AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
ADDITIONAL SCIENCE

H

Higher Tier Unit 5

Friday 10 June 2016 Morning Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a ruler
- a calculator
- the Chemistry Data Sheet and Physics Equations Sheet Booklet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3(b) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Answer **all** questions in the spaces provided.

Biology Questions

1 Mars has a lower air pressure than Earth.

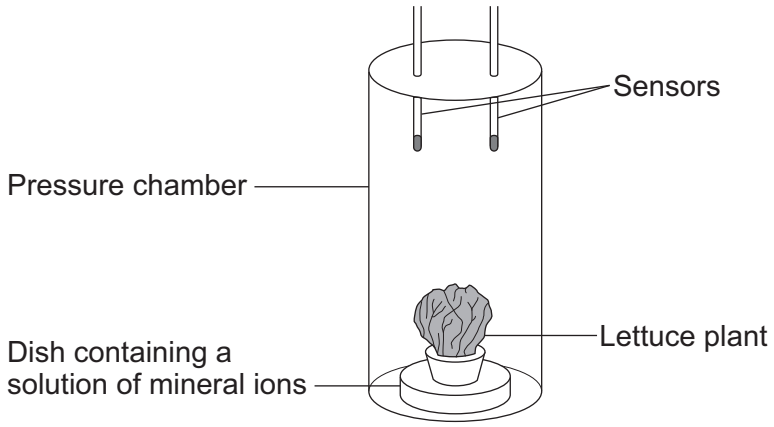
Scientists investigated the growth of plants in low air pressure.

Figure 1 shows a pressure chamber.

A pressure chamber is a transparent sealed container.

The air pressure inside the chamber can be changed.

Figure 1



1 (a) (i) To allow the lettuce plant to grow, the pressure chamber is transparent.

Explain why.

[2 marks]

Question 1 continues on the next page

1 (a) (ii) The solution in the dish contains nitrate ions.

Which chemical do plants produce using nitrate ions?

[1 mark]

Draw a ring around the correct answer.

starch **sugar** **protein**

1 (b) The scientists investigated the growth of lettuce plants.

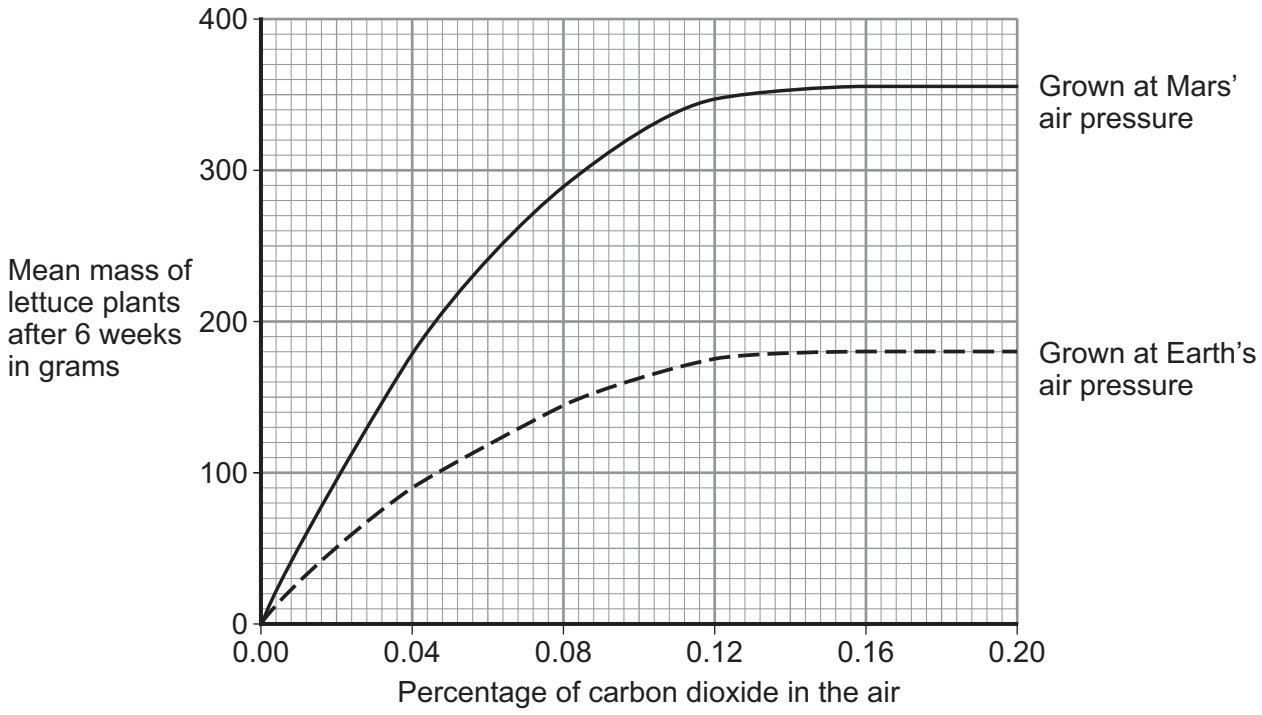
The scientists:

- grew lettuce plants at different concentrations of carbon dioxide at the air pressure found on Mars
- grew lettuce plants at different concentrations of carbon dioxide at the air pressure found on Earth.

