



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
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**PHYSICAL SCIENCE**

**0652/06**

Paper 6 Alternative to Practical

**October/November 2007**

**1 hour**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs, tables or rough working.

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

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

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1	
2	
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6	
<b>Total</b>	

This document consists of **16** printed pages.



- 1 Some students are making a water storage system. Their design is shown in Fig. 1.1. Energy is absorbed by the solar panels and is stored in a battery. The power of the battery turns an electric motor linked to a water pump. The water is stored in a tank for use at any time.

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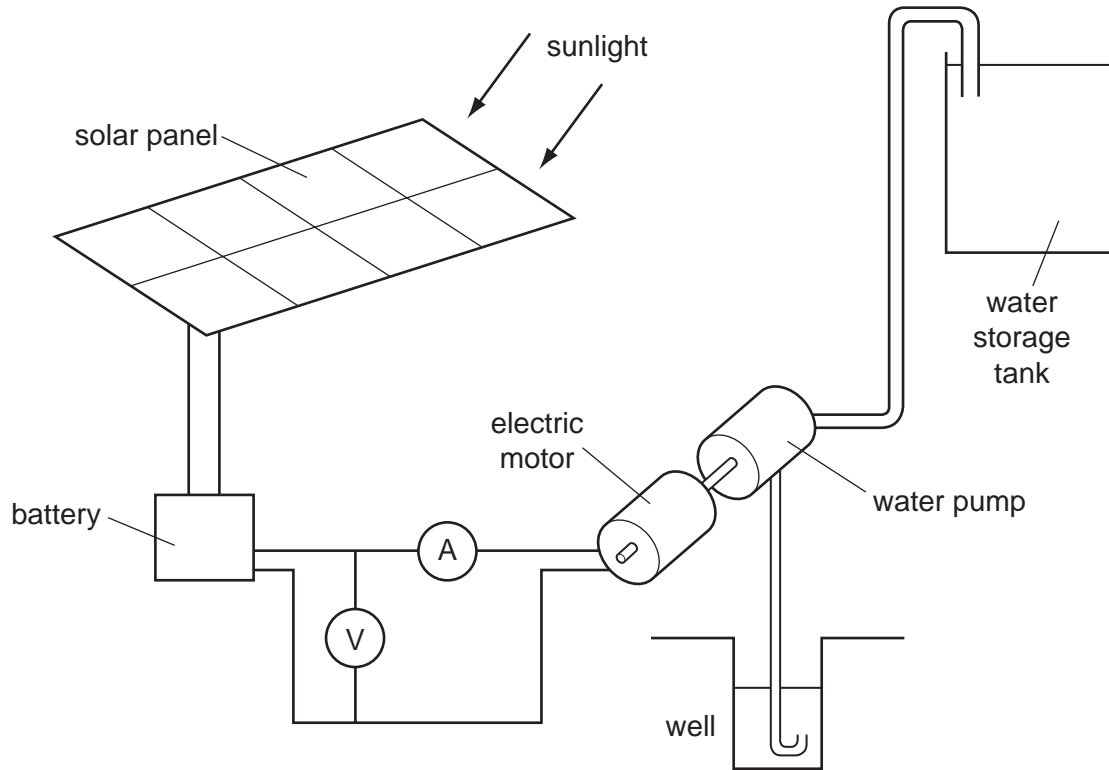


Fig. 1.1

- (a) Light energy is absorbed by the solar panel.  
In what form is the energy
- (i) in the battery, .....
  - (ii) in the shaft of the electric motor, .....
  - (iii) in the water contained in the storage tank? ..... [3]
- (b) (i) Fig. 1.2 shows the ammeter and voltmeter dials when the electric motor is working. Read and record the current and voltage.

