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

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|---------------------|------|
| For Examiner's Use  |      |
| Examiner's Initials |      |
| Question            | Mark |
| 1                   |      |
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| 14                  |      |
| TOTAL               |      |



General Certificate of Secondary Education  
Higher Tier  
January 2013

# Additional Science 1

# AS1HP

Unit 5

# H

Tuesday 22 January 2013 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

**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 2(a) 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.



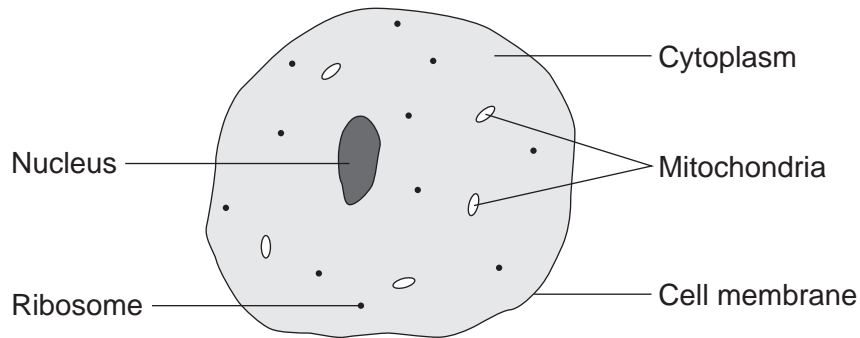
J A N 1 3 A S 1 H P O 1

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

### Biology Questions

- 1 **Diagram 1** shows a typical animal cell.

**Diagram 1**



In multicellular organisms, cells are specialised to carry out particular functions.

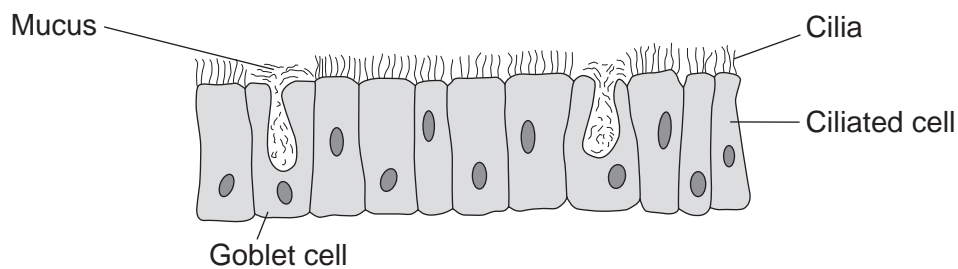
There are two types of cell lining the windpipe.

**Ciliated cells** have cilia on their surface. The cilia move mucus out of the windpipe.

**Goblet cells** produce mucus. Mucus contains a sticky protein that traps microorganisms and dust particles.

**Diagram 2** shows these two types of cell.

**Diagram 2**



Ciliated cells and goblet cells are both specialised to carry out their functions.



**1 (a)** Suggest **one** cell part that you would expect to find a lot of in the cytoplasm of ciliated cells.

Explain your answer.

Cell part .....  
(1 mark)

Explanation .....  
.....  
.....  
.....  
(2 marks)

**1 (b)** Suggest **one** cell part that you would expect to find a lot of in the cytoplasm of goblet cells.

Explain your answer.

Cell part .....  
(1 mark)

Explanation .....  
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(2 marks)