The scientists grew 10 lettuce plants for 6 weeks in each part of the investigation.

The results are shown in **Figure 2**.

Figure 2



1 (b) (i) Suggest **one** environmental factor that the scientists should keep the same in the investigation so that the results are valid.

[1 mark]

1 (b) (ii) The concentration of carbon dioxide in the air on Earth is 0.04%.

Compare the effect on the mass of the lettuces grown for 6 weeks at the air pressure found on Mars, instead of at the air pressure found on Earth at 0.04% carbon dioxide.

[2 marks]

1 (b) (iii) Give **one** way that photosynthesis will change the composition of the air in the pressure chamber.

[1 mark]

1 (c) One scientist said,

'On Earth, carbon dioxide is **not** a limiting factor at a concentration of 0.16%.'

1 (c) (i) What evidence in **Figure 2** supports this statement?

[1 mark]

1 (c) (ii) Name **one** limiting factor other than carbon dioxide concentration.

[1 mark]

9

Chemistry Questions

2 **Table 1** shows information about the structure and properties of three oxides.

Table 1

Oxide	Melting point in °C	Type of structure	Does it conduct electricity when solid?	Does it conduct electricity when liquid?
Magnesium oxide	2852	Giant ionic lattice		
Silicon dioxide	1600		No	No
Sulfur trioxide	17	Simple molecule		

2 (a) Complete **Table 1**.

[3 marks]

2 (b) Magnesium oxide and silicon dioxide are used as linings in hot furnaces.

Use information from **Table 1** to suggest **one** reason why.

[1 mark]

_____

_____

2 (c) (i) Calculate the relative formula mass (M_r) of sulfur trioxide (SO_3).

Relative atomic masses (A_r): O = 16, S = 32

[2 marks]

_____

_____

Relative formula mass (M_r) = _____

2 (c) (ii) The relative formula mass (M_r) of silicon dioxide is 60.

Calculate the percentage by mass of oxygen in silicon dioxide (SiO_2).

Relative atomic masses (A_r): O = 16, Si = 28

[2 marks]

_____

_____

Percentage by mass of oxygen = _____ %

2 (c) (iii) The relative formula mass (M_r) of magnesium oxide is 40.

What is the mass of one mole of magnesium oxide?

[1 mark]

Mass of one mole of magnesium oxide = _____

9

Turn over for the next question

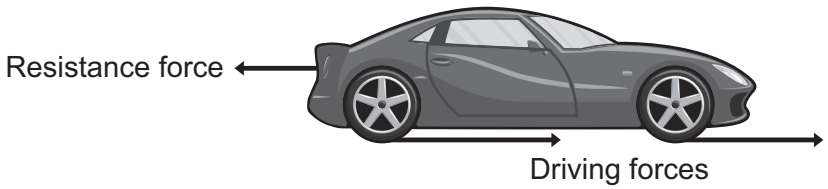
There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Physics Questions

3 **Figure 3** shows the horizontal forces acting on a moving car on a straight, level road.

Figure 3



3 (a) (i) The total resistance force is 500 N.

The driving force on **each** of the four wheels is 1000 N.

Calculate the resultant force acting on the car in **Figure 3**.

[1 mark]

Resultant force = _____ N

3 (a) (ii) Describe the motion of the car in **Figure 3**.

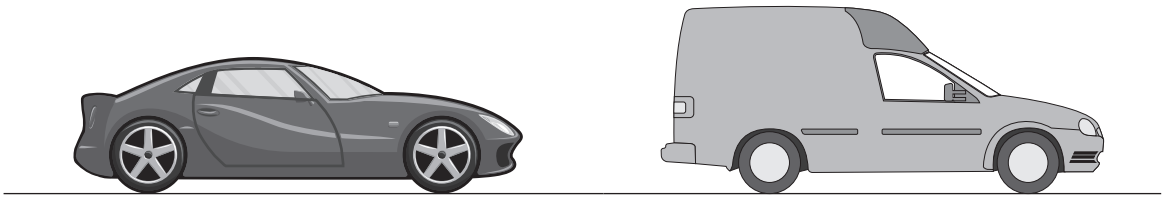
[2 marks]

Question 3 continues on the next page

3 (b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Figure 4 shows the car and a van made by the same manufacturer.

