

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 |

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

This document consists of **20** printed pages.

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**.

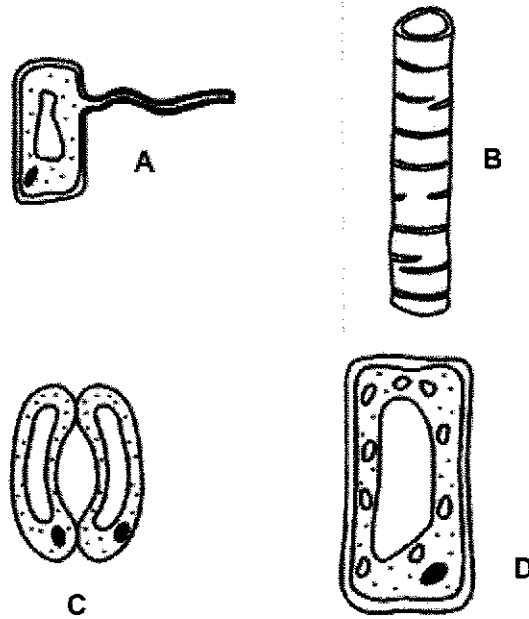


Fig. 1.1

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

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

..... [1]

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

..... [1]

- (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.

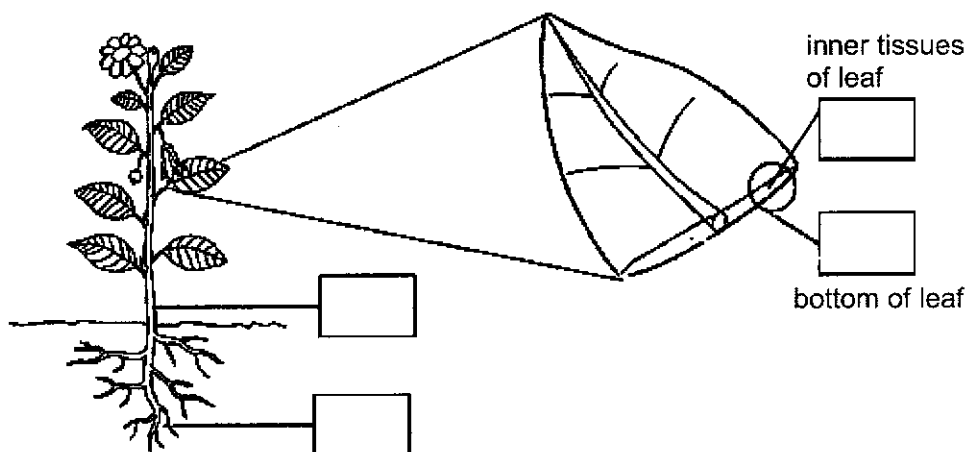


Fig. 1.2

[2]

[Total: 4]

- 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.

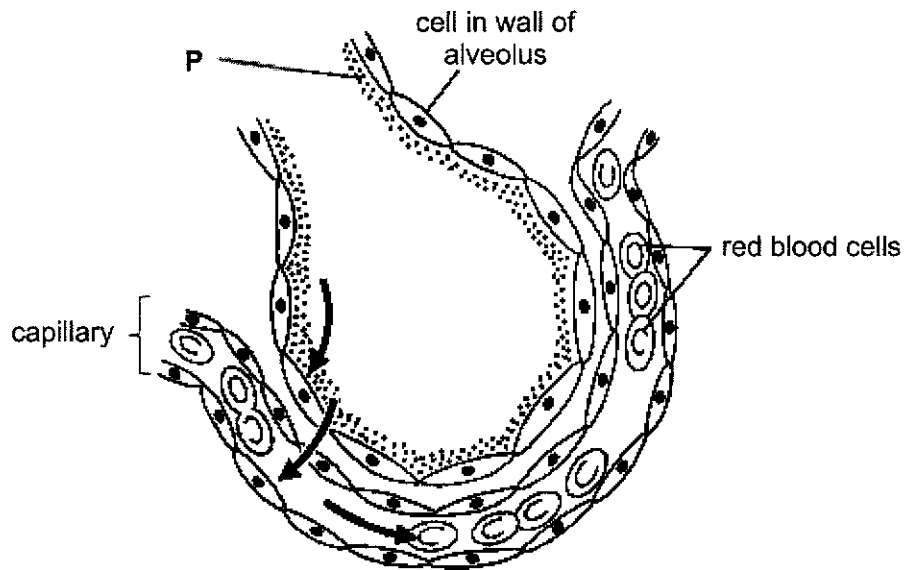


Fig. 2.1

- (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]

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

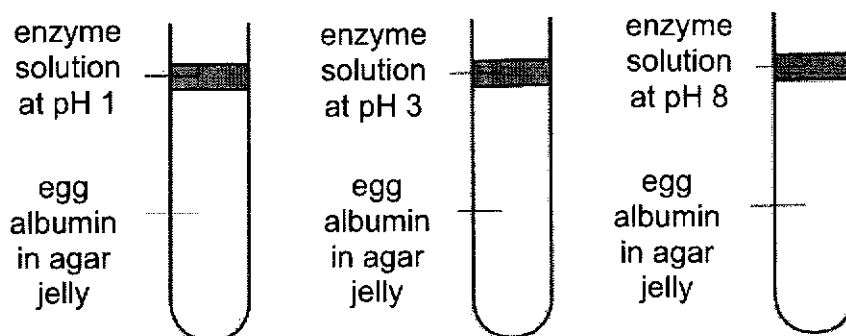


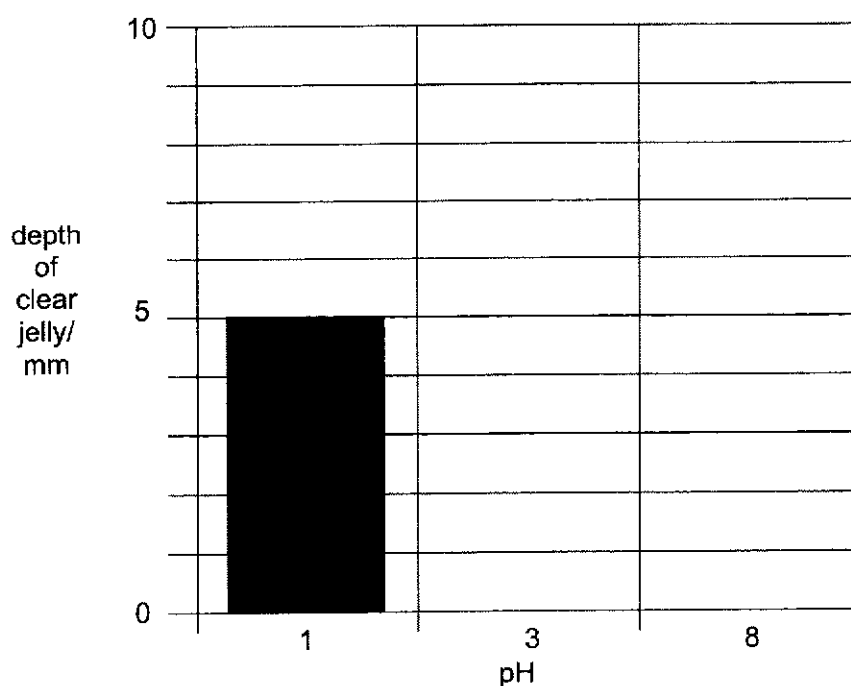
Fig. 3.1

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

(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.

