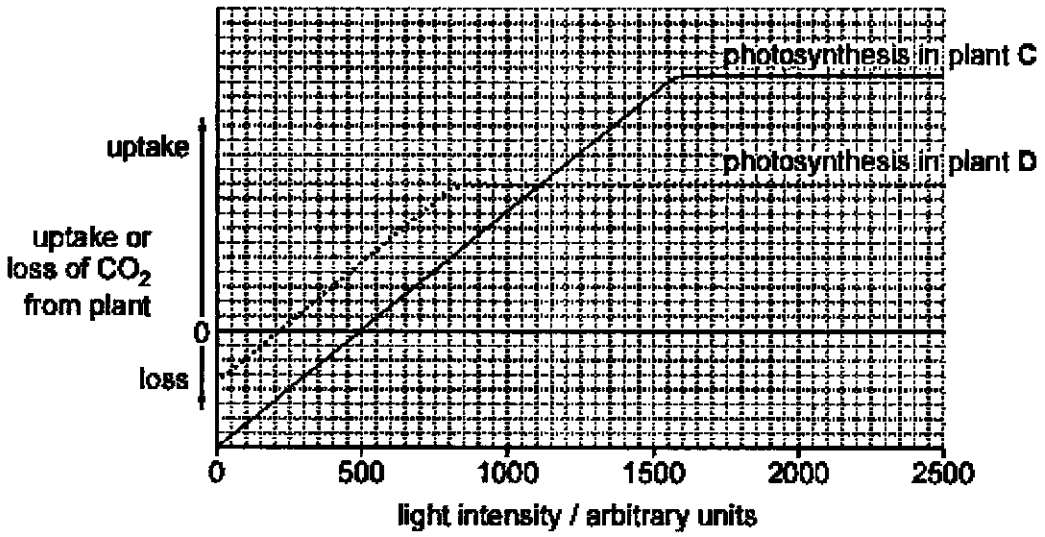


Fig. 4.1

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(a) State the word equation for aerobic respiration.

..... [1]

(b) Identify the light intensity at which plants **C** and **D** take up the same amount of carbon dioxide.

..... arbitrary units [1]

(c) Identify the light intensity at which the rate of photosynthesis is equal to the rate of respiration in plant **C**.

..... arbitrary units [1]

(d) Using Fig. 4.1, place one tick (✓) for each plant to indicate whether it grows better in the shade or in the sun.

	grows better in **shade**	grows better in **sun**
plant **C**		
plant **D**		

[1]

[Total: 4]

5 The volume of blood pumped out of the heart per minute is known as the cardiac output. The cardiac output depends on the heart rate and the volume of blood pumped out during each heartbeat, known as the stroke volume.

The cardiac output can be calculated by the formula:

cardiac output = heart rate x stroke volume

Table 5.1 shows some data for a person at rest and immediately after exercise.

Table 5.1

	heart rate/ beats per minute	stroke volume/ dm^3	cardiac output/ dm^3 per minute
person at rest	75	0.07	.....
person after exercise	191	0.11	21.01

(a) **(i)** Calculate the cardiac output for the person when he is at rest and fill in the blank in Table 5.1. [1]

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(ii) Using values from Table 5.1, calculate the percentage increase in cardiac output when the person finishes exercising.

Show your working in the space provided below and give your answer to the nearest whole number.

..... % increase [2]

(b) Explain why the cardiac output needs to increase during exercise.

.....

.....

.....

..... [2]

(c) Blood is pumped out by the heart at high pressure into arteries.
State the structure of the arteries which enable them to withstand the high blood pressure.

..... [1]

[Total: 6]

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6 An athlete ran a series of races of different distances. The bar chart in Fig. 6.1 shows the percentage of energy released by aerobic and anaerobic respiration in each race.

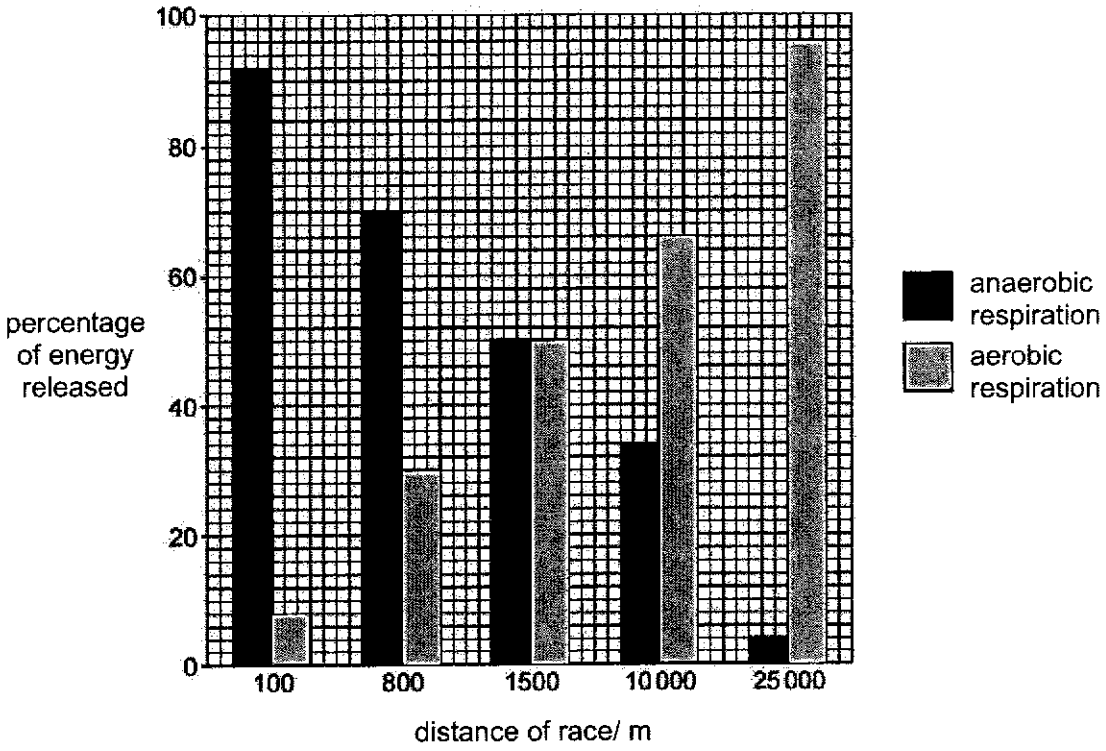


Fig. 6.1

(a) Describe how distance of the races affects the energy released by aerobic and anaerobic respiration in the athlete.

.....

.....

.....

..... [2]

(b) The athlete reported having muscle pains when sprinting in the 100m race but no muscle pain during the 25 000m marathon. Use evidence from Fig. 6.1 to explain why.

.....

.....

.....

..... [2]

[Total: 4]

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7 Accommodation is the eye's ability to form and maintain focused images of objects at different distances. Fig. 7.1 shows the contraction of the ciliary muscles in a boy's eye as he watches a bee move from flower to flower.

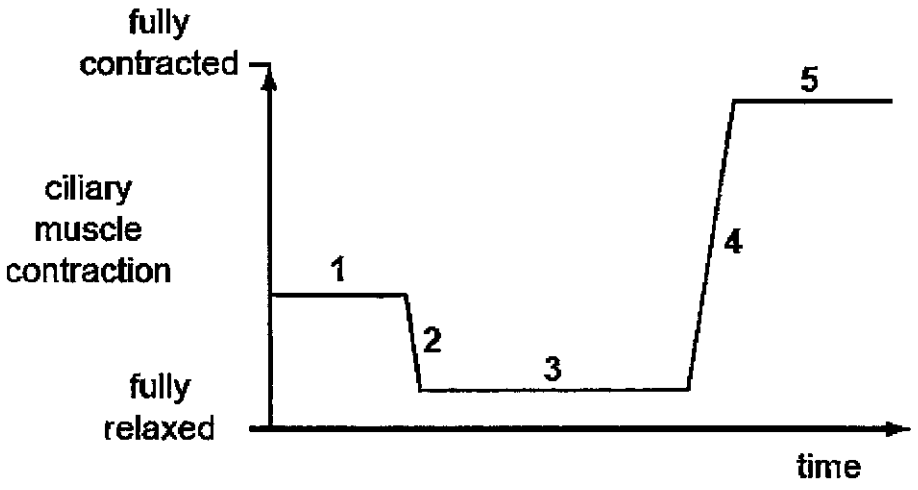


Fig. 7.1

(a) By writing down the appropriate numbers from Fig. 7.1, identify the part of the graph representing the following moments when the bee

	number
spends some time feeding on nectar in a flower very near the boy	
is flying away from the boy	

[2]

(b) Describe how the changes in the ciliary muscles in part 4 of the graph help the boy to maintain a focused image of the bee as it flies.

.....

.....

.....

..... [2]

[Total: 4]

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8 Phenylthiocarbamide (PTC) is a bitter-tasting chemical. This ability to taste PTC is controlled by a single gene with a pair of alleles. The ability to taste PTC is inherited through the dominant allele.

Fig. 8.1 shows the inheritance of the ability to taste PTC in a family. Individuals in this family are denoted by the numbers 1 to 9.