Figure 4



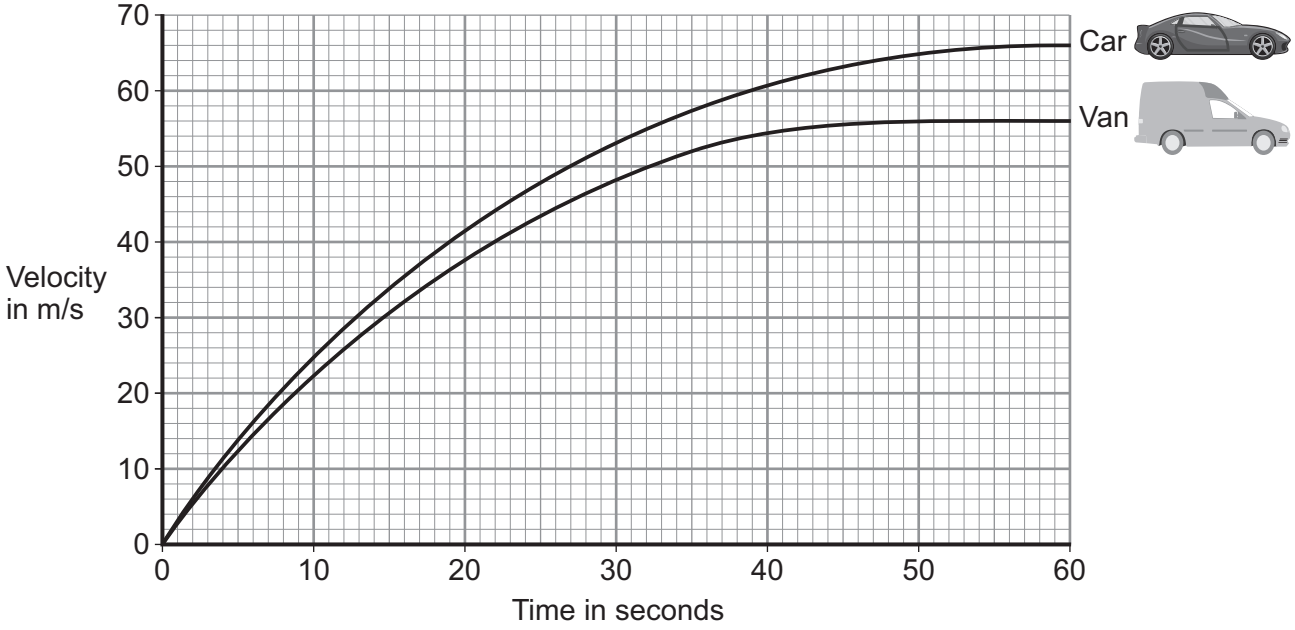
The car and the van have the same mass and identical engines.

The manufacturer carries out a test to compare the performance of the car and the van.

The test is a race between the two vehicles on a straight, level road.

Figure 5 shows the velocities of the car and the van during the test.

Figure 5



Use **Figure 5** to describe the similarities and differences between the test results for the car and the van.

In your answer you should describe, in terms of horizontal forces, what is happening to each vehicle.

[6 marks]

Extra space

9

Turn over for the next question

Biology Questions

4 During development, stem cells become differentiated.

4 (a) What does **differentiation** mean?

[2 marks]

_____

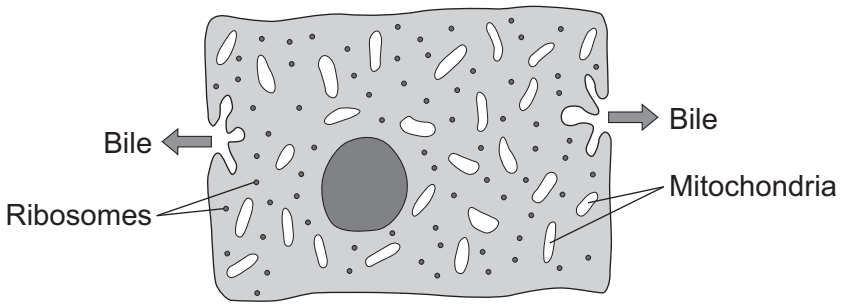
_____

_____

_____

4 (b) **Figure 6** shows a differentiated human cell.

Figure 6



In which organ in the human body would the cell in **Figure 6** be found?

Give a reason for your answer.

[2 marks]

Organ _____

Reason _____

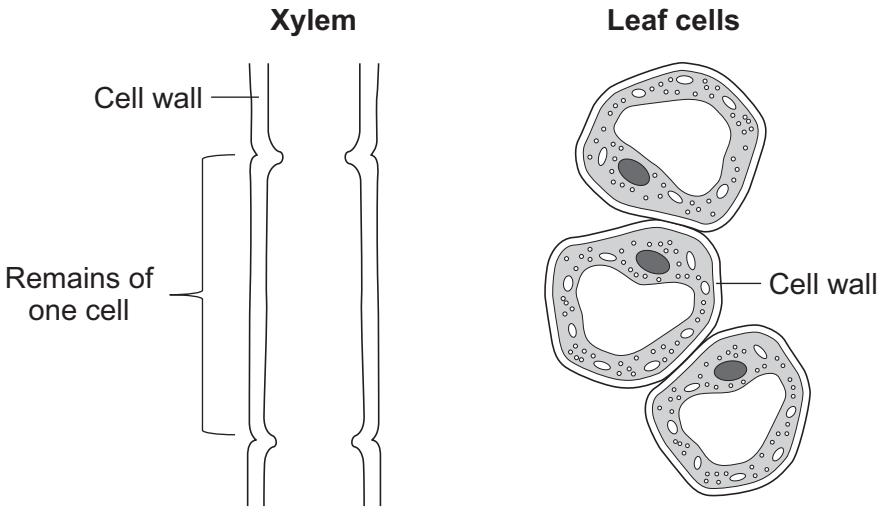
_____

4 (c) **Figure 7** shows structures found in a plant.