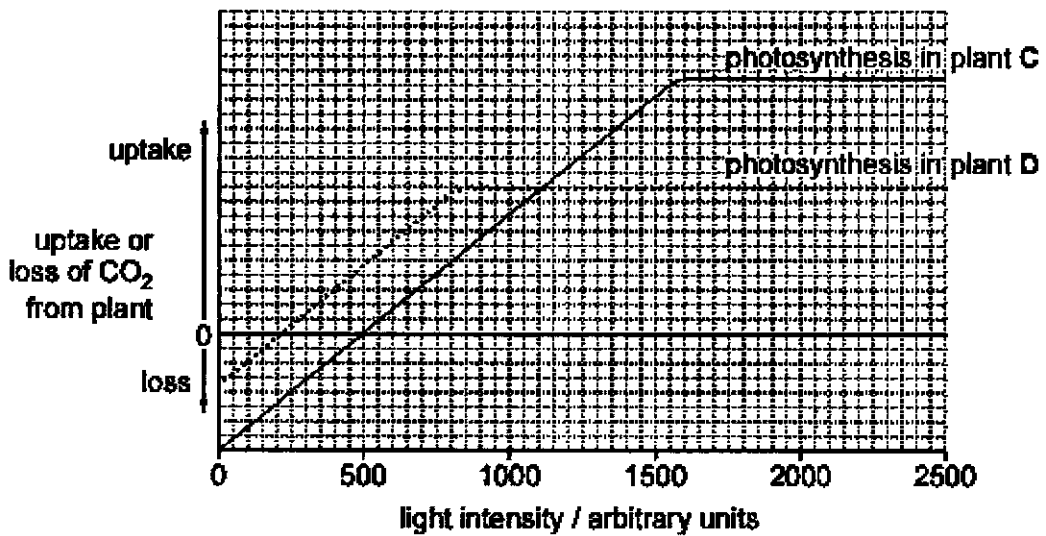


Fig. 4.1

- (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:

$$\text{cardiac output} = \text{heart rate} \times \text{stroke volume}$$

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]

- (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]

- 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.

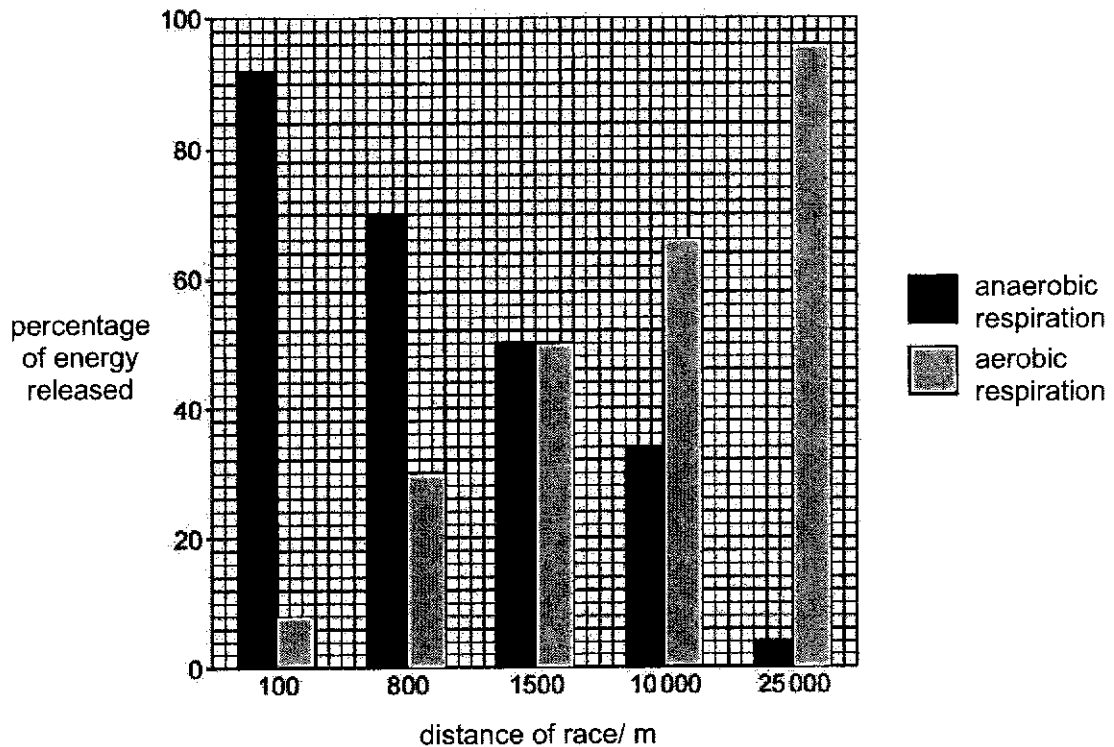


Fig. 6.1

- (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]

- 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.

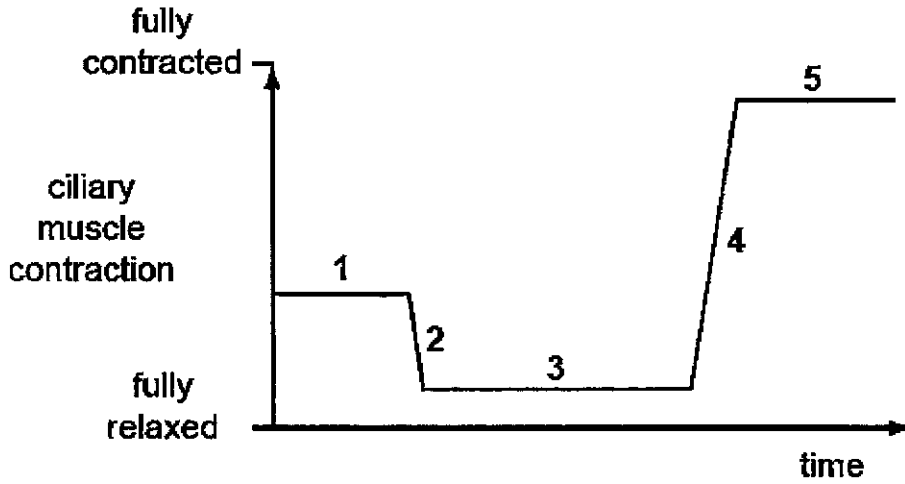


Fig. 7.1

- (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]

- 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.

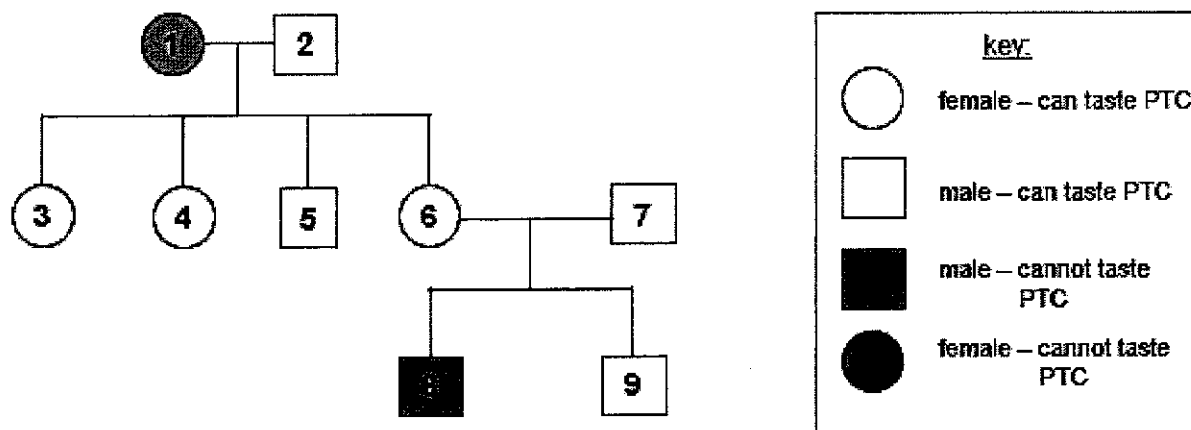


Fig. 8.1

- (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]

- (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]

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.