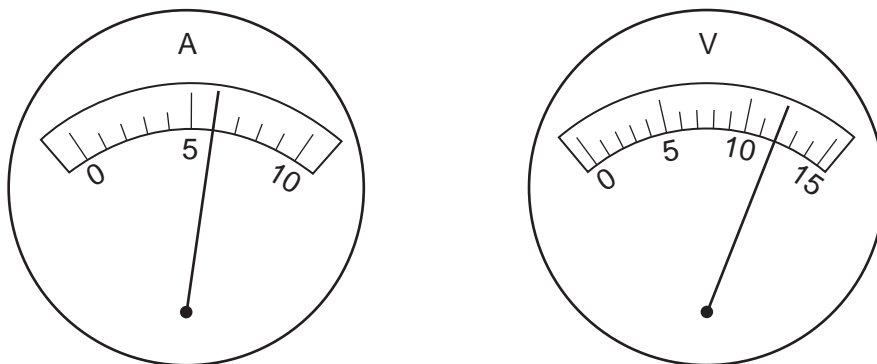


Fig. 1.2

current ..... A

voltage ..... V

[2]

- (ii) The electric motor works for 10 minutes. Calculate the work done by the electric motor using the equation shown below.

work done in joules = time in seconds x current x voltage.

work done = ..... J [2]

- (iii) During this time, 100 kg of water has been lifted to a height of 20 m.

Calculate the work done, using the equation shown below.

work done in joules = mass of water (kg) x distance raised (m) x 10

work done = ..... J [1]

- (c) (i) Suggest **one** thing that will happen if the electric motor does not stop working.

..... [1]

- (ii) Suggest a method of controlling the electric motor to prevent this happening.

.....  
.....  
..... [1]

- 2 The teacher gave two students a set of three colourless solutions, labelled **X**, **Y** and **Z**. He also gave them solution **P** which is an indicator. Solution **P** is colourless in an acidic solution but pink in an alkaline solution.

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The students added solution **P** to samples of the solutions **X**, **Y** and **Z**.  
Fig. 2.1 shows the results.

solution <b>X</b>	solution <b>Y</b>	solution <b>Z</b>
colourless	pink	pink

**Fig. 2.1**

- (a) Decide whether solutions **X**, **Y** and **Z** are acidic or alkaline.

solution **X** .....

solution **Y** .....

solution **Z** .....

[2]

- (b) The students wanted to deduce the name of the acid. They carried out a test that showed that the acid contained sulphate ions.

- (i) Name the reagent that they added to the acid.

..... [1]

- (ii) Describe what they observed when this reagent was added to the acid.

..... [1]

- (iii) Name the acid.

..... [1]

- (c) The students placed about 1 cm<sup>3</sup> of solution **Y** in a test-tube and added one drop of solution **P**.

Then they added solution **X**, a few drops at a time. After a few drops had been added there was no change in colour, but when more drops of solution **X** had been added, the colour changed.

- (i) There was no change in colour when the first few drops of solution **X** had been added. Why was this?

.....

..... [1]

(ii) Suggest how the colour changed when more drops of solution **X** were added.

The colour changed from ..... to ..... [1]

(iii) What kind of reaction took place between solution **X** and solution **Y**?

..... [1]

(d) Fig. 2.2 shows the result of two more experiments that the students carried out. Study their observations and then suggest the names of solutions **Y** and **Z**.

	test	result
<b>1</b>	1 cm <sup>3</sup> of zinc sulphate solution was placed in a test-tube, then solution <b>Y</b> was added a little at a time.	At first there was a white precipitate that dissolved when more solution <b>Y</b> was added.
<b>2</b>	1 cm <sup>3</sup> of solution <b>Z</b> was placed in a test-tube. Then solution <b>X</b> was added.	The mixture bubbled. A gas was given off that turned limewater milky

Fig. 2.2

name of solution **Y** .....

name of solution **Z** .....

[2]

- 3 A student investigated the way in which the current through a resistance wire varied with the length of the wire. He used the circuit shown in Fig. 3.1.

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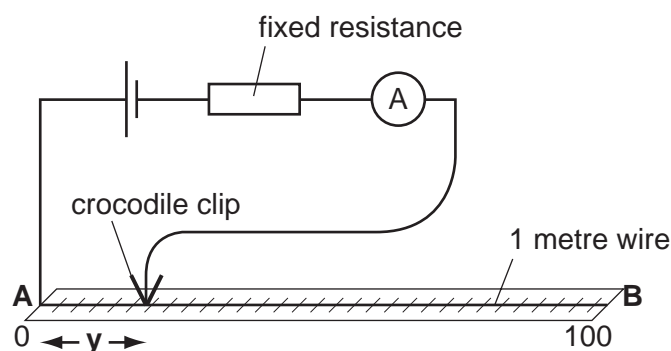


Fig. 3.1

The resistance wire, 100 cm long, was fixed on to a metre ruler. One metre of the resistance wire had a resistance of 4.5 ohms.