The xylem transports substances from the root to the leaves of a plant.

The structures in **Figure 7** are drawn to the same scale.

Figure 7



Suggest how the structure of the xylem has been differentiated to improve the transport of substances from the root to the leaves.

[3 marks]

7

There are no questions printed on this page

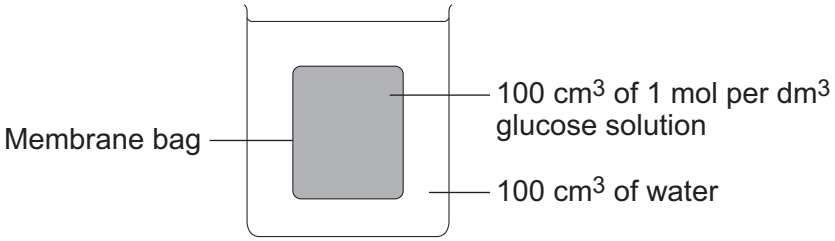
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

5 Students investigated the movement of glucose through a membrane.

A membrane bag containing 100 cm^3 of 1 mol per dm^3 glucose solution was placed in 100 cm^3 of water in a beaker.

Figure 8 shows the way the investigation was set up.

Figure 8



Every ten minutes, the concentration of glucose in the water in the beaker was measured.

The students measured the concentration of glucose using a colorimeter.

When there is no glucose, a test reagent added to the water is colourless, so 100% of light passes through.

When glucose is present, it reacts with the test reagent to form a coloured product.

The coloured product absorbs light.

Question 5 continues on the next page

Figure 9 shows the percentage of light passing through glucose solutions of different concentration to which the test reagent has been added.

Figure 9

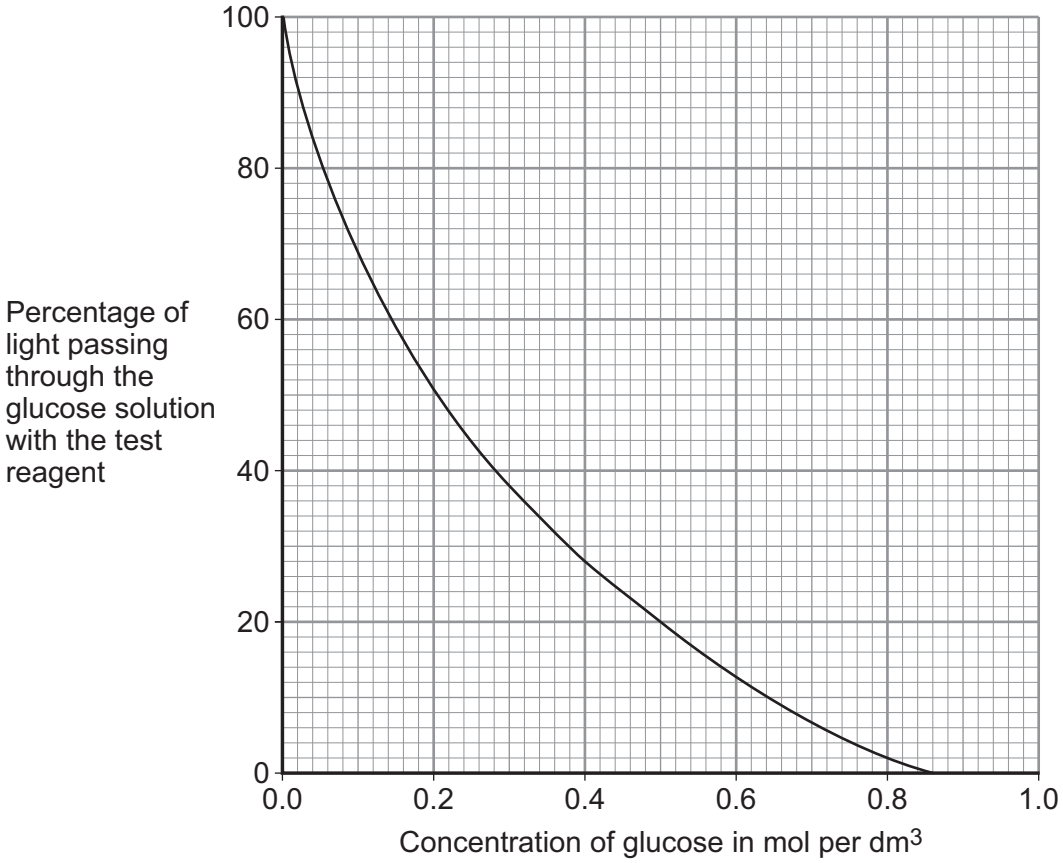


Table 2 shows the students' results.

Table 2

Time in minutes	Percentage (%) of light passing through solution with test reagent
0	100
10	38
20	28
30	22
40	20
50	20

5 (a) Use the information from **Table 2** and **Figure 9** to answer the following questions.

5 (a) (i) Between 0 minutes and 10 minutes, the concentration of glucose in the beaker increased by 0.3 mol per dm^3.

By how much did the concentration of glucose in the beaker increase between 10 minutes and 20 minutes?