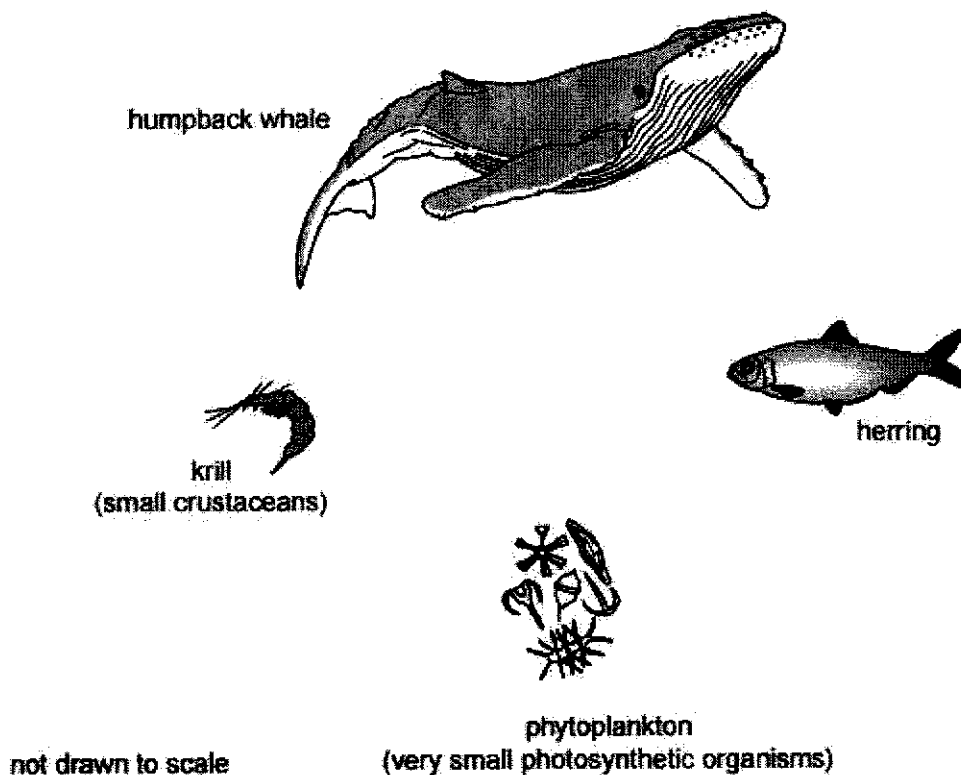


Fig. 9.1

[1]

- (b) Refer to Fig. 9.1.

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

..... [1]

- (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]

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 10]

- 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.

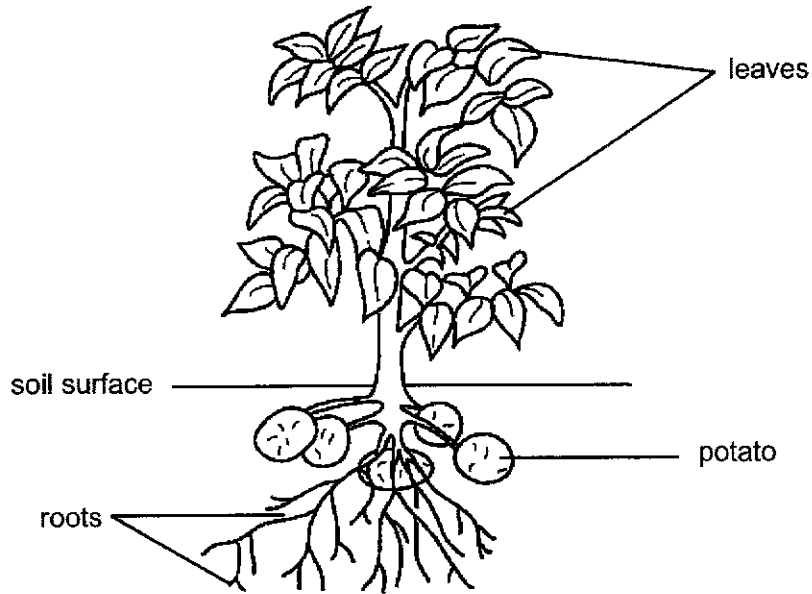


Fig. 12.1

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

- (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.

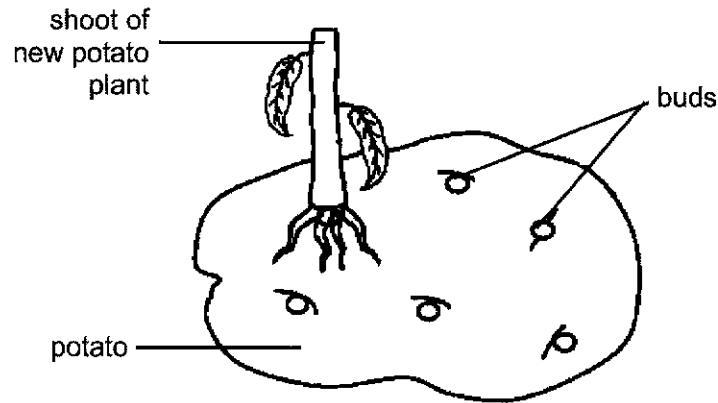


Fig. 12.2

- (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]

Name: ()

Class:



**WOODLANDS SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019**

| | | | |
|-----------|---|--------|----------------|
| 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 |

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

This document consists of **26** printed pages.

Section A

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

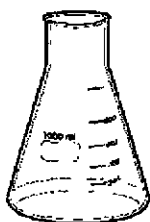
A



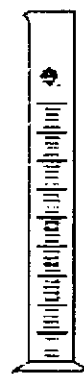
B



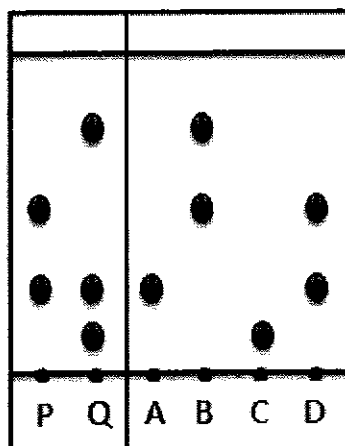
C



D



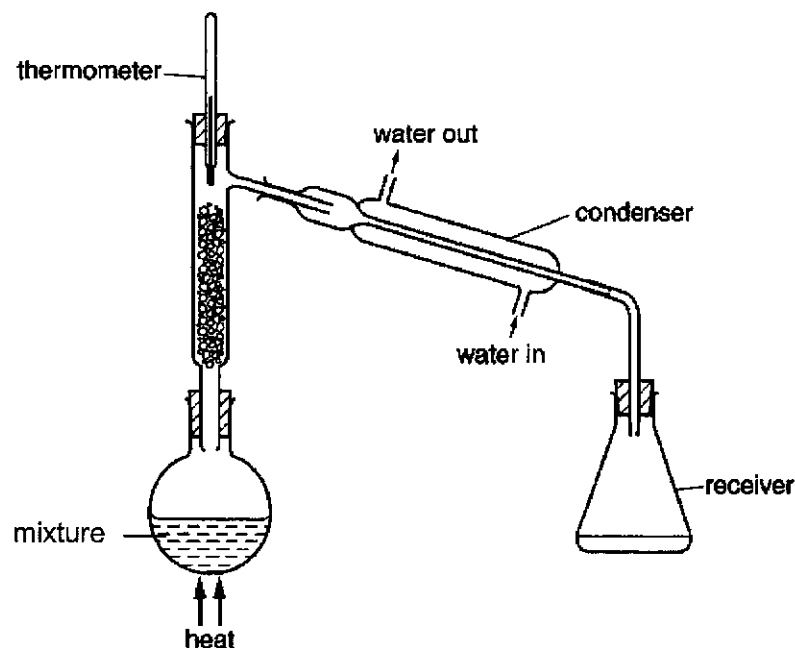
- 2 The diagram below shows a chromatogram that was carried out using ethanol as the solvent.



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**.

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



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

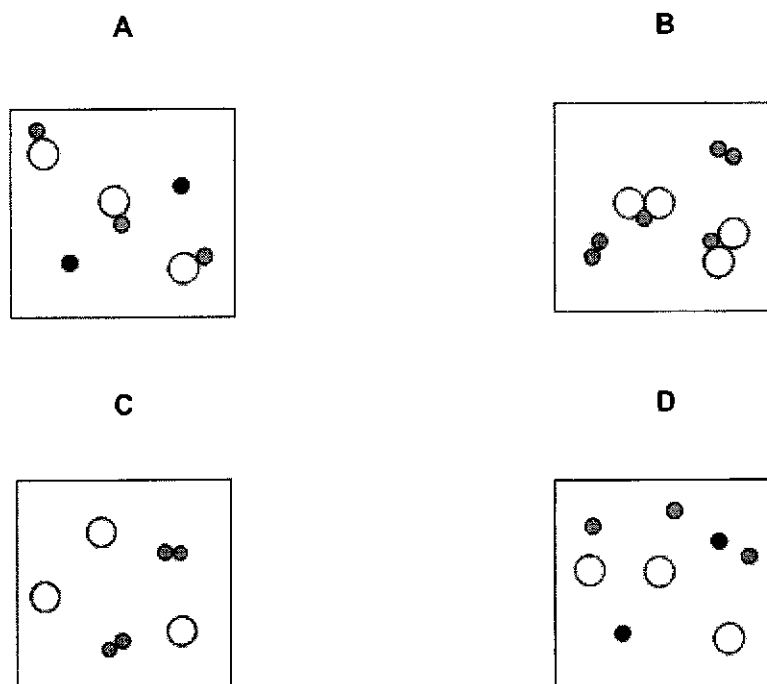
- A The thermometer is in the wrong position.
 B The top of the receiver is stoppered.
 C The volume of the distillate is too little.
 D The water enters the condenser at the wrong place.
- 4 The nucleon number and proton number of an atom of X and Y are shown.

| | 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.

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



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

| | | | | | | | | | | | | | |
|------------------|--------|---|------------|---|---|---|---|--------|------|---------|----|----|----|
| | red | | | | | | | yellow | | | | | |
| methyl orange | | | | | | | | | | | | | |
| | yellow | | | | | | | | blue | | | | |
| bromothymol blue | | | | | | | | | | | | | |
| | | | colourless | | | | | | | magenta | | | |
| phenolphthalein | | | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| | 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

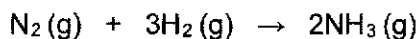
- 7 Which salt is **best** prepared by titration?
- A ammonium chloride
 - B calcium carbonate
 - C lead(II) nitrate
 - D silver chloride

- 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.



If 30 cm³ of nitrogen gas reacted with 60 cm³ 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 cm³
- B 40 cm³
- C 50 cm³
- D 60 cm³

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?

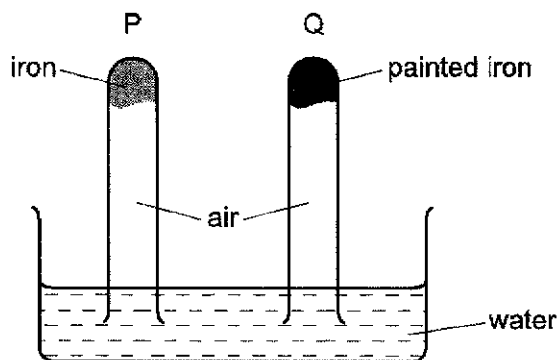
- A Brass will not react with dilute acid.
- B Brass is less malleable than copper.
- C Brass is a compound of copper and zinc.
- D Brass does not conduct heat and electricity.

- 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 |

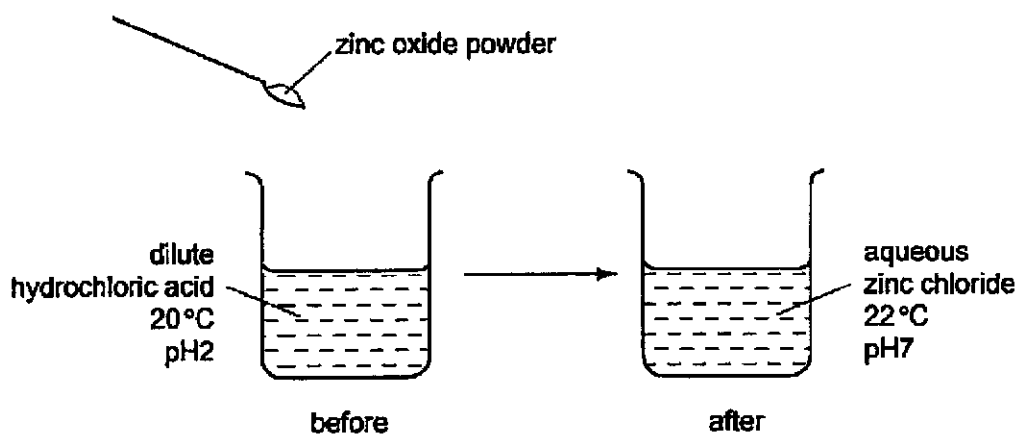
- 14 The diagram shows an experiment to investigate how paint affects the rusting of iron.



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 |

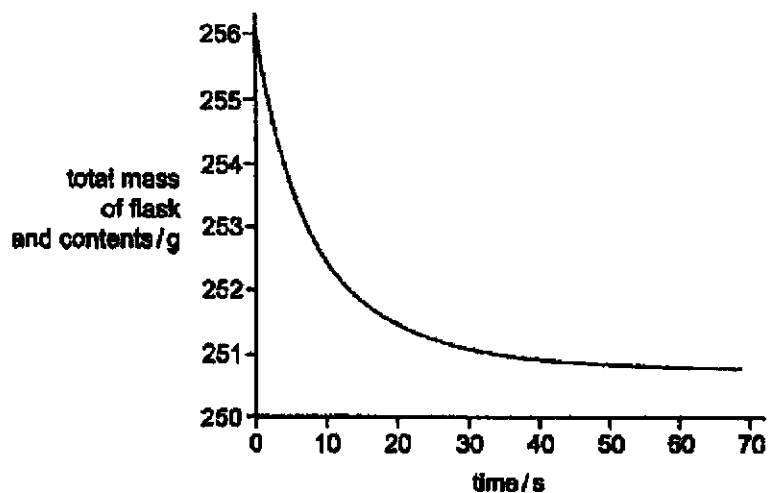
15 The diagram shows an experiment.



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

| | endothermic | neutralisation |
|----------|-------------|----------------|
| A | ✓ | ✓ |
| B | ✓ | x |
| C | x | ✓ |
| D | x | x |

- 16 Calcium carbonate is placed in a flask on a balance and dilute HCl 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."

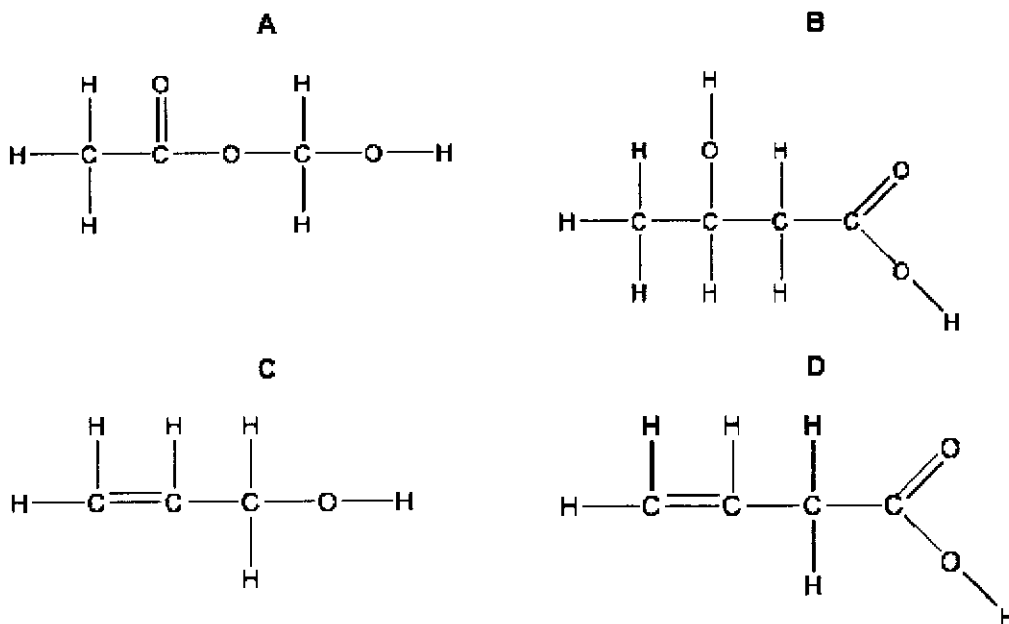
Which air pollutant is described in the above paragraph?

- A methane
- B sulfur dioxide
- C carbon monoxide
- D oxides of nitrogen

- 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?



- 19 Which list describes the three reactions correctly?

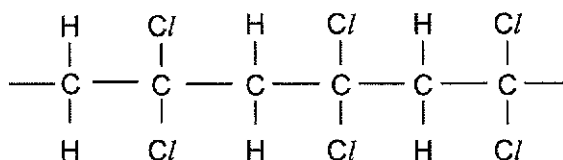


Which list describes the three reactions correctly?

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

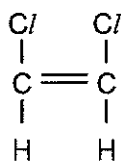
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20 The diagram below shows the structure of part of a polymer.

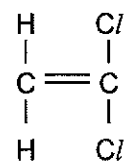


Which of the following is the monomer for the polymer shown above?