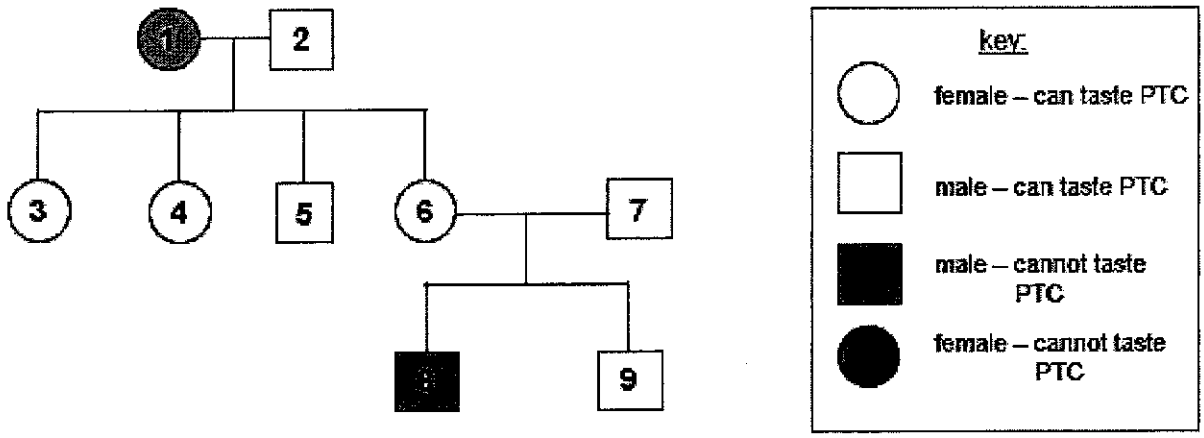


Fig. 8.1

(a) Refer to Fig. 8.1. Deduce and fill in the genotypes of the following individuals in the spaces provided below. Use ***T*** to represent the dominant allele and ***t*** to represent the recessive allele.

individual	genotype
1	
3	
7	

[2]

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(b) Individuals **6** and **7** have two sons. They wish to have another child.
Draw a genetic diagram in the space provided to determine the probability that their third child be able to taste PTC.

Use ***T*** to represent the dominant allele and ***t*** to represent the recessive allele.

[4]

(c) **(i)** With reference to the children of individuals **1** and **2**, state the ratio of males to females.

..... [1]

(ii) The ratio of males to females in a population is expected to be 1:1.
Provide a reason why the ratio in **(c)(i)** is different.

..... [1]

[Total: 8]

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9 The humpback whale, *Megaptera novaeangliae*, is one of the world's largest aquatic mammals. It can grow up to a length of 15 metres and a mass of up to 36 000 kg.

(a) The humpback whale is a carnivore which feeds on krill and herring. The herring feeds on krill. Both krill and herring feed on phytoplankton.

Fig. 9.1 shows these organisms in a food web.
Add arrows on Fig. 9.1 below to show the direction of energy flow in this food web.

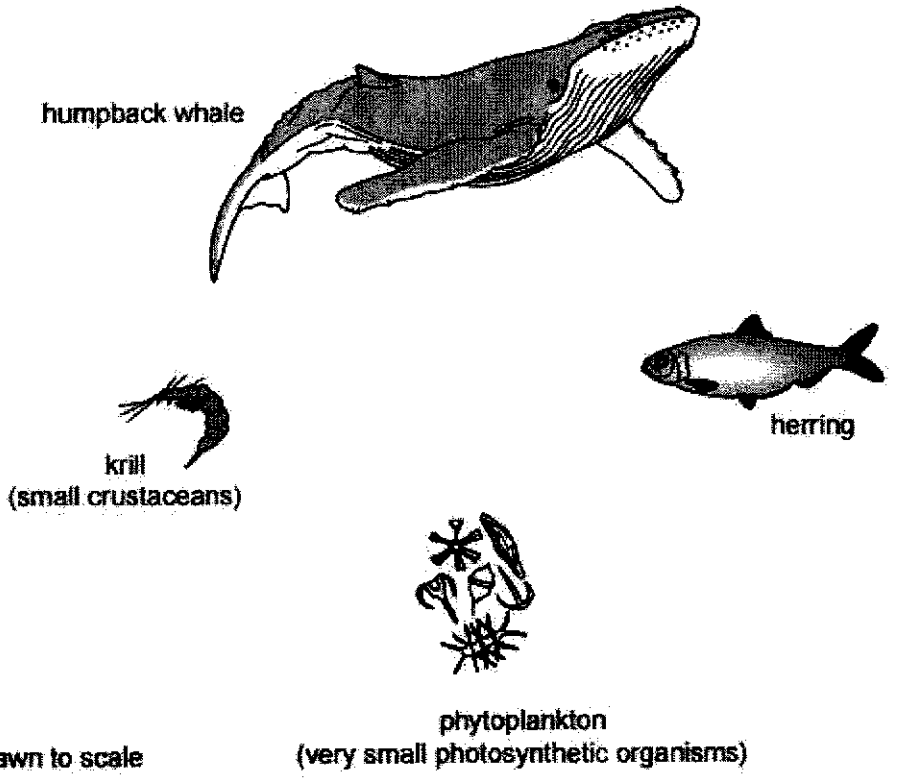


Fig. 9.1 [1]

(b) Refer to Fig. 9.1.

(i) Construct a food chain in which the humpback whale is a tertiary consumer.

..... [1]

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(ii) Draw a labelled pyramid of numbers for a food chain with three trophic levels in the space provided below.

[1]

(c) Using ideas of energy transfer, explain why energy flow in food chains such as the ones in **(b)** are non-cyclical.

.....

.....

.....

..... [2]

[Total: 5]

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Section B (20 marks)

Answer **any two** questions in the spaces provided on the question paper.

10 Fig. 10.1 shows how the blood sugar levels of two men, **X** and **Y**, change after a starchy meal. One of the two men has Type 2 diabetes.

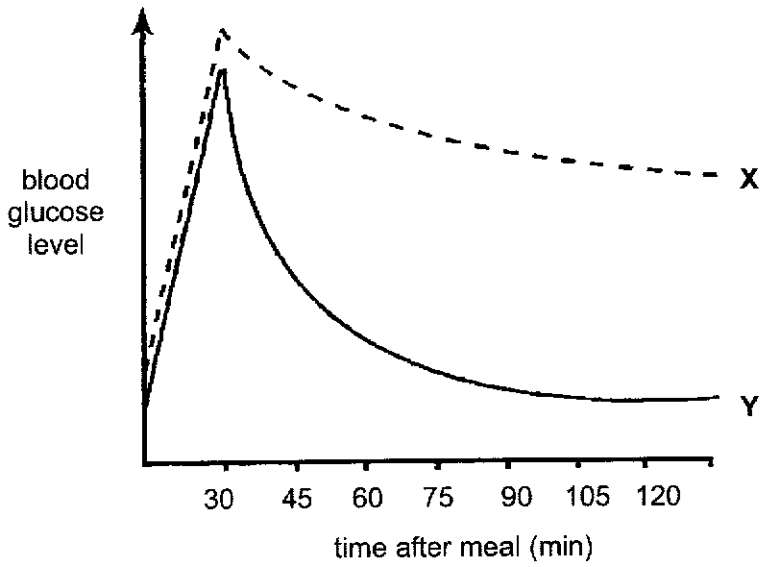


Fig. 10.1

(a) Explain how a starch molecule ingested during a meal leads to an increase in blood glucose level 30 min after the meal as shown in Fig. 10.1.

.....

.....

.....

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.....

.....

.....

..... [4]

(b) Identify which man is diabetic and provide a reason for your choice.

.....

..... [2]

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More information about Type 2 diabetes is shown in Fig. 10.2.

> Type 2 *diabetes mellitus* typically occurs in individuals above the age of 45. In Type 2 diabetes, the body cells develop insulin resistance, where these cells become less responsive to the increased insulin that is produced.
>
> *Adapted from: https://www.cdc.gov/diabetes/basics/type2.html*

Fig. 10.2

(c) Name the tissue in the human pancreas which produces insulin.

..... [1]

(d) With reference to Fig. 10.2 and the functions of insulin, explain why insulin resistance leads to abnormally high blood sugar levels.

.....

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.....

..... [3]

[Total: 10]

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11 The graphs in Fig. 11.1 show the concentration of oxygen, number of bacteria and number of fishes in a section of a river over a distance of 50 km.

A factory discharged industrial waste containing nitrates, phosphates and small amounts of other toxic chemicals into the river, resulting in pollution.

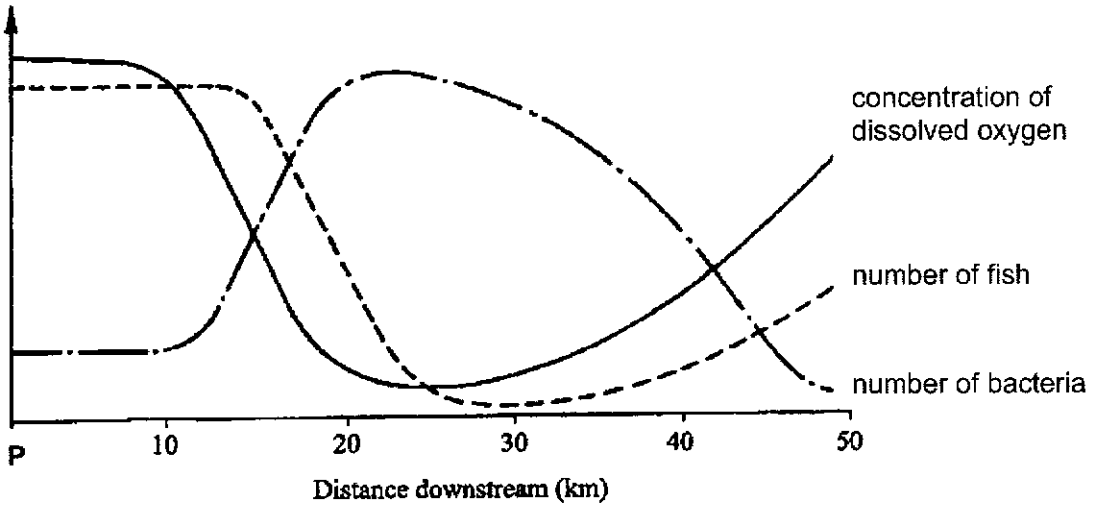


Fig. 11.1

(a) Refer to Fig. 11.1. How far from point **P** was the waste most likely released?