[2 marks]

Increase in glucose concentration = _____ mol per dm^3

5 (a) (ii) The concentration of glucose in the beaker increased more rapidly between 0 minutes and 10 minutes than it did between 10 minutes and 20 minutes.

Explain why.

[2 marks]

5 (b) (i) Name the process in cells that uses glucose.

[1 mark]

5 (b) (ii) What other chemical substance is needed by cells for the process you named in part **(b)(i)**?

[1 mark]

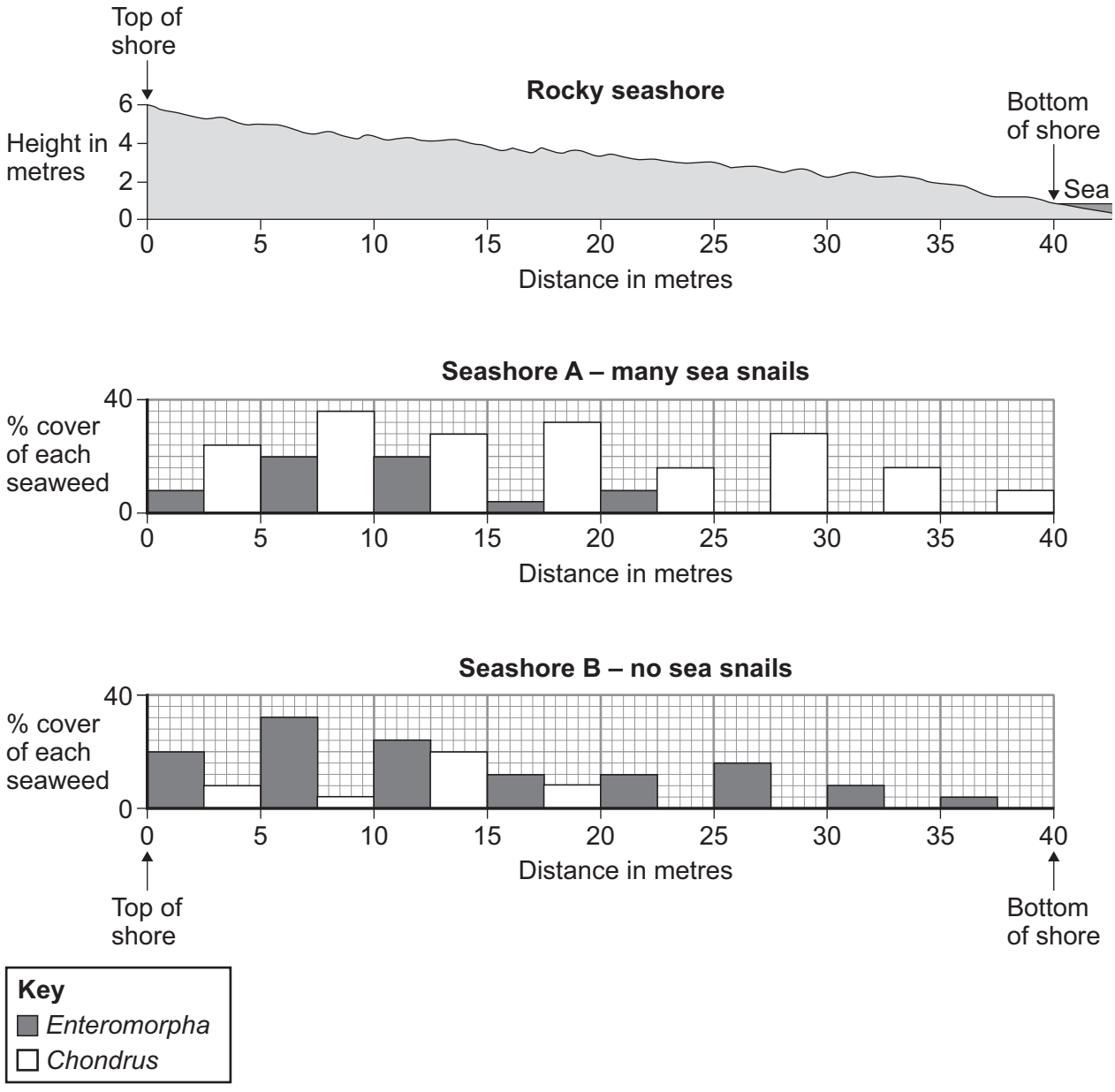
6

6 Students investigated the distribution of two species of seaweed, *Chondrus* and *Enteromorpha*, on two similar rocky seashores, **A** and **B**.

Seashore **A** had many sea snails on it.
Seashore **B** had no sea snails.

Figure 10 shows a rocky seashore and the students' results.

Figure 10



6 (a) Describe how the students could use a quadrat measuring 1 m × 1 m and a 40 metre long tape measure to collect the results for the seaweeds shown in **Figure 10**.

[4 marks]

6 (b) (i) Describe differences in the distribution of the two species of seaweed on seashores **A** and **B**.

[2 marks]

6 (b) (ii) Suggest an explanation for the differences you described in part **(b)(i)**.