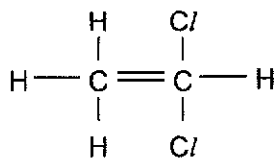
A



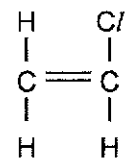
B



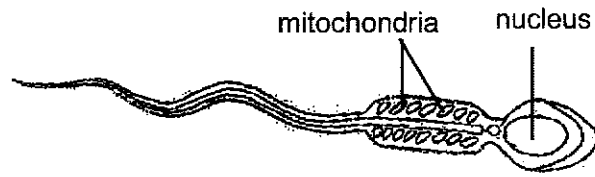
C



D



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.

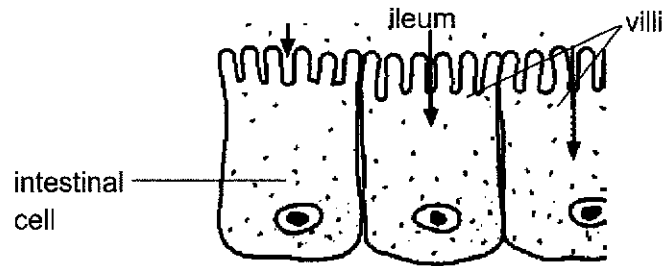
22 The statements below describe the structure of a specialised cell.

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

Identify this specialised cell.

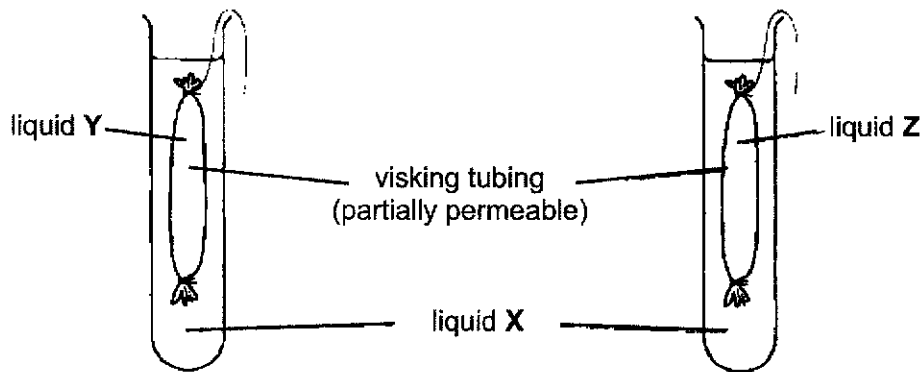
- A red blood cell
- B root hair cell
- C spongy mesophyll cell
- D white blood cell

- 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.



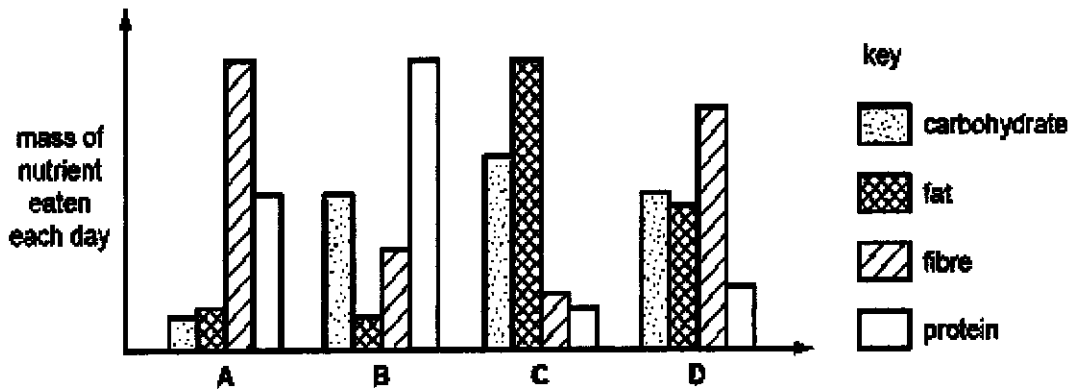
After 30 minutes, the visking tubing containing liquid Y became flaccid while the tubing containing liquid Z became more turgid.

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

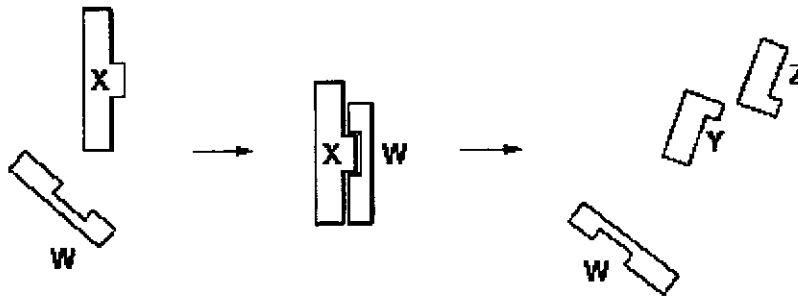
| | liquid X | liquid Y | liquid Z |
|---|----------------------|----------------------|----------------------|
| A | distilled water | 25% sucrose solution | 10% sucrose solution |
| B | 10% sucrose solution | distilled water | 25% sucrose solution |
| C | 10% sucrose solution | 25% sucrose solution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

- 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?



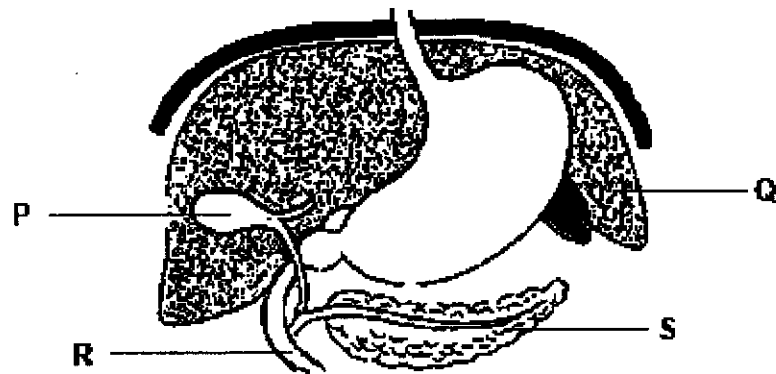
- 26 The diagram below illustrates the “lock and key” hypothesis of enzyme action.



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 |

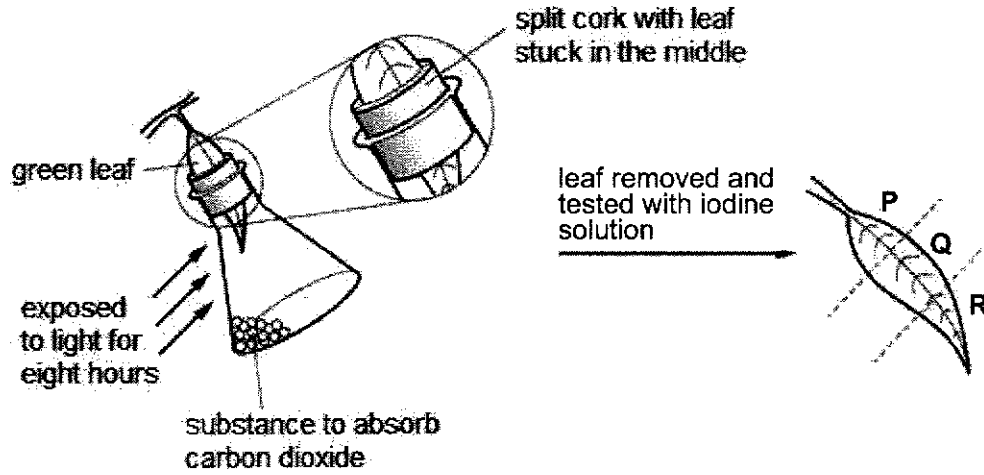
27 The diagram shows a section of the human digestive canal.



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.

- 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.

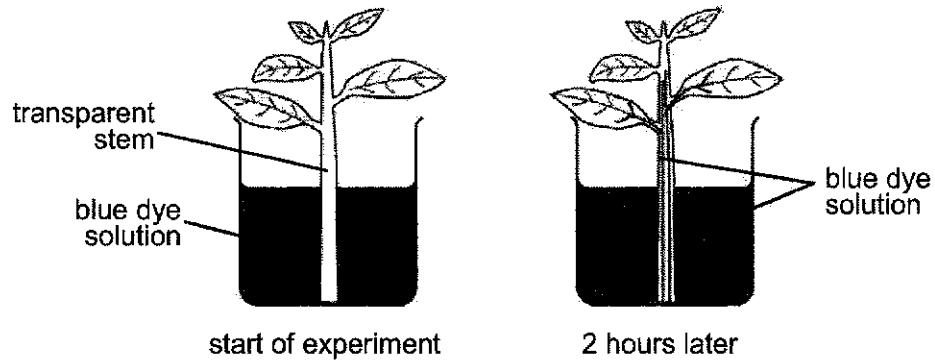


The leaf is then removed and tested with iodine solution. What are the resulting colours of parts **P**, **Q** and **R**?

| | 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 |

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

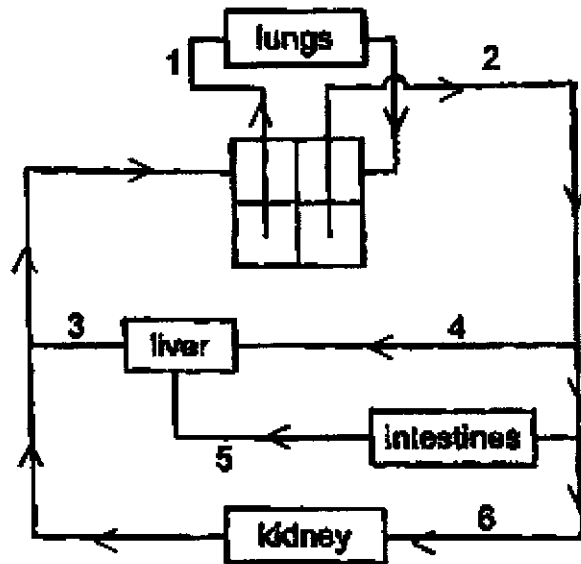
It took two hours for the blue dye solution to move up the plant stem as shown below.



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 |

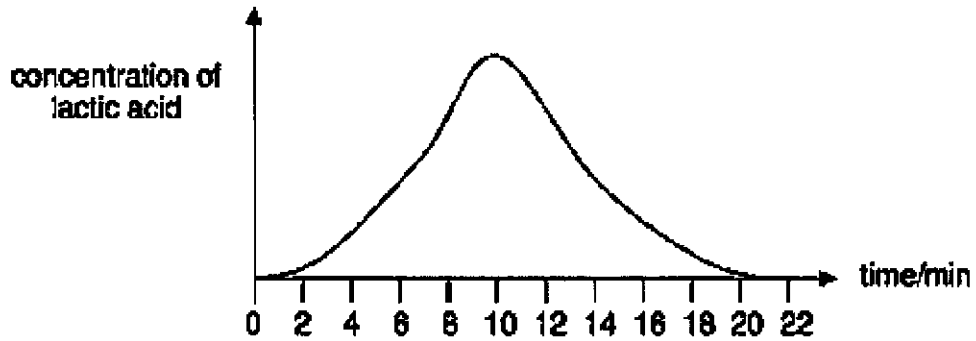
- 30 The diagram below shows the human circulatory system. The numbers 1 to 6 represent different blood vessels.



Which numbers correctly identifies the following blood vessels?

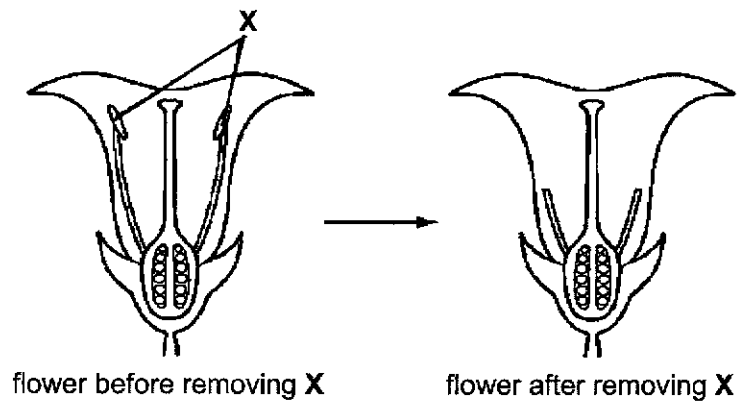
| | aorta | hepatic vein | pulmonary artery |
|----------|-------|--------------|------------------|
| A | 1 | 6 | 2 |
| B | 2 | 3 | 1 |
| C | 2 | 4 | 5 |
| D | 4 | 3 | 1 |

- 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?

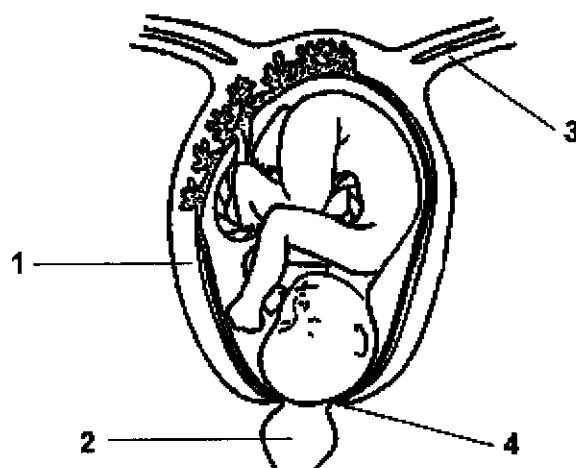
- A 2 min
 B 8 min
 C 10 min
 D 21 min
- 32 The diagram shows the longitudinal section of a flower.
 A plant breeder removed all the structures labelled X from the flower, as shown below.



Removing X helps to prevent

- A fertilisation
 B pollination by insects
 C pollination by wind
 D self-pollination

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

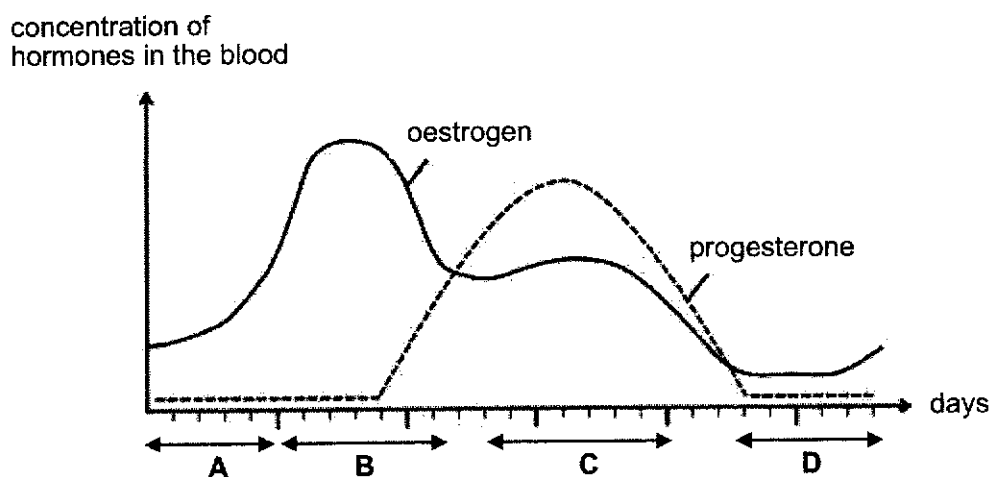


Which parts indicate the uterus and the cervix?

| | 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?



5078/PRELIMS/P1/19

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

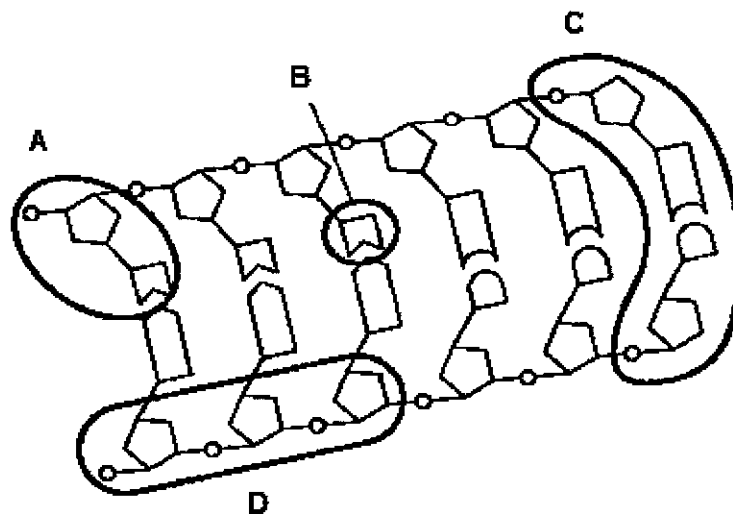
Which option correctly shows the characteristics of the mode of regulation?

| | 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 |

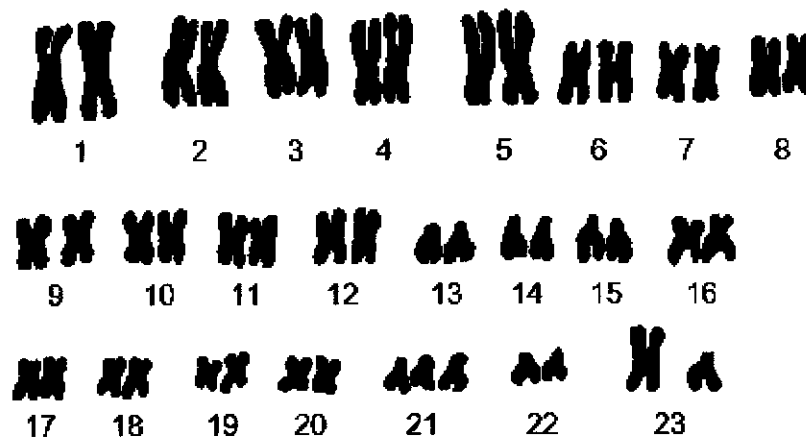
- 36 Deoxyribonucleic acid (DNA) was extracted from a man and a woman. They are not related to each other.

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?



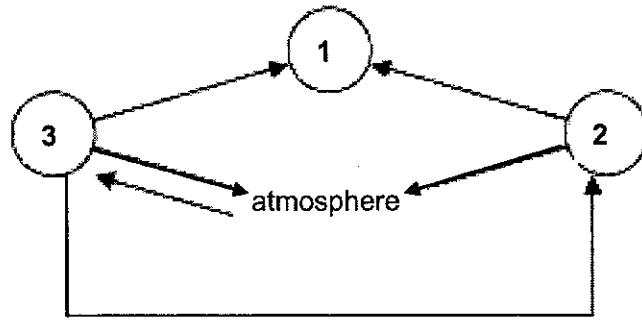
- 38 In rabbits, the allele for brown fur is dominant to the allele for white fur. Several heterozygous rabbits with brown fur were mated with several rabbits with white fur. For every 80 offspring produced, how many are expected to have white fur?
- A 0
B 20
C 40
D 60
- 39 The diagram below shows the 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 |

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 |

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 |

The Periodic Table of Elements

| I | | II | | Group | | | | | | | | | | III | IV | V | VI | VII | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|---------------------------|--------------------------|-----------------------------|----------------------------|---------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-----------------------------|------------------------|--------------------------|--------------------------|--------------------------|------------------------|---------------------------|-----------------------------|---------------------------|----------------------------|---------------------------|---------------------------|----------------------------|-----------------------------|--------------------------|-----------------------------|---------------------------|------------------------------|------------------------------|------------------------------|----------------------------|------------------------------|---------------------------|----------------------------|---------------------------|------------------------|-----------------------------|------------------------------|--------------------------|--------------------------|----------------------------|---------------------------|----------------------|-----------------------------|------------------------------|---------------------------|---------------------------------|------------------------------|-------------------------------|-----------------------------|-----------------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|---------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|----------------------------|---------------------------|----------------------------|-----------------------------|-------------------------|----------------------------|-----------------------------|-------------------------|----------------------------|-----------------------------|-----------------------------|--------------------------|----------------------------------|---------------------|-----------------------------|----------------------------|---------------------------------|---------------------------|------------------------------|------------------------------|------------------------------|---------------------------|------------------------------|--------------------------------|--------------------------------|-----------------------------|---------------------------------|------------------------------|--------------------------------|
| 3 Li lithium 7 | 4 Be beryllium 9 | 11 Na sodium 23 | 12 Mg magnesium 24 | 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 98 | 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 | 58 Fr francium 223 | 59 La lanthanum 139 | 60 Ce cerium 140 | 61 Pr praseodymium 141 | 62 Nd neodymium 144 | 63 Pm promethium 147 | 64 Sm samarium 150 | 65 Eu europium 152 | 66 Gd gadolinium 157 | 67 Tb terbium 159 | 68 Dy dysprosium 163 | 69 Ho holmium 165 | 70 Er erbium 167 | 71 Lu lutetium 175 | 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 210 | 85 At astatine 210 | 86 Rn radon 222 | 87 Rf rutherfordium 261 | 88-103 actinoids | 89 Ac actinium 227 | 90 Th thorium 232 | 91 Pa protactinium 231 | 92 U uranium 238 | 93 Np neptunium 237 | 94 Pu plutonium 244 | 95 Am americium 243 | 96 Cm curium 247 | 97 Bk berkelium 247 | 98 Cf californium 251 | 99 Es einsteinium 252 | 100 Fm fermium 257 | 101 Md mendelevium 258 | 102 No nobelium 259 | 103 Lr lawrencium 260 |

Key
atomic number
atomic symbol
name
relative atomic mass

1
H
hydrogen
1

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.)

**WOODLANDS SECONDARY SCHOOL
SEC 4E5NA SCI (CHEMISTRY/BIOLOGY) 5078**

2019 PRELIMINARY EXAMINATION ANSWERS

Paper 1 – MCQs [40 marks]

Sc Chem:

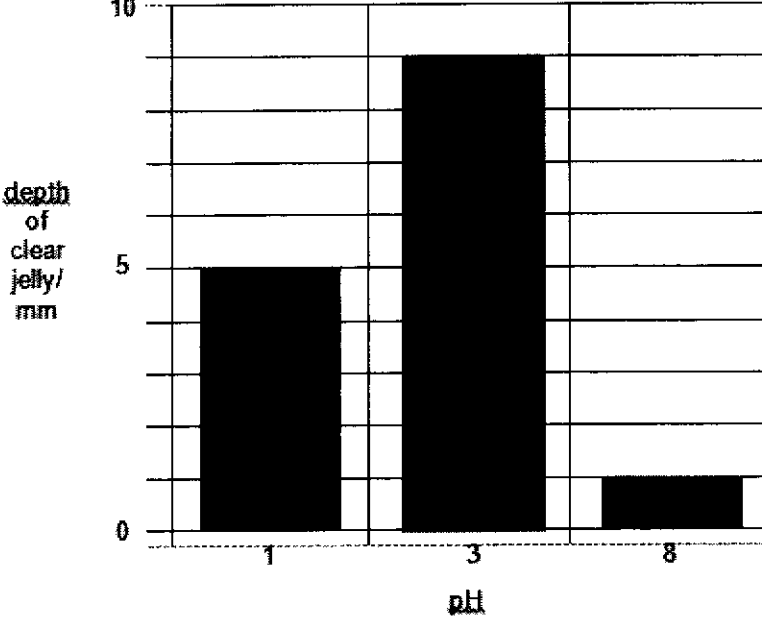
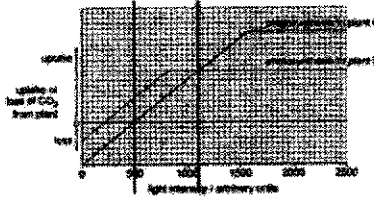
| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
| D | C | B | B | D | C | A | A | C | B |