- The student touched the wire with the contact and noted length  $y$ , and  $I$ , the reading of the ammeter.
- He noted these readings in the first and third columns of Fig.3.2.
- He repeated this procedure, choosing different lengths of wire each time.
- He calculated the resistance  $R$  of the length of wire,  $y$ , used for each reading.
- He found  $V$ , the potential drop for each length of wire by multiplying the resistance  $R$  by the current  $I$ .

length of wire $y$ /cm	resistance of wire $R$ /ohms	ammeter reading $I$ /amps	potential drop $V$ /volts
10	0.45	0.81	0.36
25			
40	1.80		
60			
70	3.15	0.39	1.2

Fig. 3.2

- (a) (i) Fig. 3.3 shows the ammeter dials for the three missing readings. Read the ammeters and record the readings in the third column of Fig. 3.2. [3]

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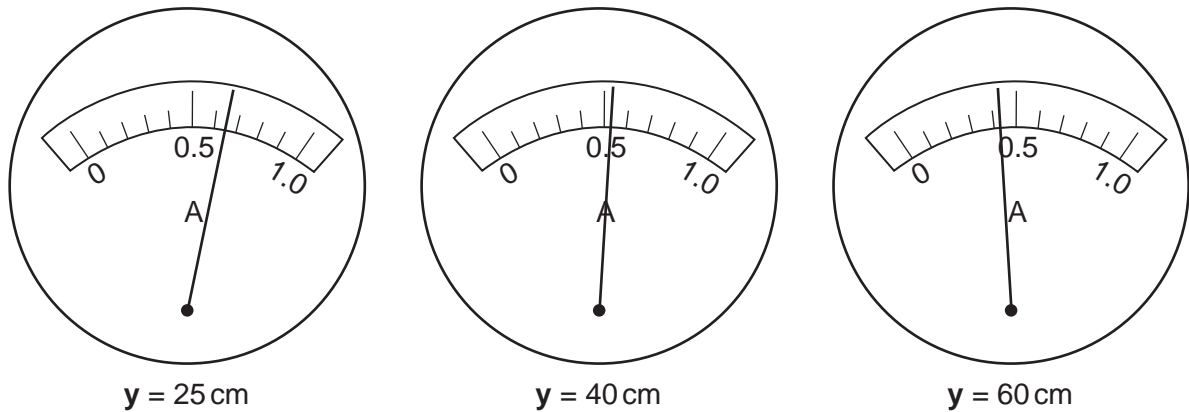


Fig. 3.3

- (ii) Calculate **R**, the resistance of the 25 cm and 60 cm lengths of wire by using the formula.