6

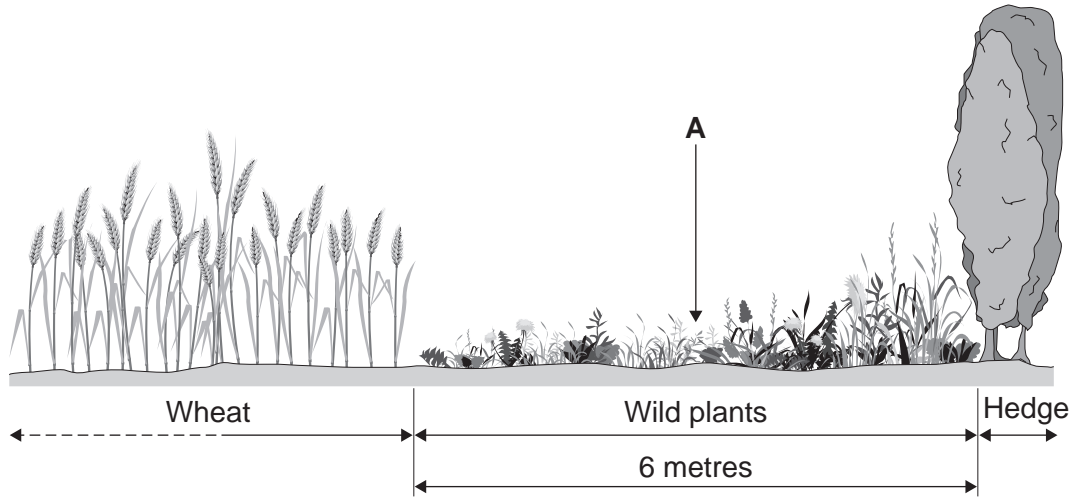
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2 Farmers grow crops of wheat.

Wild plants grow, in a border 6 metres wide, between the edge of the crop and the hedge around a field.



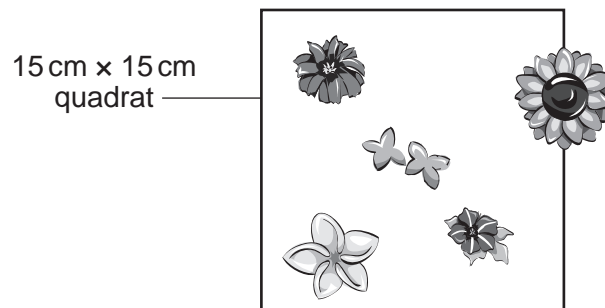
2 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

A teacher asked a student to investigate the distribution of the different species of wild plants between the edge of the wheat crop and the hedge.

The student wrote a simple plan:

- use a 15 cm x 15 cm quadrat
- put the quadrat at **A**
- count the plants in the quadrat.

The student drew a diagram of the plants in the quadrat.



The student said,  
'There are 6 plants between the edge of the wheat crop and the hedge'.





**2 (b)** Small mammals, such as mice, sometimes shelter among the wheat plants.  
Mice feed on seeds.

The student improved the method.

The student found that the further away from the crop, the **more** wild plants there were.

Suggest why.

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(2 marks)

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### Chemistry Questions

3 The age of an object can be found using carbon dating.

Carbon dating was used to estimate the age of an Egyptian boat thousands of years old.



Most carbon occurs as the isotope carbon-12 ( $^{12}_6\text{C}$ ).

Another isotope, carbon-14 ( $^{14}_6\text{C}$ ), is used in carbon dating.

What are isotopes?

In your answer you should refer to the numbers of protons, electrons and neutrons in the isotopes of carbon.

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(3 marks)

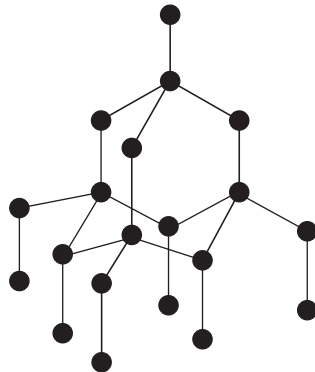
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4 Diamond-tipped drills can be used to cut through rock.

4 (a) The diagram shows how the atoms are joined in part of a diamond.



Describe the structure and bonding in diamond.

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(4 marks)

4 (b) Diamonds are used in drills even though they are expensive.

Explain why.

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(2 marks)

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**Physics Questions**

- 5 The picture shows a very fast car.  
The car was built to break the world land speed record.



- 5 (a) (i) The car accelerates from 0 m/s to a velocity of 470 m/s.  
The car reaches this velocity in 40 seconds.

Calculate the acceleration of the car. Give the unit.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Acceleration = .....  
(3 marks)

**Question 5 continues on the next page**

**Turn over ►**



5 (a) (ii) During the 40 seconds it takes to accelerate to 470 m/s the car will have travelled about 10 km.

Only some places are suitable to attempt to break the world land speed record.

Suggest **three** factors that need to be considered when choosing an area in which to attempt to break the world land speed record.

Factor 1 .....

Factor 2 .....

Factor 3 .....