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

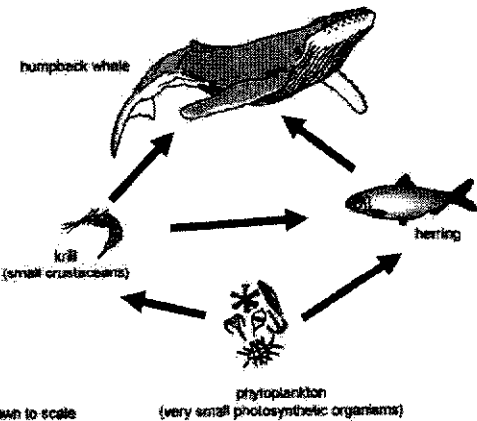
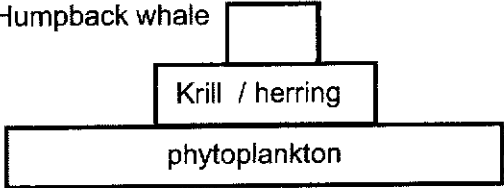
Sc Bio:

| | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 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 |

| | | | | | | | | | | | |
|---------|--|--|------------------------------|----------------------------|---------|--|---|---------|---|--|-------------------|
| 2b | <ul style="list-style-type: none"> - P is a thin film of <u>moisture</u> on the <u>inner wall</u> of alveolus - Allows gases (oxygen and carbon dioxide) to dissolve in the moisture - for faster diffusion / maintain steep concentration gradient | <p>1m</p> <p>1m</p> <p>Total: 2m</p> | | | | | | | | | |
| | | Total for Q2: 4m | | | | | | | | | |
| 3a |  <p style="text-align: center;">depth of clear jelly / mm</p> <p style="text-align: center;">pH</p> | <p>1m – pH 3</p> <p>1m – pH 8</p> <p>Total: 2m</p> | | | | | | | | | |
| 3b(i) | <ul style="list-style-type: none"> - the depth of clear jelly was greater for pH 3 than pH 8 | 1m | | | | | | | | | |
| 3b(ii) | <ul style="list-style-type: none"> - 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 | <p>3 pts – 2m</p> <p>2 pts – 1m</p> <p>0-1 pt – 0m</p> | | | | | | | | | |
| 3c | <p>Pepsin</p> <p>Give ECF based on optimum pH in 3b.</p> | 1m | | | | | | | | | |
| | | Total for Q3: 6m | | | | | | | | | |
| 4a | <p>Word eqn for aerobic respiration:</p> <p>Oxygen + glucose → Carbon dioxide + water + (large amount of) energy</p> | 1m | | | | | | | | | |
| 4b | <p>1100 arbitrary units</p>  <p style="text-align: center;">Fig. 5.1</p> | 1m | | | | | | | | | |
| 4c | 500 arbitrary units | 1m | | | | | | | | | |
| 4d | <table border="1" style="width: 100%; text-align: center;"> <tr> <td></td> <td>grows better in shade</td> <td>grows better in sun</td> </tr> <tr> <td>plant C</td> <td></td> <td>✓</td> </tr> <tr> <td>plant D</td> <td>✓</td> <td></td> </tr> </table> | | grows better in shade | grows better in sun | plant C | | ✓ | plant D | ✓ | | 1m for both ticks |
| | grows better in shade | grows better in sun | | | | | | | | | |
| plant C | | ✓ | | | | | | | | | |
| plant D | ✓ | | | | | | | | | | |
| | | Total for Q4: 4m | | | | | | | | | |

| 5a(i) | Cardiac output at rest = $75 \times 0.07 = \underline{5.25}$ (to 2 dp) | 1m | | | | | | | | |
|--|--|---|----------|--|-----------|-----------------------------|-----------|--------------------------|-----------|--|
| 5a(ii) | Increase in cardiac output = $21.01 - 5.25$ [ans frm 5a(i)] = <u>15.76</u> ($15.76 / 5.25$) \times 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 border="1" style="width: 100%;"> <thead> <tr> <th></th> <th>number</th> </tr> </thead> <tbody> <tr> <td>is feeding on nectar in a flower very near the boy</td> <td style="text-align: center;">5</td> </tr> <tr> <td>is flying away from the boy</td> <td style="text-align: center;">2</td> </tr> </tbody> </table> | | number | is feeding on nectar in a flower very near the boy | 5 | is flying away from the boy | 2 | 1m each Total: 2m | | |
| | number | | | | | | | | | |
| is feeding on nectar in a flower very near the boy | 5 | | | | | | | | | |
| is flying away from the boy | 2 | | | | | | | | | |
| 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: 6m | | | | | | | | |
| 8a | <table border="1" style="width: 100%;"> <thead> <tr> <th>individual</th> <th>genotype</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">tt</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">Tt</td> </tr> <tr> <td style="text-align: center;">7</td> <td style="text-align: center;">Tt</td> </tr> </tbody> </table> | individual | genotype | 1 | tt | 3 | Tt | 7 | Tt | All 3 correct – 2m 1 or 2 correct – 1m Total: 2m |
| individual | genotype | | | | | | | | | |
| 1 | tt | | | | | | | | | |
| 3 | Tt | | | | | | | | | |
| 7 | Tt | | | | | | | | | |

| | | |
|--------|---|--|
| 8b | <p><u>Genetic diagram</u></p> <p>Parents' phenotypes:</p> <p>Parents' genotypes:</p> <p>Gametes:</p> <p>Fertilisation</p> <p>Offspring genotype:</p> <p>Offspring phenotype:</p> <p>Probability of third child being able to taste PTC: <u>75% or $\frac{3}{4}$ or 0.75</u></p> | <p>1m – parents phenotype and genotype</p> <p>1m – gametes and fertilization correct</p> <p>1m – offspring phenotype and genotype</p> <p>1m – probability</p> <p>Total: 4m</p> |
| 8c(i) | <p>Males : females (offspring of individuals 1 and 2) 1:3</p> | 1m |
| 8c(ii) | <p>Any one:</p> <p>Observed ratio is not the same as expected ratio because...</p> <ul style="list-style-type: none"> - 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) | <p>Food chain with humpback whale as tertiary consumer: ██████████ → krill → herring → humpback whale</p> | 1m |
| 9b(ii) |  | 1m for correct shape of pyramid and labelled with organisms |

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

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

| Qn | Answer | Marking |
|-----|--|--|
| 10a | <ul style="list-style-type: none"> - 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. | <p>1m – starch digested into maltose and into glucose</p> <p>1m – mention of correct digestive enzymes for mouth, duodenum, ileum</p> <p>1m – movement of glucose from mouth to ileum to blood (location of digestion and absorption)</p> <p>1m – use of key terms 'digest(ion)' and 'absorp(tion)'</p> <p>Total: 4m</p> |
| 10b | <p>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)</p> | <p>1m – Man</p> <p>1m – reason</p> |
| 10c | Islets of Langerhans | 1m |
| 10d | <p>As the body cells are <u>not responsive</u> to insulin, insulin secreted is <u>unable</u> to:</p> <ul style="list-style-type: none"> • 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 | <p>1m each for each bulleted insulin function x 3</p> <p>Total: 3m</p> |

| | | |
|-----|--|---|
| 11a | 10 km from point P (Accept 10-12km) | 1m |
| 11b | <p>Nitrates and phosphates in the wastes released:</p> <ul style="list-style-type: none"> • 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. | <p>1m – reference to why oxygen levels decrease</p> <p>1m – why bacteria numbers increase</p> <p>1m – why fish numbers decrease</p> <p>+ any 2 other pts x 1m each</p> <p>Total: 5m</p> |
| 11c | <ul style="list-style-type: none"> • The toxic substances are consumed/taken in by primary consumers in the food chain and stored/accumulated in their tissues <p>OR</p> <p>Bioamplification of the concentration of toxic substances in the tissues of organisms over time</p> <ul style="list-style-type: none"> • 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. | <p>1m per pt x 3 pts on bioaccumulation</p> <p>1m – link to qn on why fish healthy but humans are not.</p> <p>Total: 4m</p> |

| | | |
|---------|--|--|
| 12a | <ul style="list-style-type: none"> • 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 <p>(where it is required for photosynthesis/ produce food/ for plant growth and survival)</p> <ul style="list-style-type: none"> • 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 <p>(which uses the sugars in respiration for growth/ stores the sugars as starch in the potato)</p> | <p><u>Transpiration</u> 1m – transpiration 1m – name transpiration pull 1m – relate to xylem, water transport</p> <p><u>Translocation</u> 1m – translocation 1m – relate to phloem, sugar transport</p> <p>Total: 5m</p> |
| 12b(i) | <ul style="list-style-type: none"> • Asexual reproduction • Process involving only <u>one parent</u> (plant) which results in <u>genetically identical offspring</u> | <p>1m – name asexual repro 1m – describe</p> <p>Total: 2m</p> |
| 12b(ii) | <p><u>advantages</u></p> <ul style="list-style-type: none"> • 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. <p><u>disadvantages</u></p> <ul style="list-style-type: none"> • 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 | <p>1m – advantage 1m – disadvantage 1m – additional advantage or disadvantage</p> <p>Total: 3m</p> |

