| Centre Number | | | | | | Candidate Number | | | | |
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| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

| For Examiner's Use | |
|---|---|
| Examiner's Initials | |
| Question | Mark |
| 1 | |
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| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |
| TOTAL | |

AQA

General Certificate of Secondary Education
Higher Tier
June 2014

# Additional Science
**Unit 5**

**AS1HP**

**H**

Tuesday 13 May 2014 9.00 am to 10.30 am

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

**Time allowed**
- 1 hour 30 minutes

A

**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 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.

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

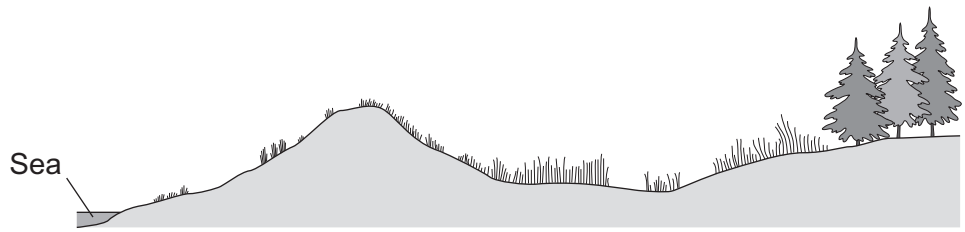
## Biology Questions

**1** A group of students investigated the distribution of plants living in a sand dune habitat next to a sea shore.

The students also collected information about some physical factors in the habitat.

**Figure 1** shows a diagram of the sand dunes and the students' results.
The bars show where each plant species was found.

**Figure 1**




**Plant species**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sea rocket | | | | | | | | | | |
| Marram grass | | | | | | | | | | |
| Red fescue | | | | | | | | | | |
| Rush | | | | | | | | | | |
| Creeping willow | | | | | | | | | | |
| Buttercup | | | | | | | | | | |
| Orchid | | | | | | | | | | |
| Pine tree | | | | | | | | | | |

**Physical factors**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| % light intensity at ground level | 98 | 92 | 98 | 88 | 85 | 82 | 93 | 80 | 52 | 27 |
| % of water in soil | 10 | 8 | 2 | 5 | 10 | 45 | 56 | 23 | 26 | 22 |

**1 (a)** Describe how the students could have collected the data for the plant species.

**[4 marks]**

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**1 (b)** Use **Figure 1** to answer these questions.

**1 (b) (i)** Which plant species has no competitors in any part of the habitat?

**[1 mark]**

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**1 (b) (ii)** Which plant species lives in the driest conditions in the habitat?

**[1 mark]**

.....

**1 (b) (iii)** The further away from the sea, the older the dune habitat becomes.

Different numbers of species of plants grow in different parts of the dune habitat.

Describe how the age of the dune habitat affects the **number** of different species sampled.

**[2 marks]**

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**1 (c)** Only a few other plants can grow in the area where the pine trees grow.

Explain why.

**[2 marks]**

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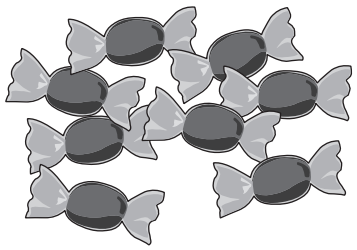
## Chemistry Questions

**2** Ammonium chloride is used to flavour sweets.



**2 (a)** Ammonium chloride is the product of the reaction between ammonia and hydrogen chloride.

The reaction is reversible.

Write a word equation for the reaction. Include the symbol for a reversible reaction.

**[2 marks]**

.....

**2 (b) (i)** A food scientist reacted 34 g of ammonia with 73 g of hydrogen chloride.

Calculate the maximum mass of ammonium chloride that the food scientist could produce.

**[1 mark]**

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Maximum mass ..... g

**2 (b) (ii)** At the end of the reaction, the food scientist obtained a lower yield of ammonium chloride than expected.

Give **one** reason why.