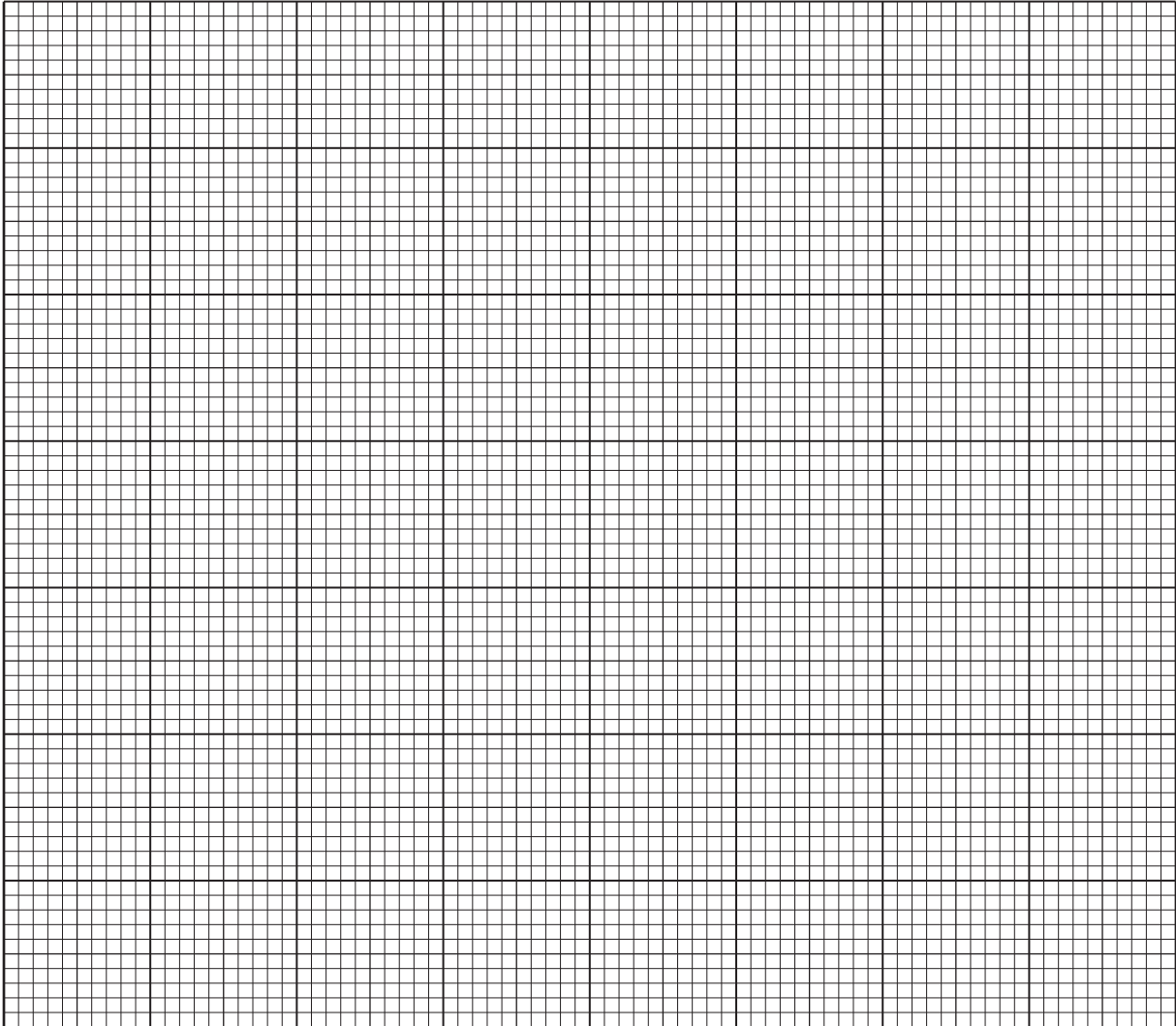
$$R = \frac{4.5 \times y}{100} \text{ ohms}$$

Record the values in the second column of Fig. 3.2. [1]

- (iii) Complete the last column of Fig. 3.2 by calculating the missing values for **V**, the potential drop. Use the following formula;

$$V = R \times I \text{ volts} \quad [1]$$

- (b) Plot a graph of  $V$ , the potential drop against  $y$ , the length of the wire. Plot  $y$  on the horizontal axis. Join the points by a smooth curve that passes through the point (0,0). [3]



- (c) The experiment is repeated using a cell with a larger voltage but the same wire. Draw a second curve on your graph to show the result you would expect. Explain how you decided this. Label this curve "expected result". [2]

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- 4 The teacher shows the class an experiment to find the mass of one mole of a hydrocarbon. The hydrocarbon is a liquid at room temperature. It boils at about 80°C. The apparatus is shown in Fig. 4.1. The teacher does the experiment twice.

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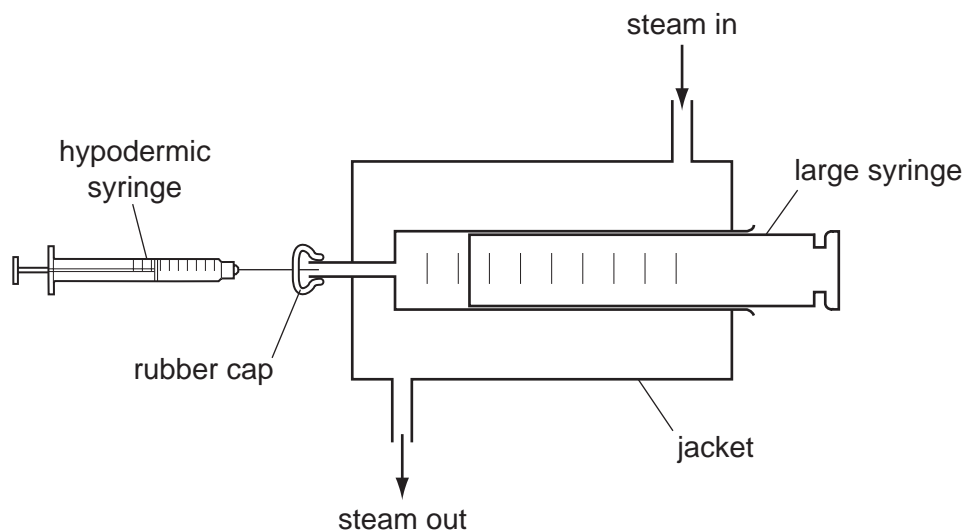


Fig. 4.1

- A large syringe is surrounded by a transparent plastic jacket.
- At first, the syringe contains about 10 cm<sup>3</sup> of air. The nozzle of the syringe has a rubber cap over it.
- Steam is passed through the jacket for a few minutes to raise the temperature of the syringe to that of steam.
- The volume of air in the syringe is read and recorded.
- A hypodermic syringe fitted with a needle is filled with the hydrocarbon liquid, then it is weighed. The mass of the hypodermic syringe is recorded.
- The needle of the hypodermic syringe is pushed through the rubber cap of the large syringe and some of the hydrocarbon liquid is injected.
- The hypodermic syringe is weighed again and its mass recorded.
- The volume contained in the large syringe is read and the volume is recorded.
- The experiment is repeated using the same hydrocarbon liquid.

- (a) (i) Fig. 4.2 shows the scale of the large syringe before and after the hydrocarbon liquid was injected. Read the volumes contained in the syringe and record them in Fig. 4.3 in the spaces marked **experiment 2**. [2]

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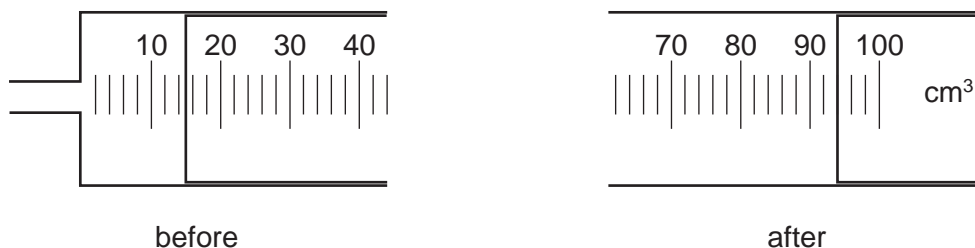


Fig. 4.2

**experiment 1**

volume contained in the large syringe /cm <sup>3</sup>		mass of hypodermic syringe /g	
before	after	before	after
13	94	15.90	16.10
change in volume/cm <sup>3</sup>		change in mass/g	
81		0.20	

**experiment 2**

volume contained in the large syringe /cm <sup>3</sup>		mass of hypodermic syringe /g	
before	after	before	after
change in volume /cm <sup>3</sup>		change in mass/g	

Fig. 4.3

- (ii) Fig. 4.4 shows the balance windows for the masses of the hypodermic syringe before and after injecting the hydrocarbon liquid into the large syringe. Read these masses and record them in Fig. 4.3 in the spaces marked **experiment 2**. [2]

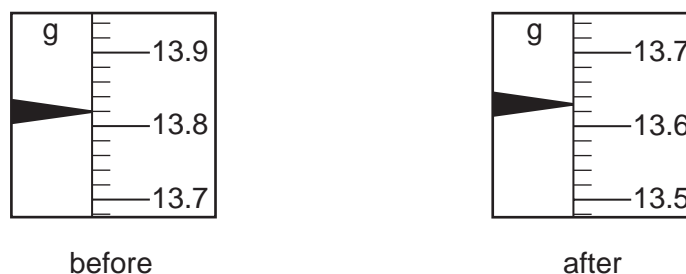


Fig. 4.4

- (iii) Complete Fig. 4.3 by finding the change in volume/cm<sup>3</sup> and the change in mass/g. [2]

- (b) What was the temperature of the syringe after steam had been passed in for a few minutes?

..... [1]

- (c) The volume of one mole of gas at this higher temperature is  $30 \text{ dm}^3$ .

- (i) Use the data from **experiment 1** to calculate the mass of  $30 \text{ dm}^3$  ( $30\,000 \text{ cm}^3$ ) of the hydrocarbon vapour.

mass of  $30 \text{ dm}^3$  of hydrocarbon vapour = ..... [2]

- (ii) Use the data in Fig. 4.5 and your result from (c)(i) to suggest the identity of the hydrocarbon used in the experiments.

You must show your working. [A<sub>r</sub>: H, 1; C, 12]

name of hydrocarbon	methane	ethane	propane	butane	pentane	hexane
formula	$\text{CH}_4$	$\text{C}_2\text{H}_6$	$\text{C}_3\text{H}_8$	$\text{C}_4\text{H}_{10}$	$\text{C}_5\text{H}_{12}$	$\text{C}_6\text{H}_{14}$

Fig. 4.5

name of the hydrocarbon: ..... [1]

- 5 A series of experiments was done to find out how temperature change affects the speed of reaction. Marble (calcium carbonate) was reacted with dilute hydrochloric acid at different temperatures.

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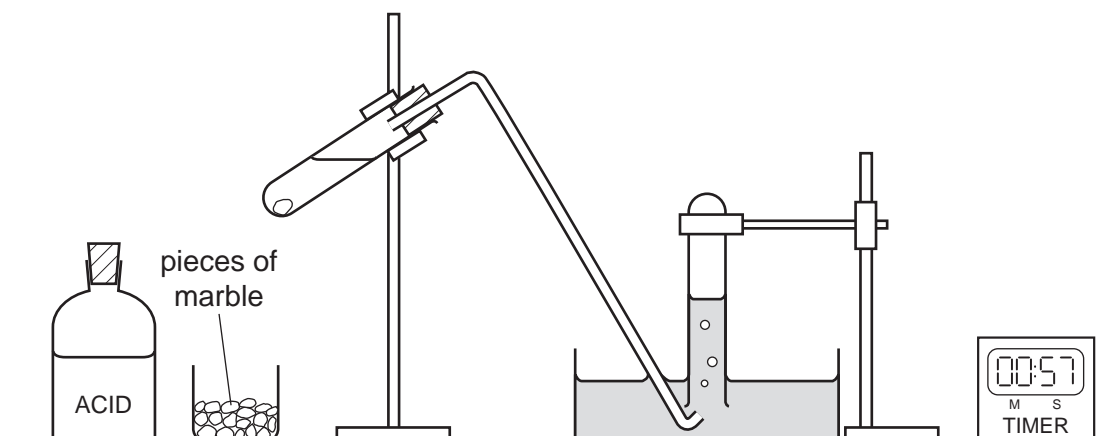


Fig. 5.1

- A test-tube was half-filled with dilute hydrochloric acid.
- The acid was gently warmed and its temperature was recorded in Fig. 5.2.
- A small piece of marble was placed in the tube and the cork was quickly replaced.
- A digital clock was started.
- When the gas collection tube was full, the clock was stopped.

experiment number	1	2	3	4
temperature /°C	24	37	49	62
time taken /s	148			22

Fig. 5.2

- (a) (i) Name two more pieces of apparatus, not shown in Fig. 5.1, that the student will need for these experiments.

1. ....

2. ....

[2]

- (ii) What must the gas collection tube be filled with, before each experiment begins?

..... [1]

- (iii) Name the gas that was collected.

..... [1]



Fig. 5.3

For  
Examiner's  
Use

(b) Read the digital clocks shown in Fig. 5.3, for the missing times, and record them in Fig. 5.2. [2]

(c) Suggest **one** change to the method to improve the accuracy of the experiment.

.....  
 ..... [1]

(d) Use the information in Fig. 5.2 to show how the speed of reaction is affected by change of temperature.

.....  
 .....  
 ..... [2]

(e) Explain your answer in (d) in terms of the behaviour of the reacting particles.