(3 marks)

5 (b) The table shows some information about a world land speed record attempted in 1997.

| Car name   | Year | Maximum engine force in newtons | Top speed in m/s |
|------------|------|---------------------------------|------------------|
| Thrust SSC | 1997 | 223 000                         | 342              |

The top speed of a car occurs when terminal velocity is reached.

Explain why a car reaches terminal velocity.

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(3 marks)



**5 (c)** When trying to break the world land speed record there will be 55 practice runs.

During each practice run the car will give out 300 times more harmful gases than a normal family car over the same distance.

In terms of the environment do you think the world land speed record attempt is justified?

Draw a ring around your answer.      **Yes**    /    **No**

Give **one** reason for your answer.

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(1 mark)

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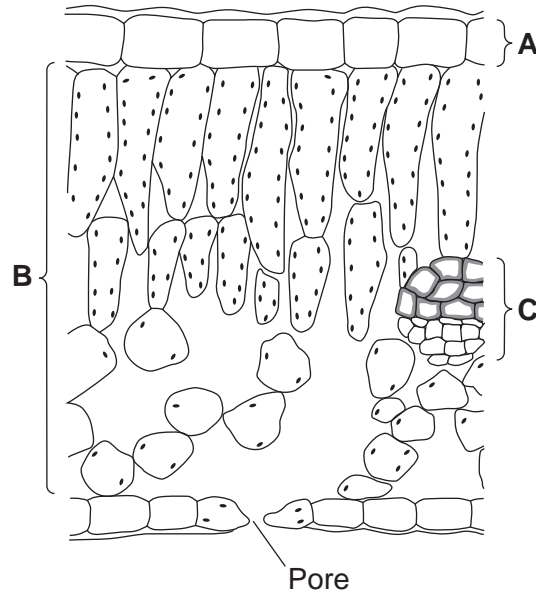
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### Biology Questions

6 A student uses a microscope to look at a section through part of a leaf.

The diagram shows the student's drawing.



6 (a) (i) Name tissues **A** and **B**.

**A** .....

**B** .....

(2 marks)

6 (a) (ii) The part of the leaf labelled **C** contains two different tissues that transport substances to and from the leaf.

Name the **two** tissues found in part **C**.

1 .....

2 .....

(2 marks)



**6 (b)** The lower leaf surface has thousands of pores.

The pores in the leaf surface allow the diffusion of gases between tissue **B** and the atmosphere.

When the leaf is photosynthesising quickly the diffusion of gases through the pores is much faster than when the leaf is photosynthesising slowly.

Explain why.

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(2 marks)

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**Turn over for the next question**

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7 This question is about photosynthesis.

7 (a) Complete the word equation for photosynthesis.



(2 marks)

7 (b) The product of photosynthesis you gave in part (a) can be used by the plant to make cellulose or proteins.

7 (b) (i) What is cellulose used for in the plant?

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(1 mark)

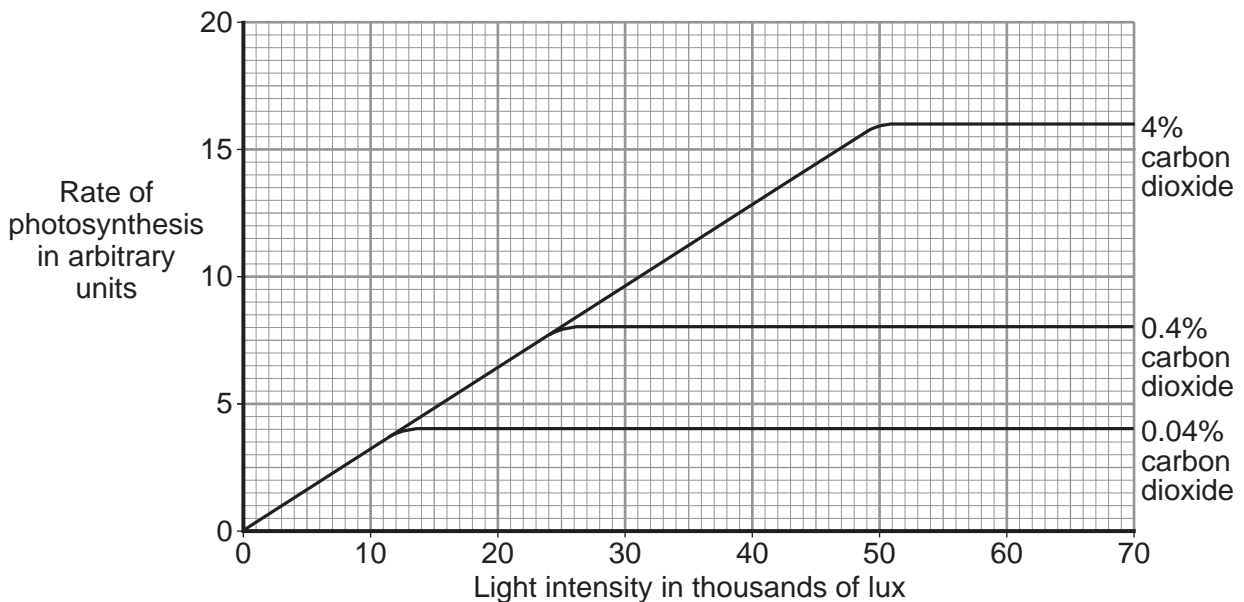
7 (b) (ii) In addition to the product of photosynthesis you gave in part (a), which other substance is needed to make proteins?

.....

(1 mark)

7 (c) Scientists investigated the effect of light intensity and carbon dioxide concentration on the rate of photosynthesis in tomato plants.

The graph shows the results.



Describe the effect of increasing carbon dioxide concentration on the rate of photosynthesis at a light intensity of 60 000 lux.

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(2 marks)

**7 (d)** The mean daily light intensity is 30 000 lux.

There is approximately 0.04% carbon dioxide in the atmosphere.

A gardener sells the tomatoes he grows in his greenhouse.

The gardener wants to make the tomato plants grow faster.

The gardener looks at the scientists' graph and decides to change the conditions in his greenhouse.

The gardener plans to:

- increase the light intensity to 60 000 lux
- and**
- increase the carbon dioxide concentration to 4%.

Evaluate the gardener's plans.

In your answer you should:

- give advantages and disadvantages to the gardener of making these changes
- give a justified conclusion.

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### Chemistry Questions

8 Bronze was used to make cannon barrels.



Bronze is an alloy of copper and tin.

The cannon barrels were made of bronze rather than copper.

Explain why.

In your answer you should describe:

- a property of bronze that makes it a more suitable material than copper to use in making cannon barrels
- how the arrangement of atoms in bronze and in copper affects the property you have given.

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(5 marks)

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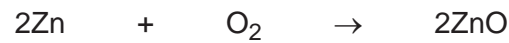


- 9 A cricketer uses zinc oxide sunblock on his face.



- 9 (a) Zinc oxide can be made by reacting zinc with oxygen.

The balanced symbol equation for the reaction is:



- 9 (a) (i) A tube of sunblock contained 40.5g of zinc oxide.

Calculate the mass of zinc that would be needed to make 40.5g of zinc oxide.

Relative atomic masses ( $A_r$ ): O=16, Zn=65

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Mass of zinc = ..... g  
(3 marks)



**9 (a) (ii)** If the mass of zinc you calculated in part **(a)(i)** is used, the mass of zinc oxide obtained may be less than 40.5g.

Suggest **one** reason why.

.....  
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(1 mark)

**9 (b) (i)** Many sun creams contain nanoparticles of zinc oxide.

What are nanoparticles?

.....

(1 mark)

**9 (b) (ii)** Nanoparticles are more useful than normal sized particles in sun creams.

Explain why.

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(2 marks)

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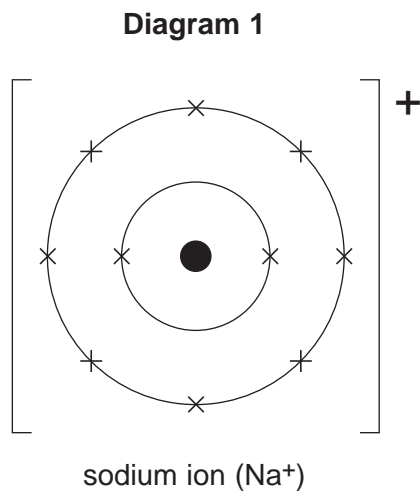
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**10 (a)** Sodium fluoride is an ionic compound.

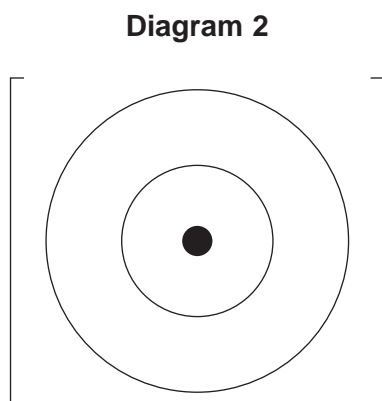
Sodium fluoride contains sodium ions and fluoride ions.

**Diagram 1** shows the electronic structure and charge of a sodium ion.



A fluorine atom has 9 electrons.

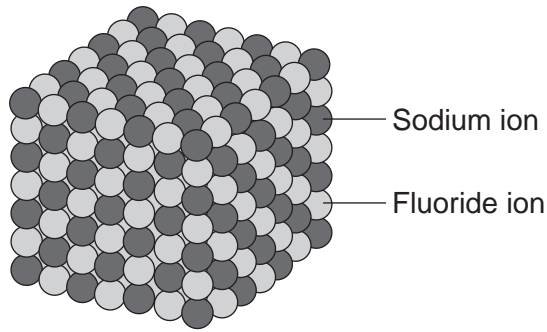
Complete **Diagram 2** to show the electronic structure and charge of a fluoride ion.



(2 marks)



**10 (b)** The structure of solid sodium fluoride is shown below.



The melting point of sodium fluoride is 993 °C.

Sodium fluoride has a high melting point.

Explain why.

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(3 marks)

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**Turn over ►**



11 Rhubarb powder was used as a drug in the 1880s.



A bottle labelled 'Rhubarb Powder' was found in a museum.

Scientists were asked to make sure the substance was rhubarb powder.

The scientists used an instrumental method known as GC-MS to identify compounds in the rhubarb powder.

11 (a) Give **two** reasons why scientists use instrumental methods and **not** chemical tests to analyse substances.

1 .....

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2 .....

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(2 marks)

11 (b) Rhubarb contains oxalic acid and malic acid.

Gas chromatography can be used to separate these acids.

Explain why.

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(2 marks)

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### Physics Questions

12 The world's tallest building is in Dubai.



12 (a) (i) There is a lift inside the building. The lift travels at a mean velocity of 10 m/s.

When the lift is carrying a full load of passengers, the mass of the lift and passengers is 1600 kg.

Calculate the mean kinetic energy of the lift. Give the unit.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Kinetic energy = .....

(3 marks)



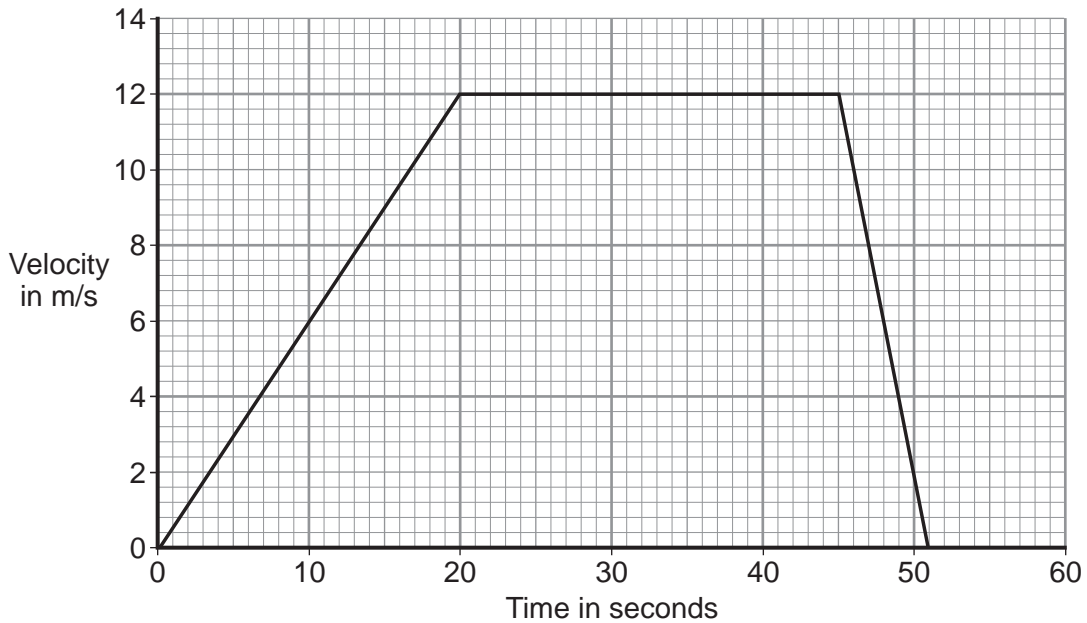


12 (a) (ii) Give **one** reason why your answer to part (a)(i) is the *mean* kinetic energy.

.....  
 .....

(1 mark)

12 (b) The graph below shows how the velocity of another lift in the building varies with time between the ground floor and an observation deck.



Use the graph to calculate the total distance travelled by the lift.

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 .....

Total distance travelled = ..... m  
 (2 marks)

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Turn over for the next question

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13 (a) (i) What is an electric current?

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(1 mark)

13 (a) (ii) A lightning strike has a current of 30 000 A and lasts for  $5.0 \times 10^{-4}$  s.



Calculate the charge transferred by the lightning strike. Give the unit.

Use the correct equation from the Physics Equations Sheet.

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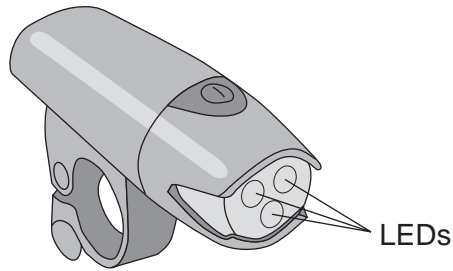
Charge = .....

(3 marks)

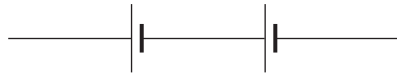
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- 14** A bicycle light uses three light-emitting diodes (LEDs).



- 14 (a)** The bicycle light has three LEDs connected in parallel.  
Two 1.5 volt cells are used in series as an electrical power supply.  
One switch is used to turn on all three LEDs at the same time.  
Complete the circuit diagram to show how all the components are connected.  
Use the correct circuit symbols.



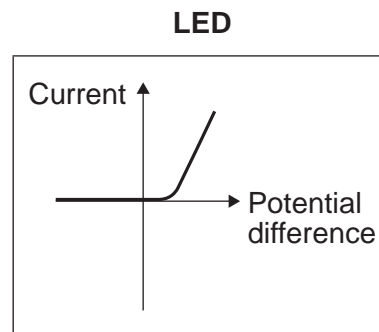
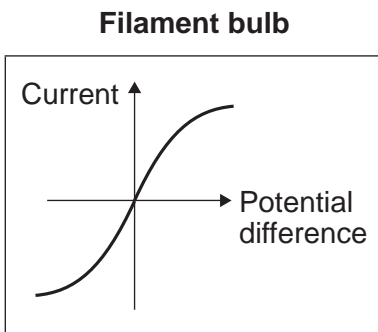
(3 marks)

Question 14 continues on the next page

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14 (b) The diagrams show the electrical characteristics for a filament bulb and an LED.



14 (b) (i) Use the graphs to compare the electrical characteristics of a filament bulb and an LED.

For each difference you should refer to the characteristics of both the filament bulb **and** the LED.

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(3 marks)



14 (b) (ii) Many car makers are using a set of LEDs in car lights instead of using a filament bulb.



The table shows information on the characteristics of a set of LEDs and a filament bulb.

|                      | Set of LEDs  | Filament bulb |
|----------------------|--------------|---------------|
| Cost                 | £10          | £0.50         |
| Life span            | 50 000 hours | 1 000 hours   |
| Power consumption    | 5 W          | 21 W          |
| Power output (light) | 3 W          | 3 W           |

Car makers are increasing the use of sets of LEDs for cars instead of using filament bulbs.

Use the information in the table to give advantages and disadvantages of the change to using LEDs.

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(4 marks)

END OF QUESTIONS

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