[2 marks]

8

Turn over ▶

Chemistry Questions

7 Potassium chloride contains potassium ions (K^+) and chloride ions (Cl^-).

7 (a) (i) Describe, in terms of electrons, what happens when a potassium atom reacts with a chlorine atom to produce potassium chloride.

[3 marks]

7 (a) (ii) Which element has atoms with the same electronic structure as a potassium ion?

[1 mark]

7 (b) The equation for the reaction between potassium and chlorine is:

$$2K + Cl_2 \longrightarrow 2KCl$$

Calculate the mass of potassium chloride produced from 13.0 g of potassium in this reaction.

Relative atomic masses (A_r): Cl = 35.5, K = 39

[3 marks]

Mass of potassium chloride produced = _____ g

7

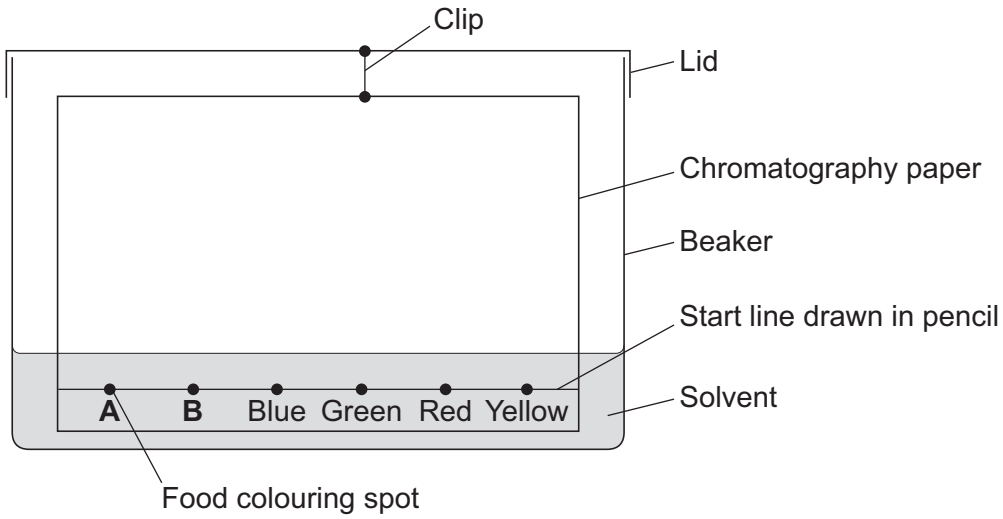
8 This question is about chromatography.

Students investigated two food colourings, **A** and **B**.

The students compared food colourings **A** and **B** with blue, green, red and yellow food colours.

8 (a) **Figure 11** shows how one student set up the apparatus.

Figure 11



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

Describe what would happen because of this error.

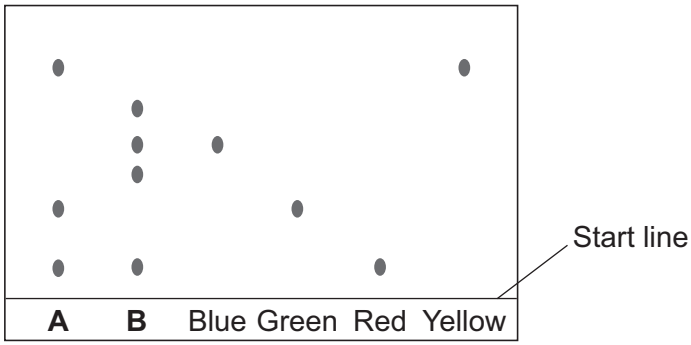
[2 marks]

Question 8 continues on the next page

8 (b) Another student set up the apparatus correctly.

Figure 12 shows this student's results.

Figure 12



What conclusions about the colours in food colourings **A** and **B** can you make from the results?

[2 marks]

4

9 Silver and graphite have different structures.

Silver and graphite are good conductors of electricity.

Describe how the bonding and structure of silver and of graphite allow both substances to conduct electricity.

[5 marks]

5

Turn over for the next question

10 This question is about uses of titanium and titanium compounds.

10 (a) Nitinol is a shape memory alloy made from nickel and titanium.

Nitinol is used in dental braces.

Figure 13 shows how a dental brace is fixed in a mouth.

Figure 13

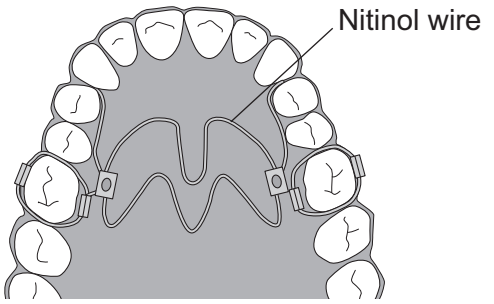
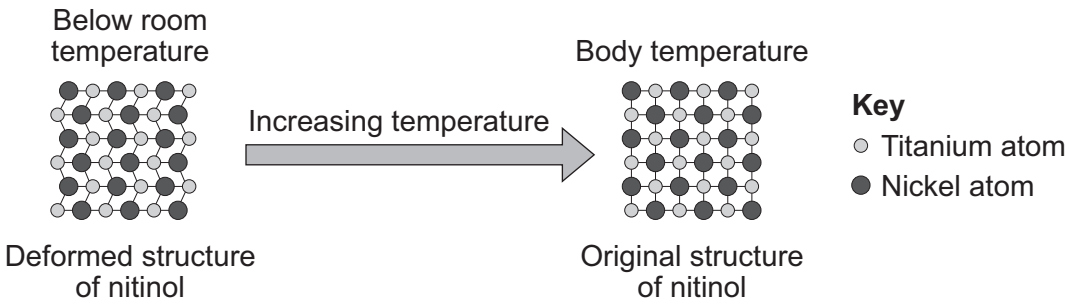


Figure 14 shows the arrangement of nickel and titanium atoms in nitinol at different temperatures.