..... [1]

(b) Explain the changes in concentration of oxygen and the number of fishes and bacteria over 30 km downstream starting from point **P**.

.....

.....

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.....

.....

..... [5]

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(c) People living nearby were warned not to catch and consume fishes from the segment of river in Fig. 11.1.

Explain why people consuming these fishes may fall ill even though the fish looked healthy.

.....

.....

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.....

.....

.....

..... [4]

[Total: 10]

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12 (a) Fig. 12.1 represents a potato plant growing on a farm. As the plant photosynthesises and grows over time, the potatoes also grow larger.

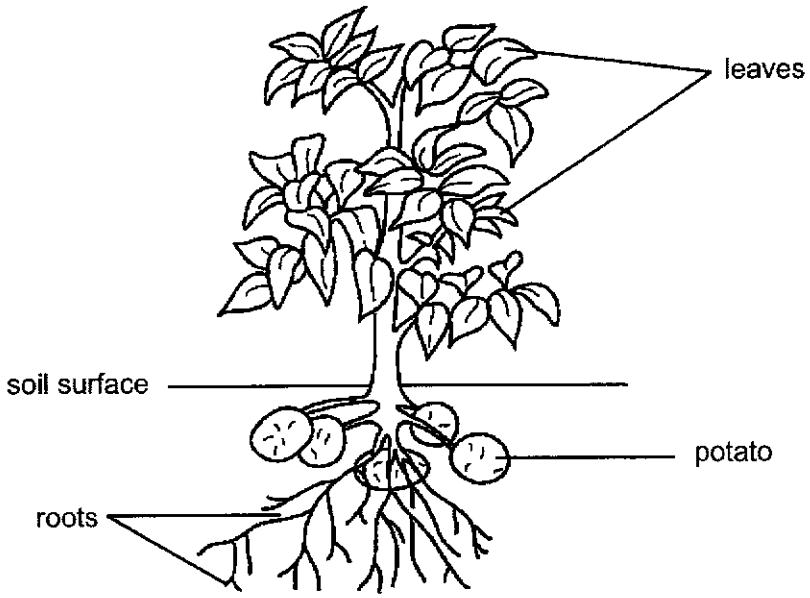


Fig. 12.1

Describe the role of *transpiration* and *translocation* in this potato plant.

.....

.....

.....

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.....

.....

.....

.....

.....

.....

..... [5]

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(b) A farmer is using a large potato from the plant in Fig. 12.1 to grow a new potato plant as shown in Fig 12.2 below.

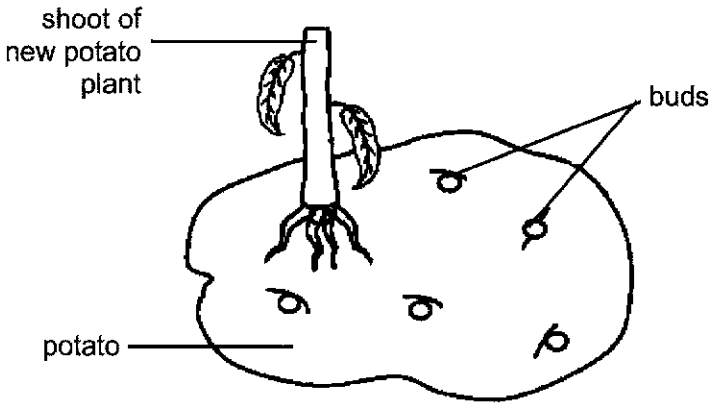


Fig. 12.2

(i) Name and describe the method of reproduction shown in Fig. 12.2.

.....

..... [2]

(ii) Suggest the advantages and disadvantages of this method of reproduction in the farming of potatoes.

.....

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 10]

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Level:	Secondary Four Express/ Five Normal (Academic)	Marks:	40
Subject:	Science (Chemistry/Biology)	Day:	Thursday
Paper:	5078/01	Date:	29 August 2019
Duration:	1 hour	Time:	0800 – 0900

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name and index number on all the work that you hand in, including the Answer Sheet.

There are **forty** 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.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done on this paper.
A copy of the Data Sheet is printed on page 25.
A copy of the Periodic Table is printed on page 26.
The use of an approved scientific calculator is expected, where appropriate.

FOR EXAMINER'S USE	
Total	/40

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Section A

1 Which of the following apparatus is **not** needed in the preparation of potassium chloride?

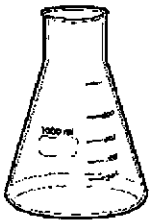
A



B



C

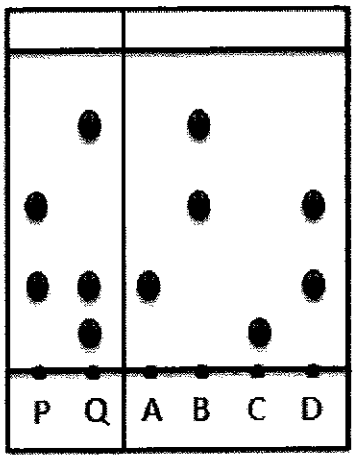


D



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2 The diagram below shows a chromatogram that was carried out using ethanol as the solvent.



Which of the following statements is **not** correct?

A Substances **A** and **C** are pure.

B Substances **P** and **D** are identical.

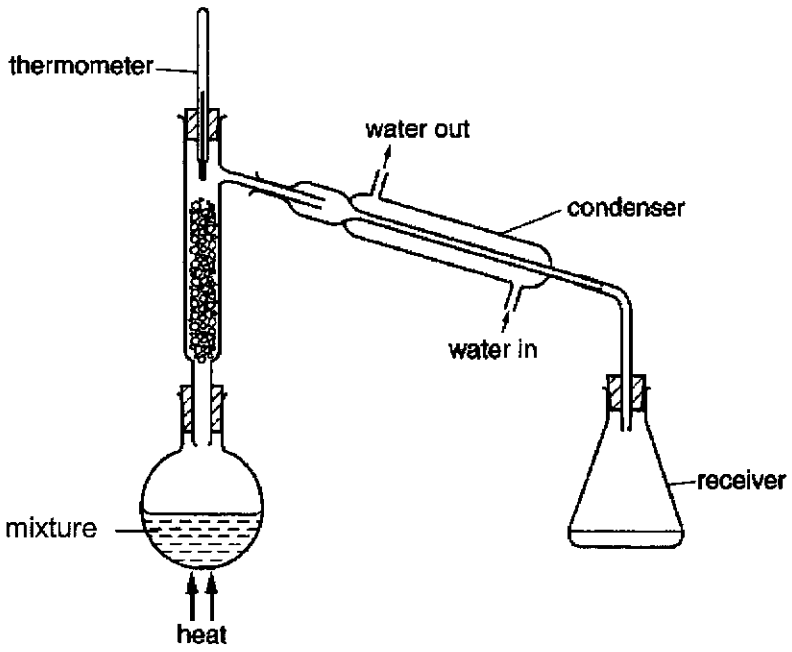
C Substance **Q** is made up of substances **A**, **C** and **D**.

D Substance **C** is less soluble in ethanol than substance **A**.

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3 A student used the apparatus shown below to separate ethanol and water.



What error has the student made in setting up the apparatus?

A The thermometer is in the wrong position.

B The top of the receiver is stoppered.

C The volume of the distillate is too little.

D The water enters the condenser at the wrong place.

4 The nucleon number and proton number of an atom of X and Y are shown.

	X	Y
nucleon number	39	40
proton number	19	18

Which statement about X and Y is correct?

A An atom of X has fewer electrons than an atom of Y.

B An atom of X has fewer neutrons than an atom of Y.

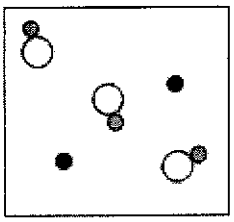
C X is above Y in the same group of the Periodic Table.

D X is in the same period in the Periodic Table as Y.

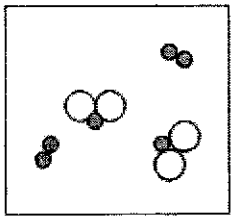
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5 Which diagram below best represents a mixture of Group 0 elements?

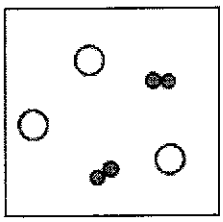
A



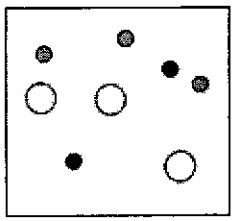
B



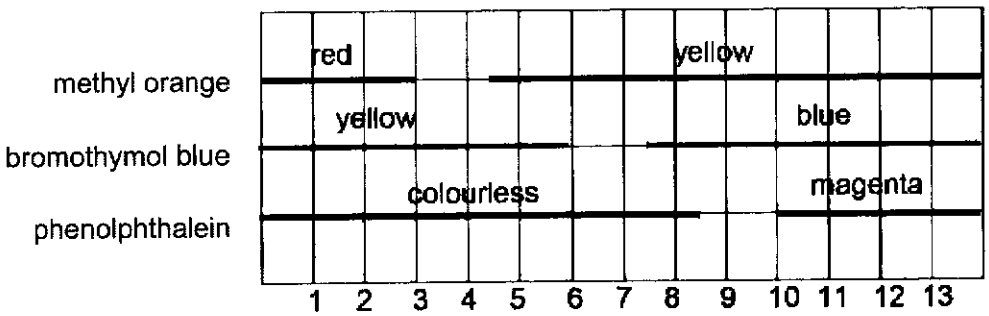
C



D



6 The figure below shows the colours of the acid-base indicators methyl orange, bromothymol blue and phenolphthalein in different pH.