.....  
 .....  
 ..... [1]

6 An experiment was done to investigate the thermal conductivity of five different metals.

- A student took a 20 cm long bar of metal and heated one end. Then he hammered the end until there was a dent in it. This is shown in Fig. 6.1.
- He dripped wax from a lit candle into the dent and then placed a small glass bead in the wax. When the metal bar was cold the wax became solid and the glass bead was stuck to the bar.
- He rested the cold bar on a tripod, shown in Fig. 6.2, so that the glass bead was underneath the bar.
- He started a stop clock and heated the other end of the bar using a moderately hot flame.
- When the wax melted and the glass bead dropped off, he stopped the clock. He recorded the time taken for the wax to melt in Fig. 6.3.

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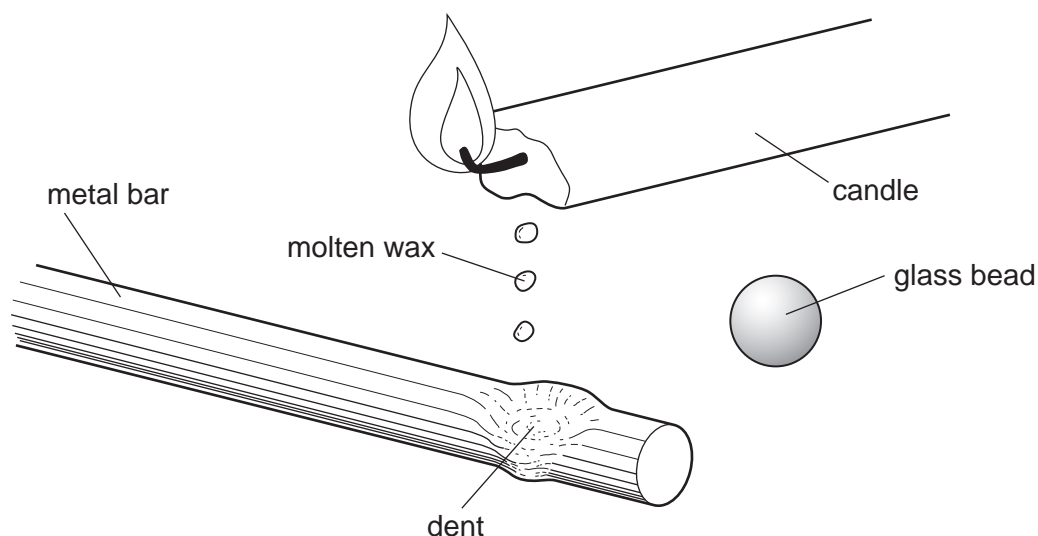


Fig. 6.1

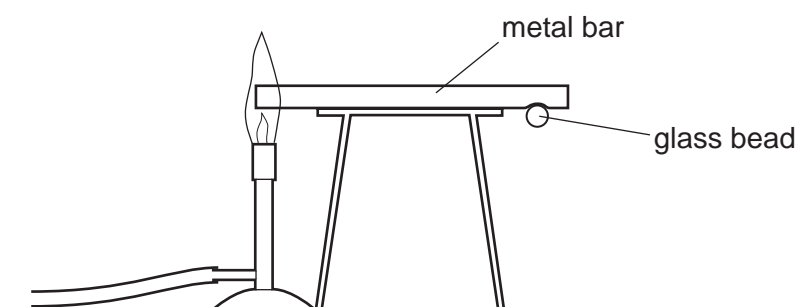


Fig. 6.2

metal	copper	iron	steel	aluminium	nickel
time taken for the wax to melt/s	26	130	190		

Fig. 6.3



Fig. 6.4

(a) Read the digital timers in Fig. 6.4 and record the results for the metals aluminium and nickel in Fig. 6.3. [2]

(b) (i) What physical property enabled the student to make a dent in the hot bar? [1]

.....

(ii) Suggest which of the metals was hardest to dent. Explain why you chose this metal.

metal .....

explanation .....

..... [2]

(c) What type of substance is candle wax? Name the main source of candle wax.

type of substance .....

source .....

[2]

(d) The student wanted to carry out this experiment with a bar of magnesium. Suggest why the teacher did not allow him to do this.

.....

..... [1]

(e) Suggest **one** way to make this experiment a fairer test.

.....  
..... [1]

(f) The student did the experiment with a 20 cm glass bar. The wax did not melt and the glass bead did not fall off.  
Explain the difference in the properties of metal and glass that is shown by this experiment.

.....  
.....  
..... [1]

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