Figure 14



Use **Figure 14** to help you answer this question.

Dentists cool the brace and bend the wire before they place the brace in the mouth.

Explain how using a dental brace made from nitinol wire helps to move teeth.

[2 marks]

10 (b) (i) Nanoparticles of titanium(IV) oxide are used in sun creams.

What size is a nanoparticle?

[1 mark]

10 (b) (ii) Explain why nano-sized particles of titanium(IV) oxide, instead of normal-sized particles, are used in sun creams.

[2 marks]

5

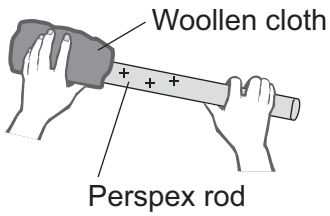
Turn over for the next question

Physics Questions

11 **Figure 15** shows a Perspex rod being rubbed with a woollen cloth.

The Perspex rod becomes positively charged.

Figure 15



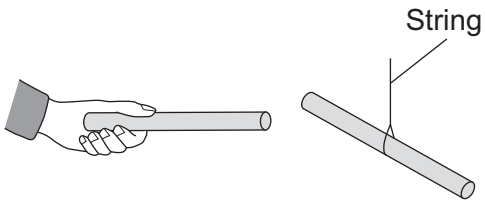
11 (a) Explain why the rod becomes positively charged.

[2 marks]

11 (b) **Figure 16** shows the charged Perspex rod suspended from a string.

Another charged Perspex rod is moved close to one end of the suspended Perspex rod.

Figure 16



11 (b) (i) Why does the rod suspended from the string move away?

[1 mark]

11 (b) (ii) The string is replaced by a copper wire and the investigation is repeated.

This time the suspended rod does **not** move.

Explain why.

[2 marks]

_____

_____

_____

_____

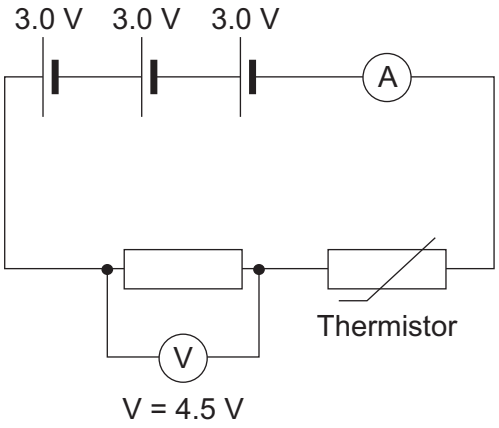
5

Turn over for the next question

12 A gardener wants to monitor the temperature in his greenhouse.

Figure 17 shows part of the temperature sensor circuit he plans to use.

Figure 17



The circuit contains three 3.0 V cells connected in series.

When the circuit is connected, the resistance of the resistor and the thermistor are the same.

The value of the potential difference on the voltmeter is 4.5 V.

12 (a) Explain why the reading on the voltmeter is 4.5 V.

[3 marks]

12 (b) As the temperature in the greenhouse increases, the current in the circuit increases.

Explain why.

[2 marks]

12 (c) The gardener wants to add a light-emitting diode (LED) to the circuit to show that the circuit is working.

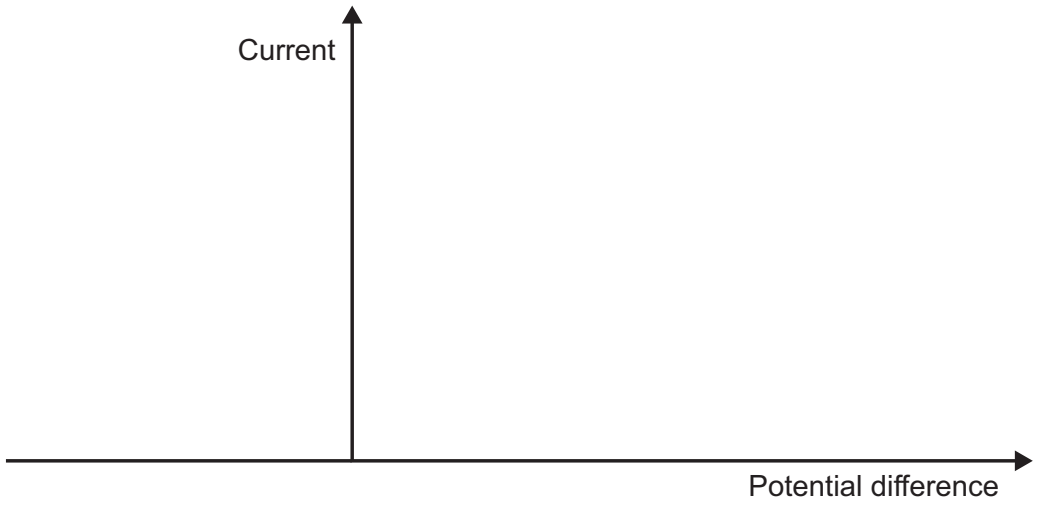
12 (c) (i) Draw the correct circuit symbol onto **Figure 17** to show how the LED should be connected in the circuit.