**[1 mark]**

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**2 (b) (iii)** The mass of ammonium chloride the food scientist obtained was 96 g.

Calculate the percentage yield for this reaction.

**[2 marks]**

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Percentage yield ..... %

6

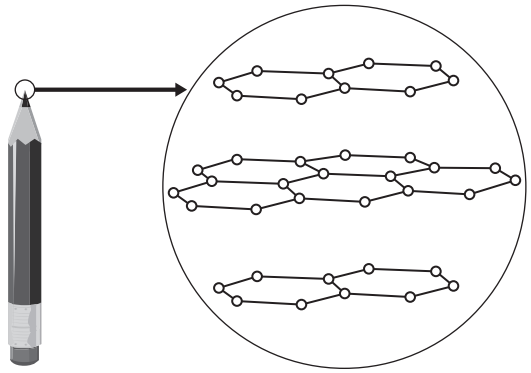
**Turn over for the next question**

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

Graphite is used in pencils and as a lubricant to reduce friction in machines.

**Figure 2** shows the structure of graphite.

**Figure 2**



- Describe the structure of graphite.
- State the properties of graphite.
- Explain why the structure of graphite gives graphite these properties.

**[6 marks]**

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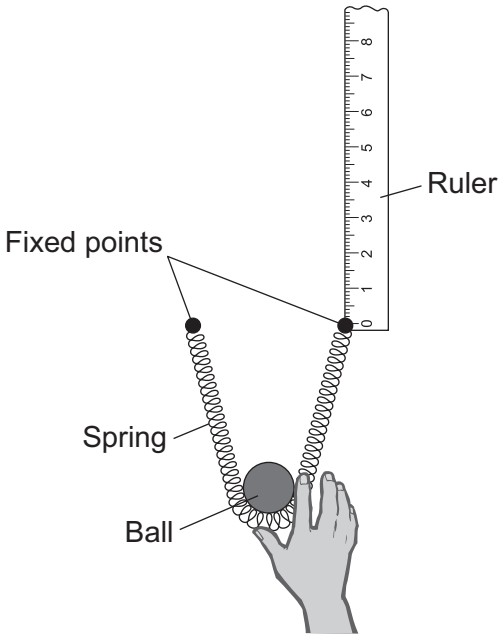
## Physics Questions

**4** Some students are investigating a catapult.

The catapult has a spring attached to two fixed points, as shown in **Figure 3**.

The spring is pulled down and stretched. It is then released so that the catapult fires a ball into the air.

**Figure 3**




**4 (a)** Suggest **one** safety precaution the students should take when using the catapult.

**[1 mark]**

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**4 (b)** What type of energy is stored in the stretched spring?

**[1 mark]**

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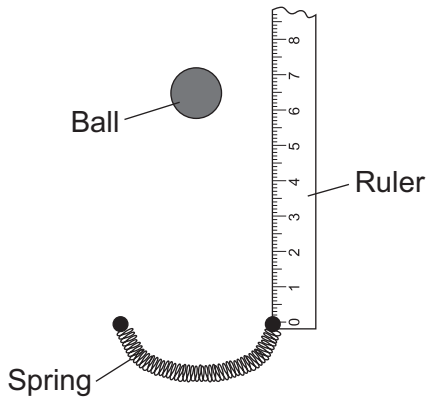
**Turn over ▶**

**4 (c)** The students stretch the spring by different amounts and measure the height the ball reaches each time. **Figure 4** shows the ball after it has been fired into the air.

**Figure 4**




**4 (c) (i)** Suggest **two** sources of error when measuring the height the ball reaches.

**[2 marks]**

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2 .....

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**4 (c) (ii)** The ball is fired into the air and reaches a height of 1.8 metres.

The mass of the ball is 20 g.

The gravitational field strength is 10 N/kg.

Calculate the gravitational potential energy gained by the ball and give the unit.

Use the correct equation from the Physics Equations Sheet.

**[3 marks]**

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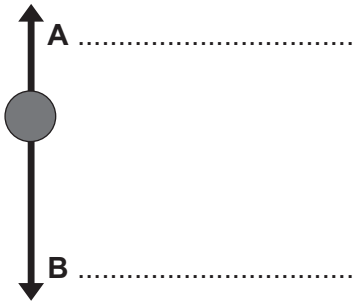
Energy = ..... Unit .....

**4 (d)** After reaching a maximum height, the ball accelerates towards the ground.

**Figure 5** shows the two forces acting on the ball as it accelerates.

**Figure 5**




**4 (d) (i)** Label the forces **A** and **B**, on **Figure 5**.

**[2 marks]**

**4 (d) (ii)** Draw a ring around the correct answer to complete the sentence.

**[1 mark]**

As the ball accelerates, its gravitational potential energy decreases

and its kinetic energy | increases. | stays the same. | decreases. |

10

**Turn over for the next question**

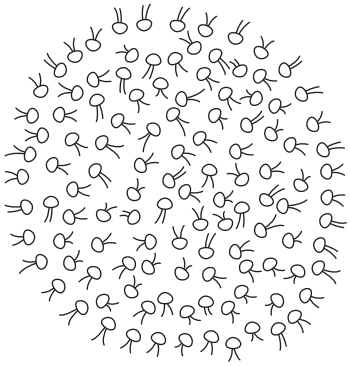
## Biology Questions

**5** *Volvox* is a small organism found in ponds.
Each *Volvox* organism is a ball of as many as 50 000 cells.

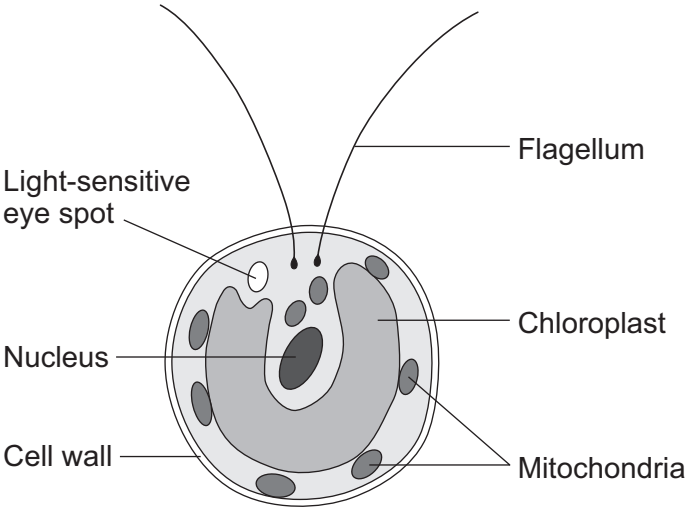
**Figure 6** shows a *Volvox* organism and one *Volvox* cell.

**Figure 6**

***Volvox* organism**



**One *Volvox* cell**




**5 (a)** *Volvox* was discovered in 1700.
In 1700, some scientists thought *Volvox* was a plant but other scientists thought *Volvox* was an animal.

Use evidence from **Figure 6** to answer these questions.

**5 (a) (i)** Suggest **two** reasons why some scientists in 1700 thought *Volvox* was a plant.

**[2 marks]**

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**5 (a) (ii)** Suggest **one** reason why some scientists in 1700 thought *Volvox* was an animal.

**[1 mark]**

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**5 (a) (iii)** *Volvox* is made of many cells.

Why is the *Volvox* organism **not** described as multicellular?

**[1 mark]**

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**5 (b)** During the day, *Volvox* moves up and down in the water.

Explain how *Volvox* can move.

**[2 marks]**

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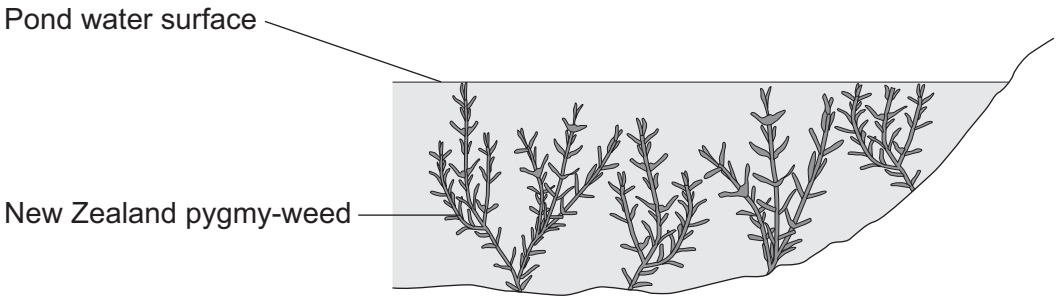
**Turn over for the next question**

**6** New Zealand pygmy-weed is a fast growing plant which lives in ponds.




Pygmy-weed has spread to ponds in the countryside and is causing the death of native pond plants.

Native pond plants only grow in spring and summer and have no leaves at other times of the year. Pygmy-weed grows all year round.

Wild animals feed on pygmy-weed and on native plants.

Scientists are investigating ways of getting rid of pygmy-weed in ponds.
In one investigation a non-poisonous black dye is added to pond water in early autumn. This makes the water black.
The dye breaks down after about 4 months.

Evaluate the use of the black dye to kill the pygmy-weed.

In your evaluation:

- explain why using the black dye in autumn kills pygmy-weed but does **not** kill native pond plants
- suggest any problems to the environment that may result from using the black dye
- decide whether or not the dye should be used and justify your decision.

**[5 marks]**

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**Turn over for the next question**

**7** Soluble food is absorbed in the digestive system.

**7 (a)** The digestive system contains muscular tissue and glandular tissue.

**7 (a) (i)** Describe why muscular tissue is important in the digestive system.

**[2 marks]**

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**7 (a) (ii)** Describe why glandular tissue is important in the digestive system.

**[2 marks]**

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**7 (b)** A person eats a meal. The food mixture changes as it passes through the digestive system.

**Table 1** shows the percentage of water in the food mixture as the food mixture moves through different parts of the digestive system.

**Table 1**

| Part of the digestive system | Percentage of water in the food mixture |
|---|---|
| (Before food is eaten) | 56 |
| Mouth | 62 |
| Stomach | 66 |
| Beginning of small intestine | 70 |
| End of small intestine | 85 |
| Large intestine | 50 |

**7 (b) (i)** Suggest reasons for the increase in the percentage of water in the food mixture as it moves through the mouth, stomach and the beginning of the small intestine.

**[3 marks]**

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**7 (b) (ii)** Suggest **one** reason for the increase in the percentage of water in the food mixture as it moves along the small intestine.

**[1 mark]**

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**7 (b) (iii)** Suggest **one** reason for the decrease in the percentage of water when the food mixture is in the large intestine.

**[1 mark]**

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9

**Turn over for the next question**

## Chemistry Questions

**8 (a)** Chlorine contains two different isotopes, $^{35}_{17}Cl$ and $^{37}_{17}Cl$

What is meant by isotopes?

Refer to the number of particles in the chlorine atoms to help you answer the question.

**[2 marks]**

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**8 (b) (i)** Use the Chemistry Data Sheet to find the relative atomic mass of chlorine.

**[1 mark]**

Complete the sentence.

The relative atomic mass of chlorine is ..... .

**8 (b) (ii)** Why is the relative atomic mass of chlorine **not** the same as the mass number of either isotope?

**[1 mark]**

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4

**Turn over for the next question**

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**ANSWER IN THE SPACES PROVIDED**

**9** There are different types of poly(ethene).

Different types of poly(ethene) are used to make different products.

Supermarket plastic bag


Garden chair

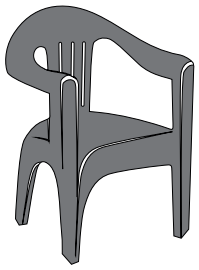

**Table 2** gives information about two types of poly(ethene), LD poly(ethene) and HD poly(ethene).

**Table 2**

| **Property** | **LD poly(ethene)** | **HD poly(ethene)** |
|---|---|---|
| Density in g/cm$^3$ | 0.92 | 0.95 |
| Flexibility | Very flexible | Rigid |
| Relative strength | 1 | 2.7 |
| Melting point in °C | 98 | 120 |

**9 (a)** Use the information given in **Table 2** to explain why LD poly(ethene) is used to make plastic bags, but HD poly(ethene) is used to make garden chairs.

**[2 marks]**

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**9 (b) (i)** How does the information given in **Table 2** show that poly(ethene) is a thermosoftening polymer, **not** a thermosetting polymer?

**[1 mark]**

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**9 (b) (ii)** Describe in terms of intermolecular forces why poly(ethene) is a thermosoftening polymer.

**[2 marks]**

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**9 (c)** Give **two** reasons why LD poly(ethene) and HD poly(ethene) have different properties.

**[2 marks]**

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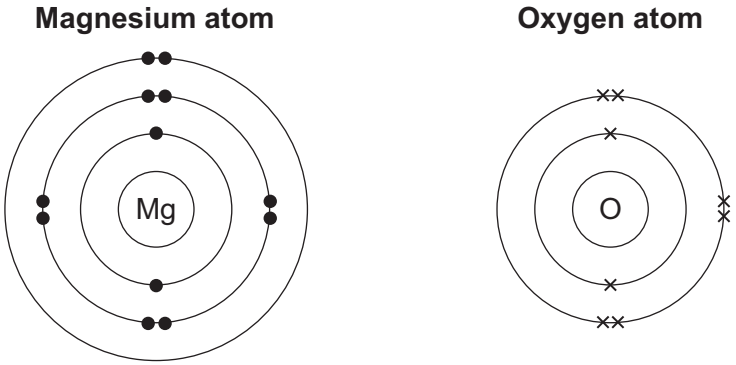
**Turn over for the next question**

**10** Magnesium is used in fireworks.

Magnesium reacts with oxygen to produce magnesium oxide.

**10 (a)** **Figure 7** shows the electronic structure of a magnesium atom and of an oxygen atom.

**Figure 7**



Describe, as fully as you can, what happens to the atoms when magnesium reacts with oxygen to produce magnesium oxide.

**[4 marks]**

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**10 (b)** The melting point of magnesium oxide is 2852 °C.

Explain why magnesium oxide has a high melting point.

**[3 marks]**

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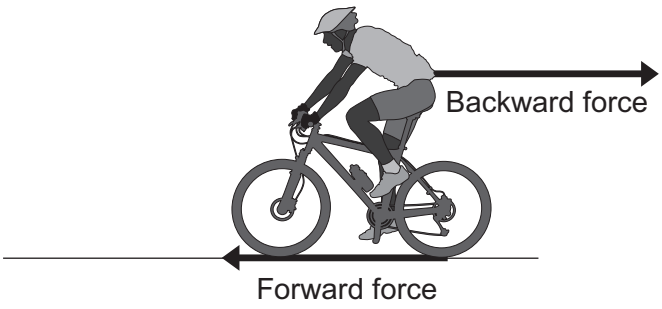
**Turn over for the next question**

## Physics Questions

**11** The body position of a cyclist affects his velocity.

**11 (a)** **Figure 8** shows the forces acting on a cyclist at a constant velocity.

**Figure 8**




**11 (a) (i)** What is the main cause of the backward force?

**[1 mark]**

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**11 (a) (ii)** Complete the sentence.

**[1 mark]**

At a constant velocity the resultant force on the cyclist is ..... .

**11 (b)** The cyclist changes to the body position shown in **Figure 9**. He pedals with the same force as in **Figure 8**.

**Figure 9**

Describe and explain how the motion of the cyclist changes as his body position changes.

**[3 marks]**

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**11 (c)** The cyclist accelerates at a constant rate of 2.0 m/s$^2$ from 3.0 m/s to 18.0 m/s.

Calculate the time taken for the acceleration.

Use the correct equation from the Physics Equations Sheet.

**[2 marks]**

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Time = ..... seconds

**11 (d)** Suggest **two** factors, other than body position, that would affect the velocity of the cyclist.

**[2 marks]**

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**Turn over for the next question**

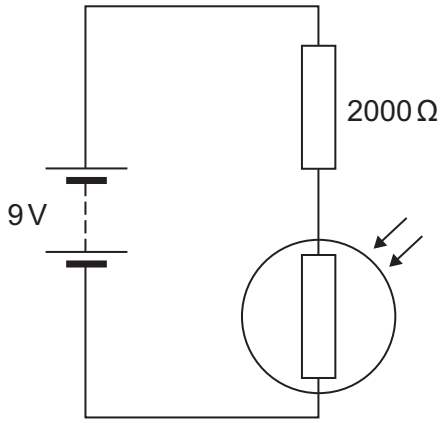
**12** A light meter is used to check the light levels during a cricket match.

**Figure 10** shows a cricket umpire using a light meter.

**Figure 10**

**12 (a)** Some light meters use a light-dependent resistor (LDR).
**Figure 11** shows a circuit in a light meter.

**Figure 11**




**12 (a) (i)** What **two** measurements are needed to determine the resistance of the LDR?
**[2 marks]**

Measurement 1 .....

Measurement 2 .....

**12 (a) (ii)** What will happen to the current in the circuit if the resistance of the LDR increases?
**[1 mark]**

.....

**12 (b) (i)** **Table 3** shows the resistance of the LDR at different light levels.

**Table 3**

| Light level in lux | Resistance in ohms |
|---|---|
| 0.1 | 250 000 |
| 1 | 50 000 |
| 10 | 10 000 |
| 100 | 2 000 |
| 1000 | 400 |

What conclusion can you make from this data?

**[2 marks]**

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**12 (b) (ii)** A game of cricket may be stopped if the light level falls below 100 lux.

What is the potential difference across the LDR when the light level is 100 lux?

Use information from **Figure 11** and **Table 3**.

**[1 mark]**

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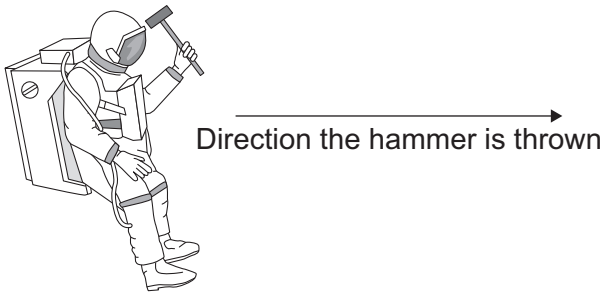
Potential difference = ..... V

6

**13** **Figure 12** shows an astronaut floating in space.

The astronaut is stationary. She throws a hammer in the direction shown.

**Figure 12**




**13 (a)** The total momentum of the astronaut and the hammer are conserved.

What is meant by the conservation of momentum?

**[2 marks]**

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**13 (b)** The astronaut moves after throwing the hammer. The momentum of the hammer is 5.0 kgm/s. The mass of the astronaut is 80 kg.

Calculate the velocity of the astronaut.

Use the correct equation from the Physics Equations Sheet.

**[2 marks]**

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Velocity = ..... m/s

**13 (c)** The momentum of the astronaut has a negative value. Why?

**[1 mark]**

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**END OF QUESTIONS**

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**ANSWER IN THE SPACES PROVIDED**

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