A solution is yellow in methyl orange, blue in bromothymol blue and colourless in phenolphthalein.

What is the pH range of the solution?

A 4.5 to 6.0

B 6.0 to 7.5

C 7.5 to 8.5

D 8.5 to 10.0

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7 Which salt is **best** prepared by titration?

A ammonium chloride

B calcium carbonate

C lead(II) nitrate

D silver chloride

8 Rat poison needs to be insoluble in rainwater but soluble in the acidic conditions of the rat stomach.

Which of the following poisonous barium compounds is suitable for use as rat poison?

A barium carbonate

B barium chloride

C barium nitrate

D barium sulfate

9 Ammonia can be produced by reacting nitrogen gas and hydrogen gas.

The chemical equation for the reaction is as shown below.

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

If 30 cm^3 of nitrogen gas reacted with 60 cm^3 of hydrogen gas, what is the **total** volume of gas remaining after the reaction?
(All volumes are measured at room temperature and pressure.)

A 30 cm^3

B 40 cm^3

C 50 cm^3

D 60 cm^3

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10 Sodium and rubidium are elements in Group I of the Periodic Table.

Which statement about sodium and rubidium is correct?

A Sodium is a metal and rubidium is a non-metal.

B Sodium has a higher melting point than rubidium.

C Sodium reacts more rapidly with water than rubidium does.

D Sodium has fewer electrons in its valence shell than rubidium.

11 The colour changes are recorded in a table when small portions of aqueous potassium iodide and acidified aqueous potassium manganate(VII) were separately added to four colourless solutions.

solution number	aqueous potassium iodide	acidified aqueous potassium manganate(VII)
1	colourless to brown	no change
2	colourless to brown	purple to colourless
3	no change	no change
4	no change	purple to colourless

Which solution(s) contains a reducing agent and oxidising agent?

A 2 only

B 4 only

C 1 and 3 only

D 2 and 3 only

12 Brass is a useful alloy of copper.

Which statement about brass is correct?

A Brass will not react with dilute acid.

B Brass is less malleable than copper.

C Brass is a compound of copper and zinc.

D Brass does not conduct heat and electricity.

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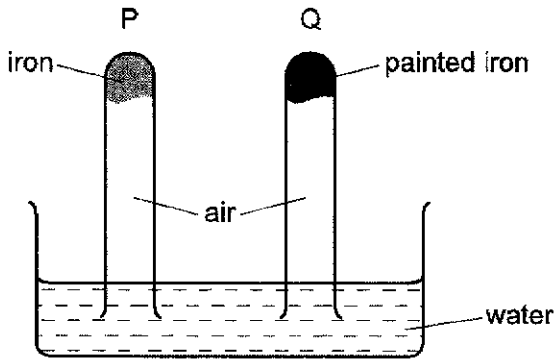
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13 Element **X** displaces **Y** from the aqueous chloride of **Y**.
Element **X** gives hydrogen gas but only when it is heated with steam.
Element **Z** reacts with cold water to give hydrogen.

What are **X**, **Y** and **Z**?

	X	Y	Z
A	calcium	copper	potassium
B	iron	silver	zinc
C	iron	silver	sodium
D	zinc	copper	calcium

14 The diagram shows an experiment to investigate how paint affects the rusting of iron.

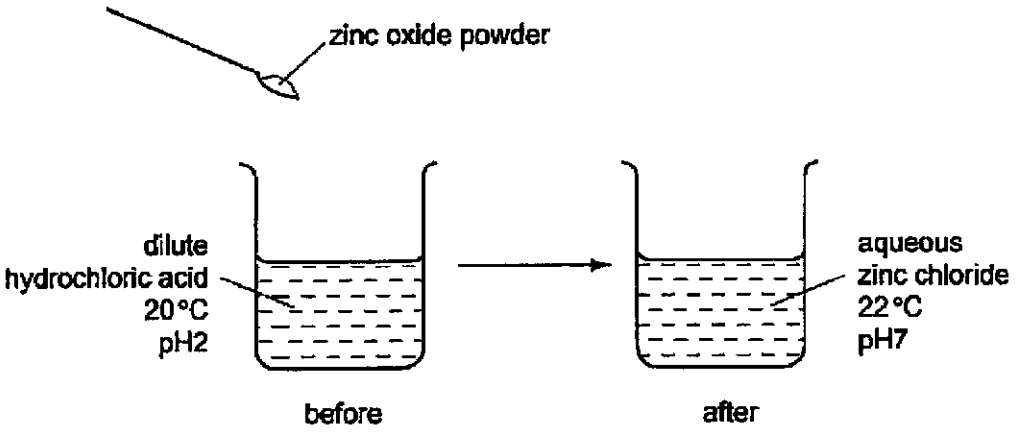


What happens to the water level in tubes P and Q?

	P	Q
A	falls	rises
B	no change	rises
C	rises	falls
D	rises	no change

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15 The diagram shows an experiment.



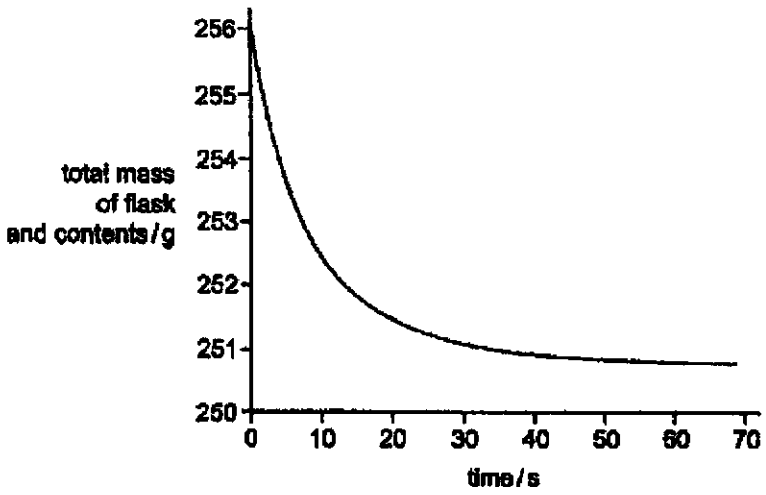
Which term(s) describe(s) the nature of the experiment?

	endothermic	neutralisation
A	✓	✓
B	✓	×
C	×	✓
D	×	×

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16 Calcium carbonate is placed in a flask on a balance and dilute HC*l* is added. The total mass of the flask and its contents is recorded every 10 seconds.



At which of the following times is the reaction the fastest?

A 10 s

B 20 s

C 40 s

D 50 s

17 "It reacts with haemoglobin to form a stable compound which prevents the blood from carrying oxygen around our body. Exposure of higher than 100 parts per millions of this air pollutant can cause death due to the lack of oxygen in the body."

Which air pollutant is described in the above paragraph?

A methane

B sulfur dioxide

C carbon monoxide

D oxides of nitrogen

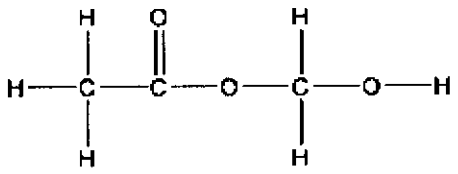
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18 The table shows the results of tests carried out on a compound **X**.

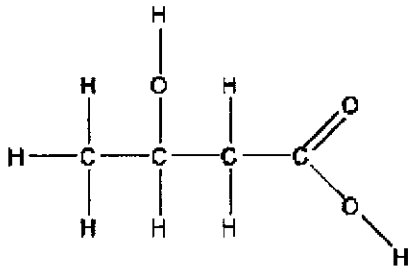
test	result
bromine water added	decolourised
sodium carbonate added	colourless gas evolved

Which organic molecule could compound **X** be?

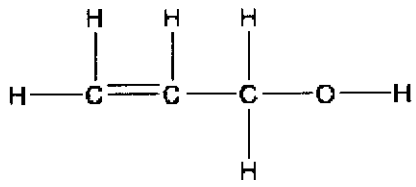
A



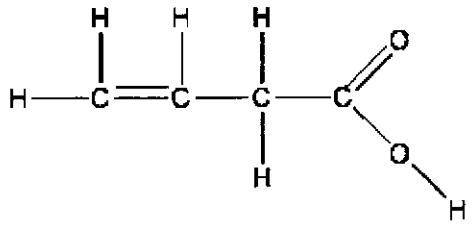
B



C



D



19 Which list describes the three reactions correctly?

$$CH_4 + Cl_2 \xrightarrow{\text{reaction A}} CH_3Cl + HCl$$

$$C_2H_4 + 3O_2 \xrightarrow{\text{reaction B}} 2CO_2 + 2H_2O$$

$$C_{10}H_{22} \xrightarrow{\text{reaction C}} C_3H_8 + C_7H_{14}$$

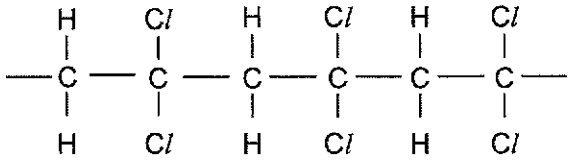
Which list describes the three reactions correctly?

	reaction A	reaction B	reaction C
A	combustion	cracking	addition
B	substitution	combustion	cracking
C	substitution	cracking	combustion
D	reduction	combustion	addition

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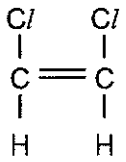
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20 The diagram below shows the structure of part of a polymer.

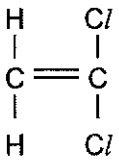


Which of the following is the monomer for the polymer shown above?

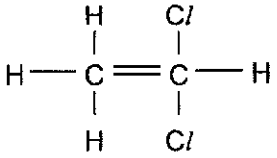
A



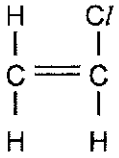
B



C

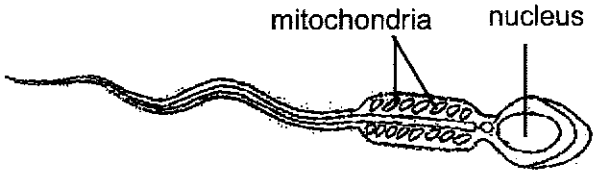


D



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21 The diagram below shows a sperm cell.



Which statement is **false**?

A The mitochondria fuses with the egg during fertilisation but the nucleus does not.

B The mitochondria releases energy which is required by the sperm cell to swim.

C The nucleus controls all cellular activities occurring in the sperm.

D The nucleus is visible under a light microscope, but the mitochondria is not.

22 The statements below describe the structure of a specialised cell.

- has a cell wall
- has a high surface area to volume ratio
- vacuole contains concentrated cell sap

Identify this specialised cell.

A red blood cell

B root hair cell

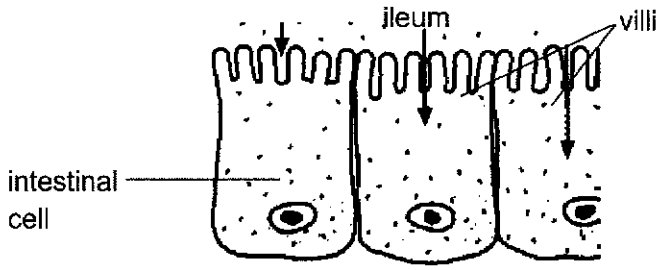
C spongy mesophyll cell

D white blood cell

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23 The diagram shows the absorption of digested food substances from the ileum into some intestinal cells by diffusion.



When option about the process above is **false**?

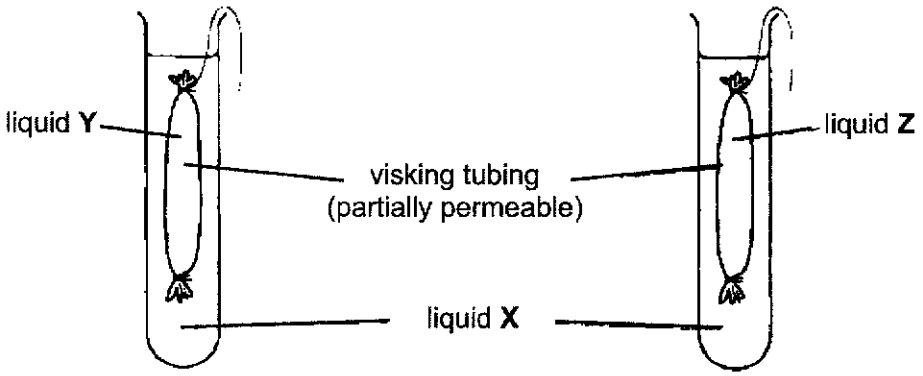
A Absorption of digested food does not involve partially permeable membranes.

B Digested food substances are small enough to diffuse into intestinal cells.

C Digested food substances diffuse down a concentration gradient.

D The presence of villi on the intestinal cells increases the rate of diffusion.

24 The apparatus was set up as shown in the diagram.



After 30 minutes, the visking tubing containing liquid **Y** became flaccid while the tubing containing liquid **Z** became more turgid.

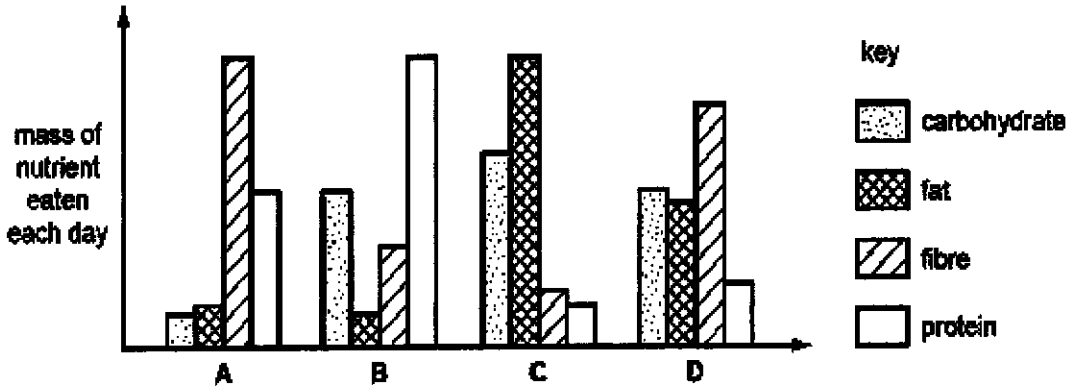
Which option correctly describes the liquids at the start of the experiment?

	liquid **X**	liquid **Y**	liquid **Z**
A	distilled water	25% sucrose solution	10% sucrose solution
B	10% sucrose solution	distilled water	25% sucrose solution
C	10% sucrose solution	25% sucrose solution	distilled water
D	25% sucrose solution	10% sucrose solution	distilled water

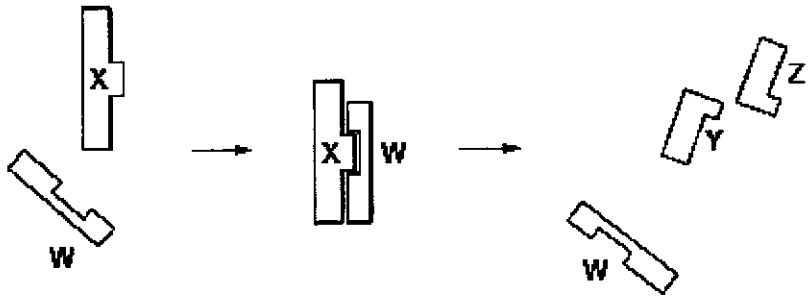
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25 The bar graphs below show the relative masses of carbohydrate, fat, fibre and protein consumed by four mammals each day.

Which mammal is most likely to be a bear preparing to start hibernation (whereby it remains mostly asleep in its cave) for the duration of the winter months?



26 The diagram below illustrates the "lock and key" hypothesis of enzyme action.



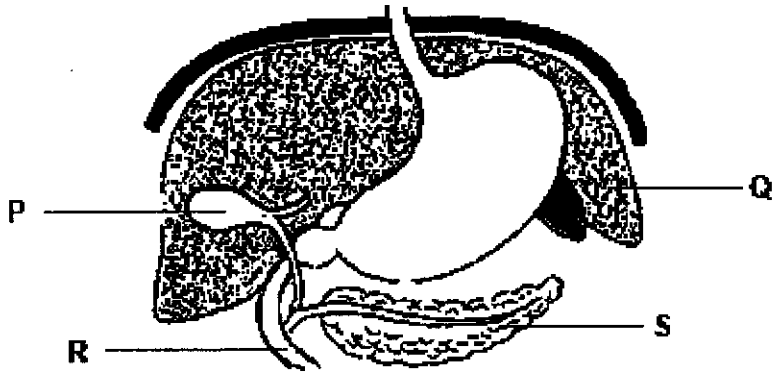
Which option correctly identifies the lock and key in the above reaction?

	lock	key
A	W	X
B	W	Y
C	X	W
D	Y	Z

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27 The diagram shows a section of the human digestive canal.



Which statement about the structures is **true**?

A Structure **P** is involved in chemical digestion.

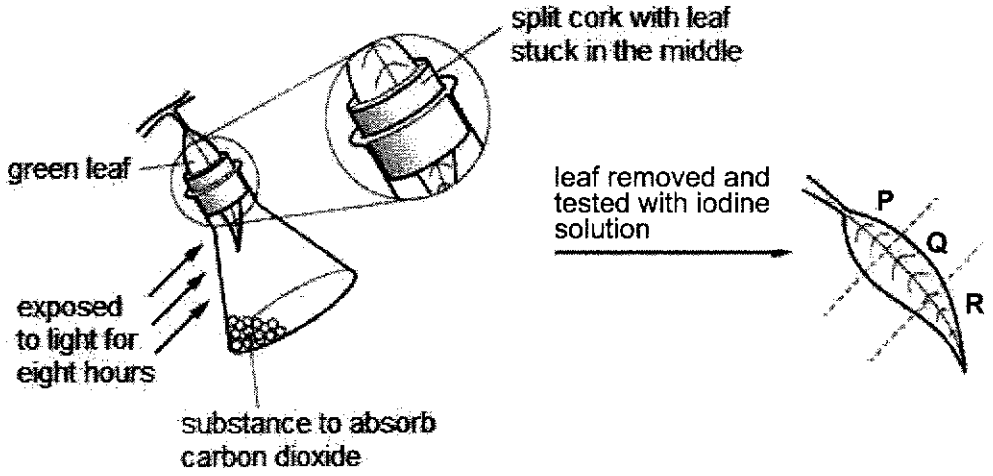
B Structure **Q** stores bile required to emulsify fats.

C Structure **R** detoxifies alcohol.

D Structure **S** produces digestive enzymes.

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28 A plant has kept in the dark for two days. After that, one of its leaves is used in an experiment to investigate photosynthesis as shown in the diagram.



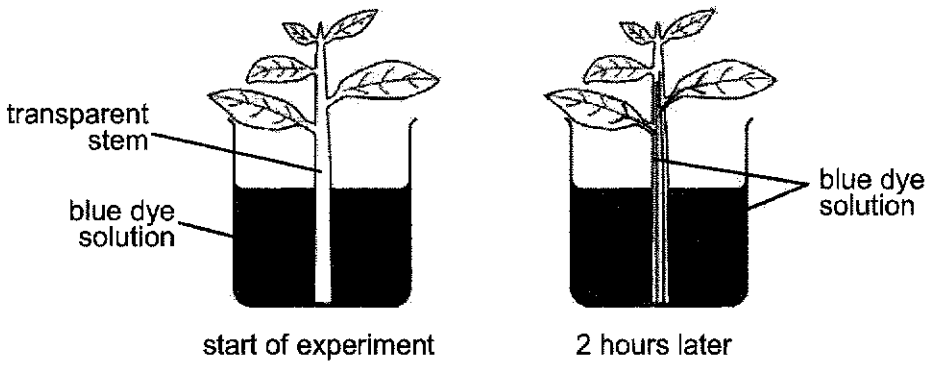
The leaf is then removed and tested with iodine solution.
What are the resulting colours of parts **P**, **Q** and **R**?

	P	Q	R
A	blue-black	blue-black	brown
B	blue-black	brown	brown
C	brown	blue-black	blue-black
D	brown	brown	blue-black

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29 A student conducted an experiment by placing a fresh plant shoot with a transparent stem in a beaker containing blue dye solution.

It took two hours for the blue dye solution to move up the plant stem as shown below.

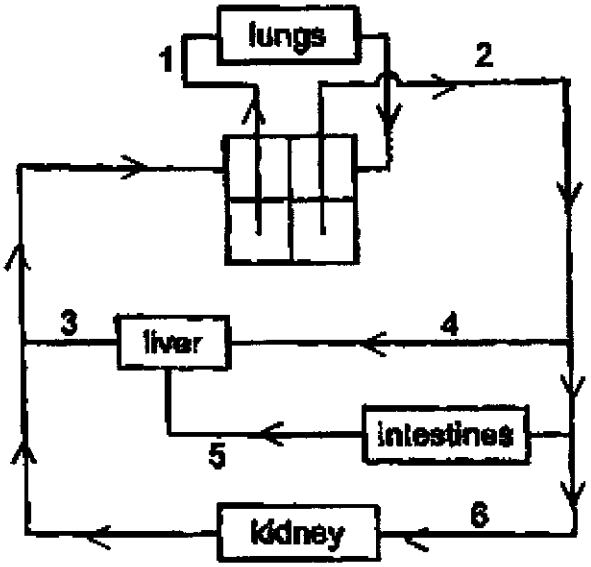


Which part of the stem transports the blue dye solution up the shoot and which environmental condition would reduce the time taken for it to move up to the same level?

	part of stem	environmental condition
A	phloem	increased wind speed
B	phloem	increased humidity
C	xylem	increased humidity
D	xylem	increased temperature

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30 The diagram below shows the human circulatory system. The numbers 1 to 6 represent different blood vessels.



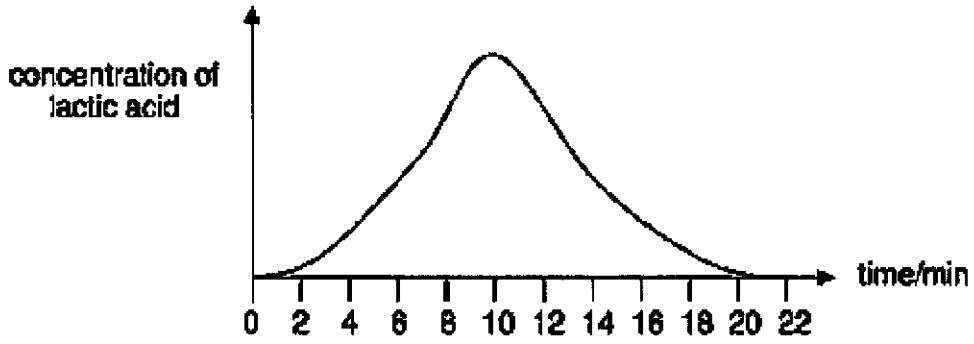
Which numbers correctly identifies the following blood vessels?

	aorta	hepatic vein	pulmonary artery
A	1	6	2
B	2	3	1
C	2	4	5
D	4	3	1

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31 The graph below shows the concentration of lactic acid in the blood of an athlete, from the time he started running the race.



How long did the athlete take to complete the race?

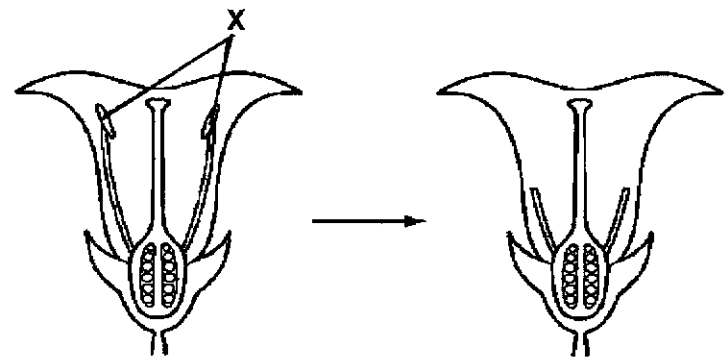
A 2 min

B 8 min

C 10 min

D 21 min

32 The diagram shows the longitudinal section of a flower.
A plant breeder removed all the structures labelled **X** from the flower, as shown below.



flower before removing **X** flower after removing **X**

Removing **X** helps to prevent

A fertilisation

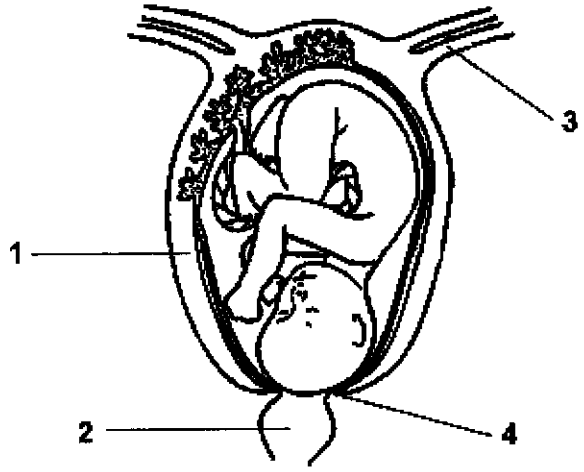
B pollination by insects

C pollination by wind

D self-pollination

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33 The diagram shows part of the reproductive system of a pregnant woman.

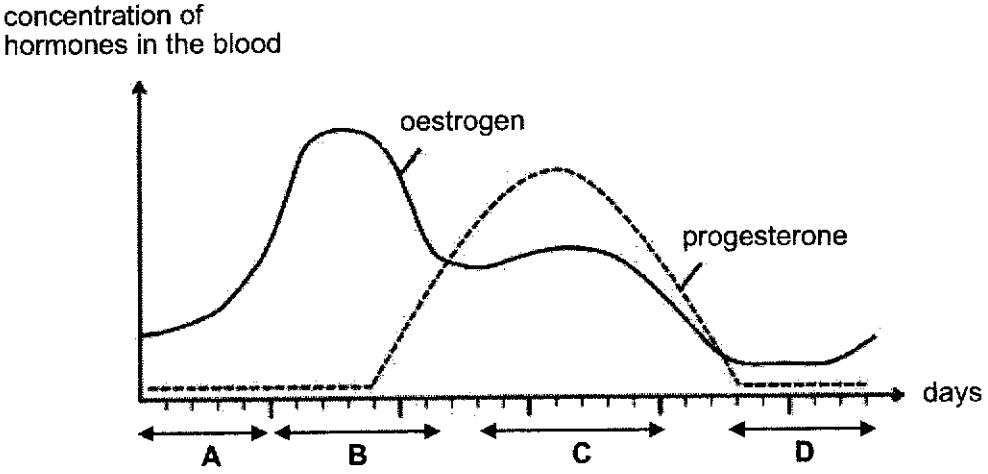


Which parts indicate the uterus and the cervix?

	uterus	cervix
A	1	3
B	1	4
C	2	3
D	2	4

34 The graphs below show how the concentration of oestrogen and progesterone change over the duration of a woman's menstrual cycle.

During which period of time would she be likely to conceive a baby if she were to have sexual intercourse?



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35 Responses to stimuli in the human body are regulated using two modes – hormonal regulation or nervous regulation.

Which option correctly shows the characteristics of the mode of regulation?

	mode of regulation	speed of response	range of effect
A	hormonal	fast	localised
B	hormonal	slow	widespread
C	nervous	fast	widespread
D	nervous	slow	localised

36 Deoxyribonucleic acid (DNA) was extracted from a man and a woman. They are not related to each other.

In which way are their DNA molecules most likely to be different?

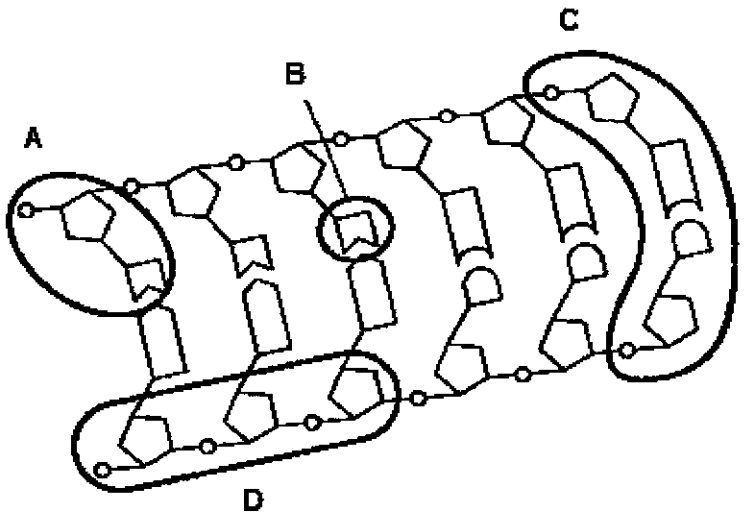
A The base-pairing between nucleotides are different.

B The genes in their DNA molecules are different.

C The sequence of nucleotides are different.

D The types of nitrogenous bases they have are different.

37 The diagram below shows part of a DNA molecule.
Which letter could likely indicate adenine?



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38 In rabbits, the allele for brown fur is dominant to the allele for white fur.
Several heterozygous rabbits with brown fur were mated with several rabbits with white fur. For every 80 offspring produced, how many are expected to have white fur?

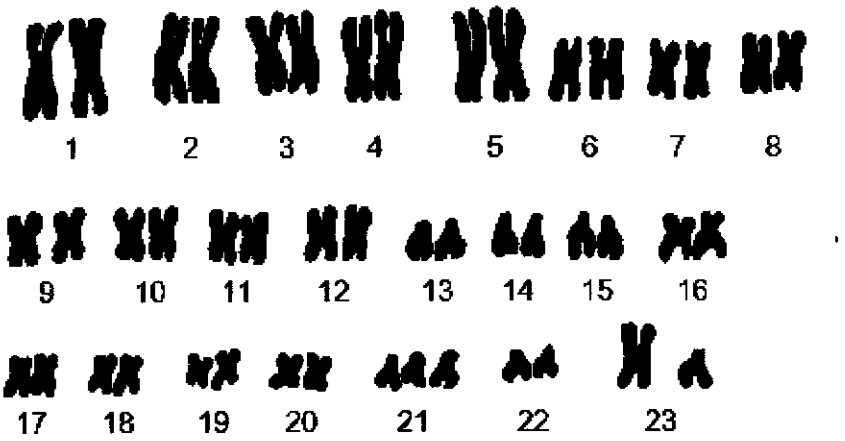
A 0

B 20

C 40

D 60

39 The diagram below shows the 23 pairs of chromosomes found in the cells of a baby.



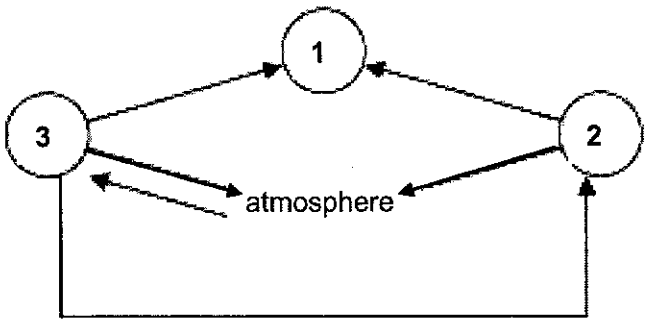
What is the sex of the baby and what genetic condition does the baby have?

	sex	genetic condition
A	female	Down's syndrome
B	female	sickle cell anaemia
C	male	Down's syndrome
D	male	sickle cell anaemia

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40 The diagram is a simplified diagram showing how carbon moves in the carbon cycle.



What do the numbers represent?

	1	2	3
A	animals	decomposers	plants
B	animals	plants	decomposers
C	decomposers	animals	plants
D	plants	animals	decomposers

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Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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The Periodic Table of Elements

	Group																		
	I	II									III	IV	V	VI	VII	0
						1 H hydrogen 1										2 He helium 4
	3 Li lithium 7	4 Be beryllium 9									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
	11 Na sodium 23	12 Mg magnesium 24									13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
	37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
	55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
	87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key: atomic number / atomic symbol / name / relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.)

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2019 PRELIMINARY EXAMINATION ANSWERS

Paper 1 – MCQs [40 marks]

Sc Chem:

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
D	C	B	B	D	C	A	A	C	B

Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
A	B	D	D	C	A	C	D	B	B

Sc Bio:

Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
A	B	A	B	C	A	D	B	D	B

Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
C	D	B	B	B	C	B	C	C	C

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SEC 4E5NA SCI (BIOLOGY)

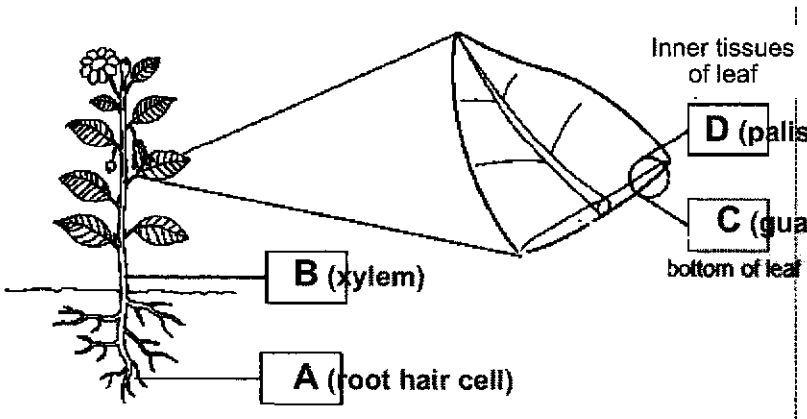
2019 PRELIMINARY EXAMINATION ANSWERS

Paper 1 – MCQs [20 marks]

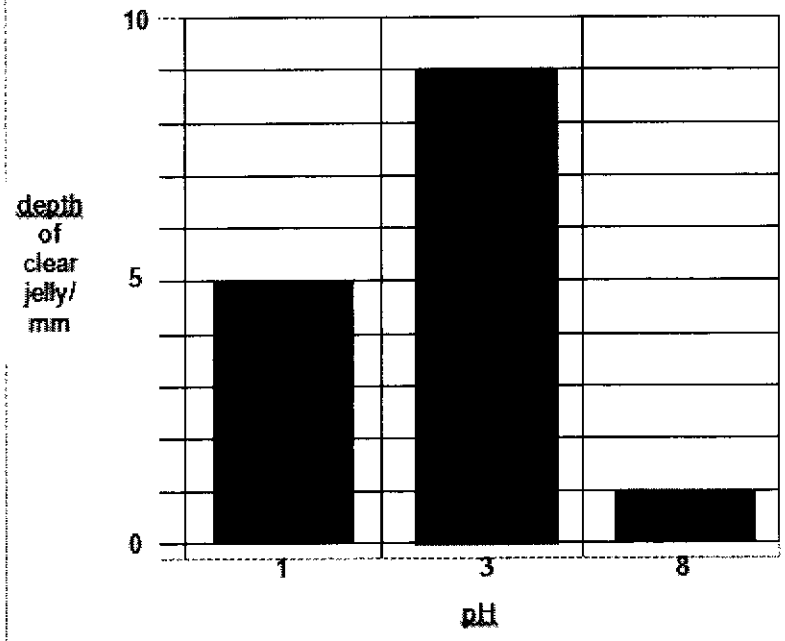
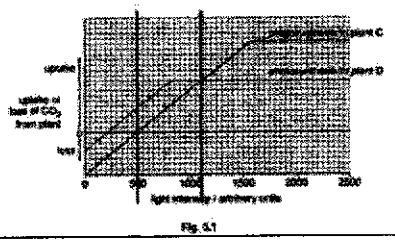
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
A	B	C	B	C	A	D	B	D	B

Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
C	D	B	B	B	C	B	C	C	C

Paper 4 Section A – SAQs [45 marks]

Qn	Answer	Marking
1a(i)	Cell A (root hair cell) vs Cell D (palisade mesophyll cell): Any one: - A has a long narrow extension / higher surface area to volume ratio while D does not / has a regular rectangular shape / has a lower surface area to volume ratio - A does not have chloroplasts while D has chloroplasts.	1m
1a(ii)	Cell B (xylem) vs Cell D (palisade mesophyll cell): Any one: - B has lignified walls while D does not. - B does not have cytoplasm/nucleus/protoplasm while D does.	1m
1b	 **Fig. 1.2**	Every 2 correct – 1m Total: 2m
	-	**Total for Q1: 4m**
2a	- Diffusion - Oxygen molecules move <u>from a region of higher concentration to a region of lower concentration</u> from inside the alveolus, into the red blood cell in the capillary / <u>down a concentration gradient</u>	1m 1m – mention of concentration gradient Total: 2m

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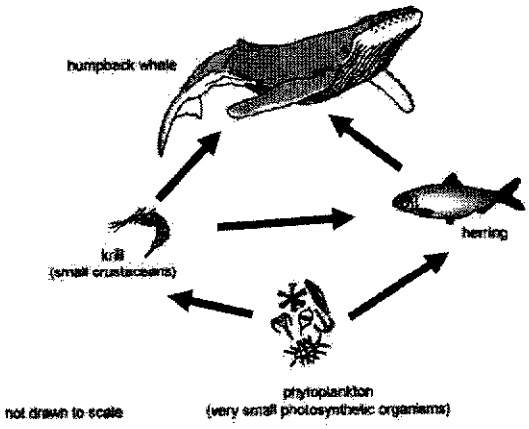
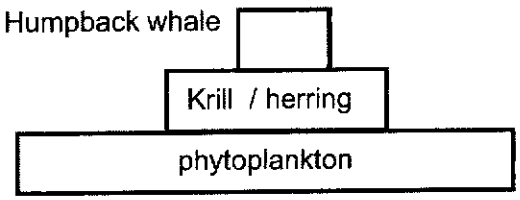
2b	- **P** is a thin film of moisture on the inner wall of alveolus - Allows gases (oxygen and carbon dioxide) to dissolve in the moisture - for faster diffusion / maintain steep concentration gradient	1m 1m Total: 2m
		Total for Q2: 4m
3a		1m – pH 3 1m – pH 8 Total: 2m
3b(i)	- the depth of clear jelly was greater for pH 3 than pH 8	1m
3b(ii)	- more protein was digested in test tube for pH 3 than pH 8. - Enzyme X was more active at pH 3 / less active at pH 8 - As it was optimum pH / it was denatured	3 pts – 2m 2 pts – 1m 0-1 pt – 0m
3c	Pepsin Give ECF based on optimum pH in 3b.	1m
		Total for Q3: 6m
4a	Word eqn for aerobic respiration: Oxygen + glucose → Carbon dioxide + water + (large amount of) energy	1m
4b	1100 arbitrary units 	1m
4c	500 arbitrary units	1m
4d	<table><tr><th></th><th>grows better in **shade**</th><th>grows better in **sun**</th></tr><tr><td>plant **C**</td><td></td><td>✓</td></tr><tr><td>plant **D**</td><td>✓</td><td></td></tr></table>	1m for both ticks
		Total for Q4: 4m

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5a(i)	Cardiac output at rest = 75 x 0.07 = <u>5.25</u> **(to 2 dp)**	1m
5a(ii)	Increase in cardiac output = 21.01 – ***5.25*** [ans frm 5a(i)] = **<u>15.76</u>** (***15.76*** / 5.25) x 100% = **<u>300 %</u>** (to nearest whole number)	1m – allow ECF for ans from 5a(i) 1m – allow ECF for increase in cardiac output Total: 2m
5b	- Pump more blood <u>transporting more glucose and oxygen</u> - to the <u>exercising muscles</u> - so that muscles can <u>carry out faster/more aerobic respiration</u> - to <u>release more energy</u> for exercise.	Every 2 pts – 1m Total: 2m
5c	- thick/ elastic muscular wall	1m
		Total for Q5 : 6m
6a	- As the distance of race increases, - percentage of energy released by aerobic respiration increases and - percentage of energy released by anaerobic respiration decreases.	Any 2 – 1m All 3 – 2m Total: 2m
6b	- In the 100m race, <u>92% of energy was released by anaerobic respiration while only 4% of energy was released by aerobic respiration during the 25km marathon</u>. / <u>88% more energy was released due to anaerobic respiration during the 100m race as compared to the 25km marathon.</u> - <u>More lactic acid</u> was produced in the 100m race, causing muscle pains	1m – comparison with values from Fig 7.1 1m – lactic acid Total: 2m
		Total for Q6 : 4m
7a	<table><tr><th></th><th>number</th></tr><tr><td>is feeding on nectar in a flower very near the boy</td><td>**5**</td></tr><tr><td>is flying away from the boy</td><td>**2**</td></tr></table>	1m each Total: 2m
7b	In part 4, - The ciliary muscles are contracting (further) - Causing the suspensory ligaments to slacken (more) - And the lens to become more convex / curved / thicker In order to focus the light rays to form a focused image.	All 3 pts – 2m 1 or 2 pts – 1m 0 pts – 0m Total: 2m
		Total for Q7 : 4m
8a	<table><tr><th>individual</th><th>genotype</th></tr><tr><td>1</td><td>***tt***</td></tr><tr><td>3</td><td>***Tt***</td></tr><tr><td>7</td><td>***Tt***</td></tr></table>	All 3 correct – 2m 1 or 2 correct – 1m Total: 2m

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8b	Genetic diagram Parents' phenotypes: Parents' genotypes: Gametes: Fertilisation Offspring genotype: Offspring phenotype: Probability of third child being able to taste PTC: 75% or ¾ or 0.75	1m – parents phenotype and genotype 1m – gametes and fertilization correct 1m – offspring phenotype and genotype 1m – probability Total: 4m
8c(i)	Males : females (offspring of individuals 1 and 2) 1:3	1m
8c(ii)	Any one: Observed ratio is not the same as expected ratio because… - Fertilisation of sperm and egg occurs randomly - Random assortment of chromosomes in the production of sperm/egg/gametes - Sample size of 4 children is too small	1m
9a		1m for all correct arrows
9b(i)	Food chain with humpback whale as tertiary consumer: [redacted] → krill → herring → humpback whale	1m
9b(ii)		1m for correct shape of pyramid and labelled with organisms

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9c	- With every trophic level, 90%/most of the energy is lost to the environment as heat energy from respiration or chemical energy trapped in uneaten or undigested tissues. The energy lost is not returned to the food chain. - More energy has to be continually supplied to the food chain in the form of light energy trapped by phytoplankton for photosynthesis. OR - Energy lost cannot be recycled	1m – loss of energy at each trophic level 1m – link to non-cyclical energy flow Total: 2m
		Total for Q9: 5m

Paper 4 Section B – AQs - 3 choose 2 - [10 marks x 2 = 20 marks]

Qn	Answer	Marking
10a	- Starch is digested into maltose in the mouth by salivary amylase. - Starch is also digested into maltose, and then glucose in the duodenum and ileum by amylases and maltases. - Glucose is then absorbed from the ileum into the blood by diffusion.	1m – starch digested into maltose and into glucose 1m – mention of correct digestive enzymes for mouth, duodenum, ileum 1m – movement of glucose from mouth to ileum to blood (location of digestion and absorption) 1m – use of key terms 'digest(ion)' and 'absorp(tion)' Total: 4m
10b	Man **X** (as his blood glucose levels remains high even 120min after the meal whereas for Y, blood glucose levels has fallen back to pre-meal levels)	1m – Man 1m – reason
10c	Islets of Langerhans	1m
10d	As the body cells are not responsive to insulin, insulin secreted is unable to: • stimulate liver and muscles to convert excess glucose into glycogen for storage / less glucose is converted into glycogen for storage in the liver • increases permeability of cell membranes to glucose for greater uptake of glucose / less glucose is taken up by cells by diffusion, resulting in more left in the blood • causes increase in rate of respiration to utilize more glucose / less glucose is utilized by cells as the cells' rate of respiration remains lower	1m each for each bulleted insulin function x 3 Total: 3m

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11a	10 km from point P (Accept 10-12km)	1m
11b	Nitrates and phosphates in the wastes released: • is decomposed by aerobic bacteria in the water, using up oxygen. • Caused increased growth of plants in the water, resulting in eutrophication • Submerged plants receive insufficient light for photosynthesis and die • As aerobic bacteria decompose these dead plants/sewage, the numbers of aerobic bacteria increase. • When increased numbers of aerobic bacteria use up oxygen to carry out decomposition, the concentration of oxygen in the river decreases. • This causes the fish in the water to have insufficient oxygen for aerobic respiration and die, causing numbers of fish to decrease.	1m – reference to why oxygen levels decrease 1m – why bacteria numbers increase 1m – why fish numbers decrease + any 2 other pts x 1m each Total: 5m
11c	• The toxic substances are consumed/taken in by primary consumers in the food chain and stored/accumulated in their tissues OR Bioamplification of the concentration of toxic substances in the tissues of organisms over time • As secondary and tertiary consumers in subsequent trophic levels consume these organisms, increasing concentrations of toxic substances are passed along the food chain up the trophic levels. • Bioaccumulation occurs. • Thus, humans consuming the fish may consume higher amounts of the toxic substances enough to cause illness while the fish are at lower trophic levels and may not have accumulated high enough levels of toxic substances to cause them to fall ill.	1m per pt x 3 pts on bioaccumulation 1m – link to qn on why fish healthy but humans are not. Total: 4m

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12a	• Transpiration is the loss of water vapour from the stomata. • This results in (a suction force called) transpiration pull • which transports water upwards through the xylem from roots to leaves (where it is required for photosynthesis/ produce food/ for plant growth and survival) • Translocation is the process transporting sugars produced from photosynthesis • from the leaves to the other parts of the plant like the potato, through the phloem (which uses the sugars in respiration for growth/ stores the sugars as starch in the potato)	<u>Transpiration</u> 1m – transpiration 1m – name transpiration pull 1m – relate to xylem, water transport <u>Translocation</u> 1m – translocation 1m – relate to phloem, sugar transport Total: 5m
12b(i)	• Asexual reproduction • Process involving only <u>one parent</u> (plant) which results in <u>genetically identical offspring</u>	1m – name asexual repro 1m – describe Total: 2m
12b(ii)	<u>advantages</u> • Potato offspring produced all inherit/share the same beneficial characteristics as the parent plant. • Potato offspring all have (genetically) identical characteristics and are uniform for ease of sale/quality control. <u>disadvantages</u> • Any diseases or disadvantageous characteristics of the potato parent plant would also be inherited by the potato offspring. • There is less genetic diversity/ genetic variety so the potato offspring crop is susceptible to diseases / would likely be wiped out if there was a disease affecting it / OWTTE	1m – advantage 1m – disadvantage 1m – additional advantage or disadvantage Total: 3m
		Total for Q13: 10m

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