[2 marks]

12 (c) (ii) On **Figure 18** sketch a graph to show how the current varies with potential difference for an LED.

[1 mark]

Figure 18



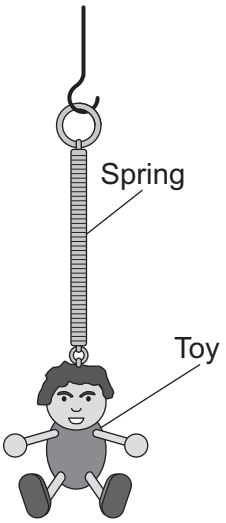
8

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

13 **Figure 19** shows a toy attached to a spring.

Figure 19



13 (a) (i) The toy exerts a force on the spring causing the spring to extend.

Describe how the student can determine the extension of the spring.

[1 mark]

_____

_____

13 (a) (ii) The force exerted by the toy on the spring is 1.5 N. This causes an extension of the spring of 0.12 m.

Calculate the spring constant of the spring.

Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

_____

_____

Spring constant = _____ Unit _____

Question 13 continues on the next page

13 (b) A student investigated how the force used to pull the toy downwards affects the total extension of the spring.

Figure 20 shows the student's graph.

Figure 20

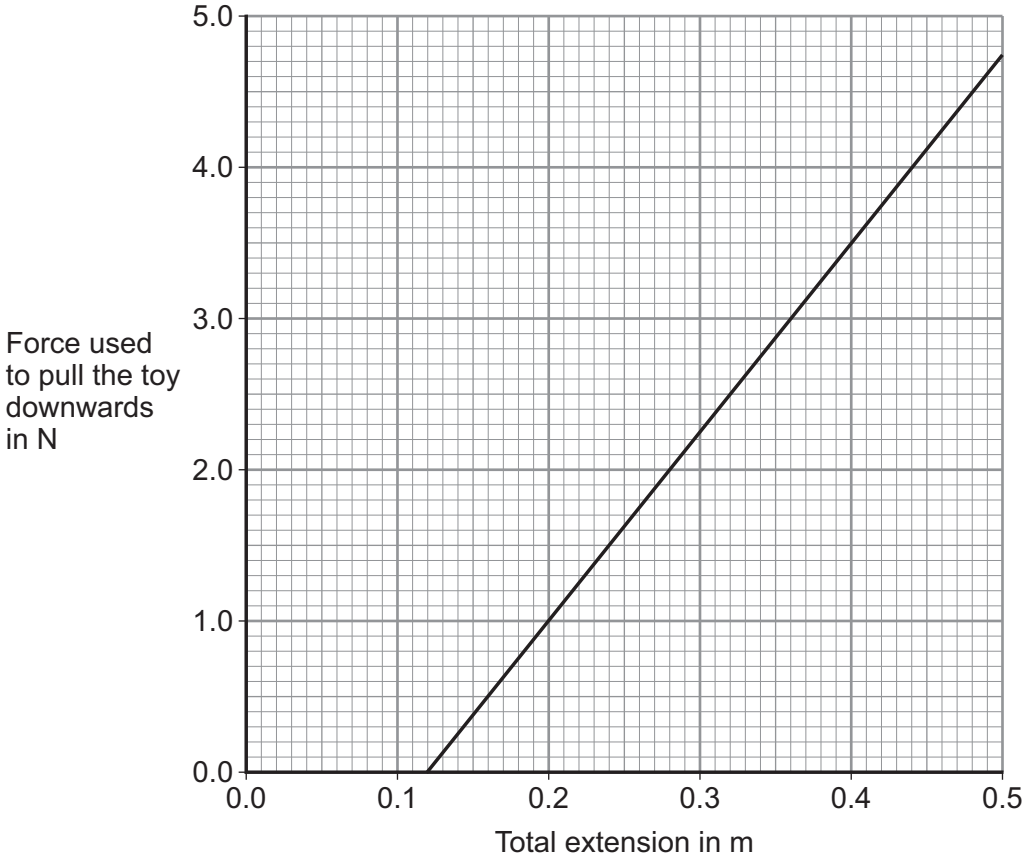


Figure 20 shows that as the force increases, the total extension of the spring increases.

Explain the relationship shown in **Figure 20**.

[2 marks]

13 (c) The student changes the spring the toy is attached to. The new spring has a greater spring constant.

The student repeats the investigation.

Describe the effect the new spring will have on the student's graph.

Give the reason for your answer.

[2 marks]

_____

_____

_____

_____

8

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED