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| Centre Number | Candidate Number | Name |
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICAL SCIENCE

0652/06

Paper 6 Alternative to Practical

October/November 2004

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 in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.

| For Examiner's Use | |
|--------------------|--|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| Total | |

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

- 1 A student was investigating the 'Law of Conservation of Mass', which states that mass is neither created nor destroyed during a chemical reaction'.

He set up the apparatus as shown in Fig. 1.1.

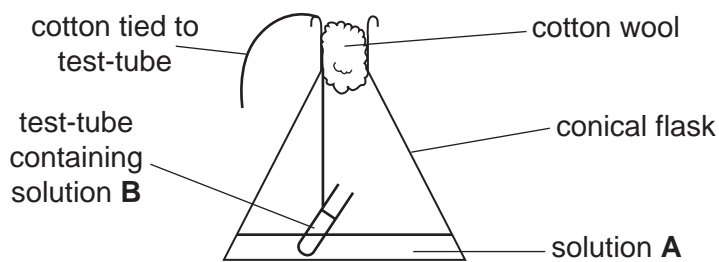


Fig. 1.1

He weighed the flask and its contents. He then shook the conical flask, mixing the two chemicals. He noticed that a precipitate was formed, showing that a reaction had occurred. He then re-weighed the flask and its contents. He repeated the experiment twice more using different chemicals each time. Fig. 1.2 shows his results.

| reaction | solution A | solution B | mass before reaction / g | mass after reaction / g | colour of precipitate |
|----------|-------------------|------------------|--------------------------|-------------------------|-----------------------|
| 1 | sulphuric acid | barium nitrate | 84.5 | 84.5 | |
| 2 | silver nitrate | sodium chloride | 82.7 | 82.7 | |
| 3 | iron(II) sulphate | sodium hydroxide | 87.3 | 87.3 | |

Fig. 1.2

- (a) Explain how the results prove the Law of Conservation of Mass.

.....

[2]

- (b) What is meant by the term *precipitate*?

.....
[1]

- (c) In the last column of Fig. 1.2 write the **colour** of the precipitate formed in each reaction.

[3]



(d) Name the precipitate formed in each of the reactions.

reaction 1

reaction 2

reaction 3[3]

(e) Why would the mass after reaction be less than the mass before reaction if a gas was produced in the experiment?

.....

.....[1]

2 An experiment was carried out to investigate the time taken for strips of magnesium to dissolve in varying concentrations of hydrochloric acid. These different solutions of hydrochloric acid were prepared by mixing suitable volumes of the acid and water as shown in Fig. 2.1.

- The magnesium was cut into 5 cm long pieces.
- A piece of magnesium was placed in a beaker containing 100 cm³ of hydrochloric acid of concentration 4.0 mol / dm³, and a clock was started.
- The time the magnesium took to dissolve was noted in Fig. 2.1.
- The procedure was repeated using the other concentrations of acid.

| expt. no. | volume of 4.0 mol / dm ³ hydrochloric acid / cm ³ | volume of water / cm ³ | concentration of mixture in mol / dm ³ | time the magnesium took to dissolve / s |
|-----------|---|-----------------------------------|---|---|
| 1 | 100 | 0 | 4.0 | 12 |
| 2 | 75 | 25 | | |
| 3 | 50 | 50 | 2.0 | 48 |
| 4 | 25 | 75 | | |

Fig. 2.1

- (a) (i) Calculate the concentrations of the mixtures of acid and water in experiments 2 and 4, and write them in the table.

[2]

- (ii) Fig. 2.2 shows the digital readout of the time taken for experiments 2 and 4. Read and record the times taken in Fig. 2.1.



experiment 2

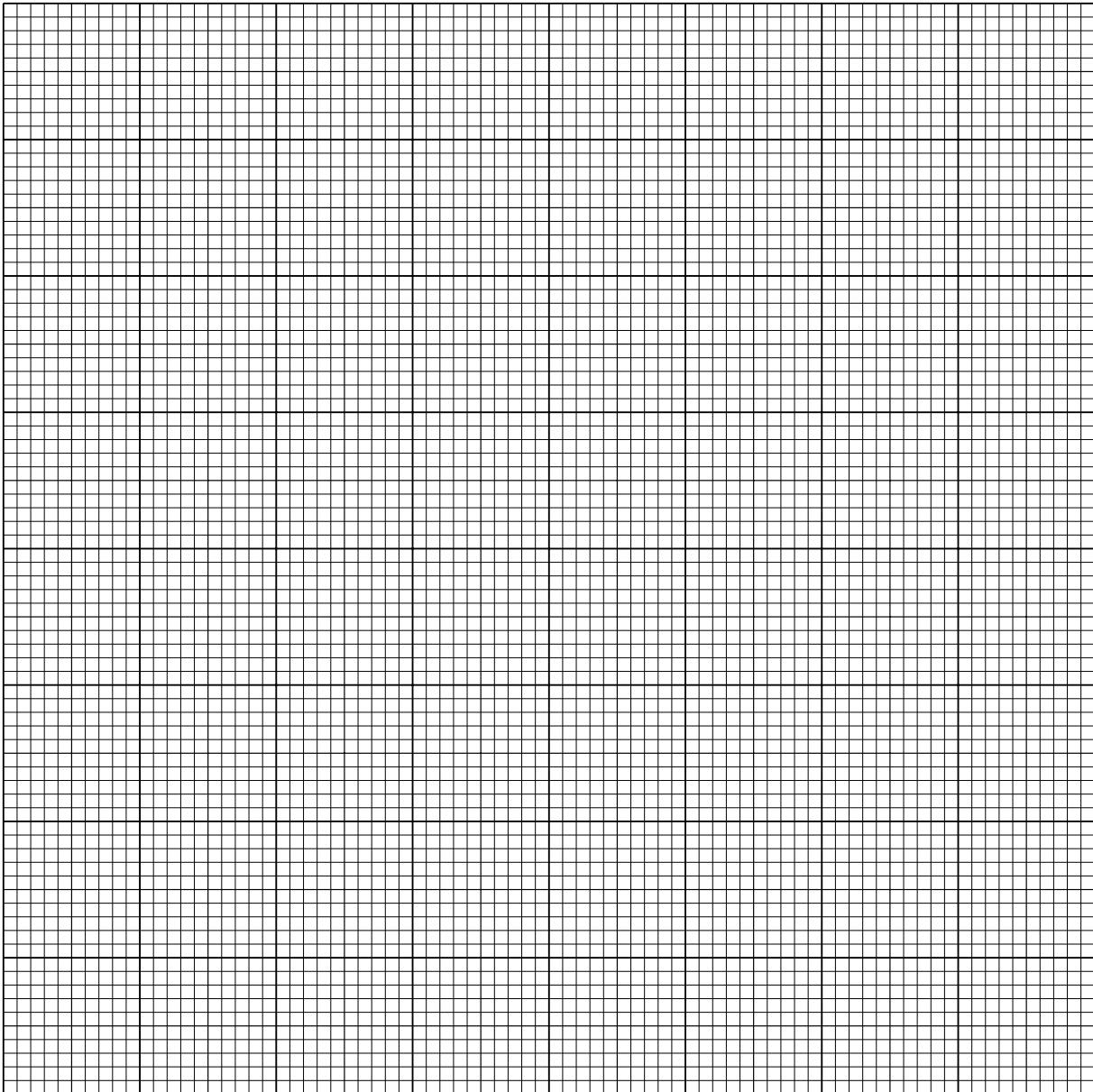


experiment 4

Fig. 2.2

[2]

(b) Plot a graph of concentration of acid (horizontal axis) against the time for the magnesium to dissolve.



[3]

(c) Use the graph to predict the time that the magnesium will take to dissolve in acid of concentration 2.5 mol/dm^3 .

.....[1]

- (d) A student read in a book that 0.1 g of magnesium produces 100 cm³ of hydrogen when it dissolves in acid. Draw a diagram of the apparatus you would use to test this statement.

[2]

3 A student is given a convex lens, a small white screen and a ruler.

(a) At the other end of the laboratory there is a bright light. Explain how she can use the lens, the screen and the bright light to find the focal length of the lens.

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

(b) The student finds out that the focal length of the lens is 15 cm. She fixes the lens upright on the 50 cm mark of the ruler. She marks the points **F** and **2F** on the ruler that are 15 cm and 30 cm away from the lens on the left. She also marks the points **F¹** and **2F¹**, 15 cm and 30 cm away from the lens on the right. Write in the spaces on Fig. 3.1 the **actual numbers on the ruler** for the points **F**, **2F**, **F¹** and **2F¹**.

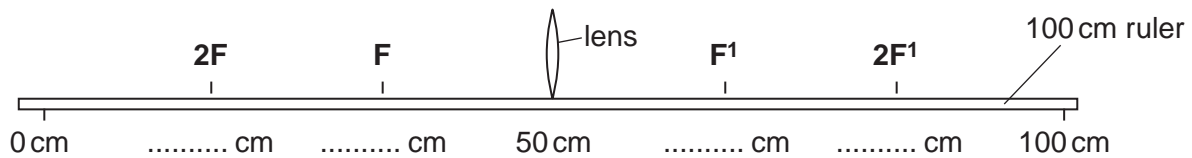


Fig. 3.1

[2]

(c) In experiment 1, the student puts a lighted candle more than **2F** cm away from the lens. Then she moves the screen on the other side of the lens so that a sharp image of the candle flame is formed. See Fig. 3.2.

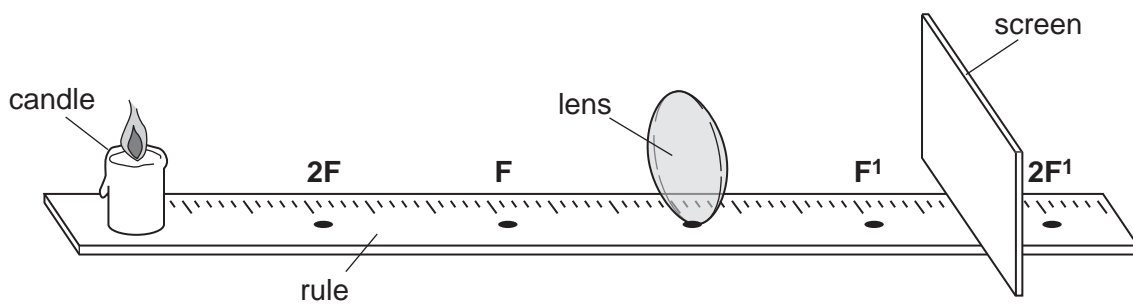


Fig. 3.2

She does two more experiments with the candle in different positions. Each time, the student draws a picture of the image of the candle flame. Use the pictures in Fig. 3.4 to help you to fill in the last two columns of Fig. 3.3.

| expt. no. | candle position | image position | what the image is like | |
|-----------|--------------------------------|--|---|---|
| | | | Is it larger, smaller or same size as the candle? | Is it upright or inverted ? |
| 1 | beyond 2F | between F¹ and 2F¹ | | |
| 2 | at 2F | at 2F¹ | | |
| 3 | between F and 2F | beyond 2F¹ | | |

Fig. 3.3

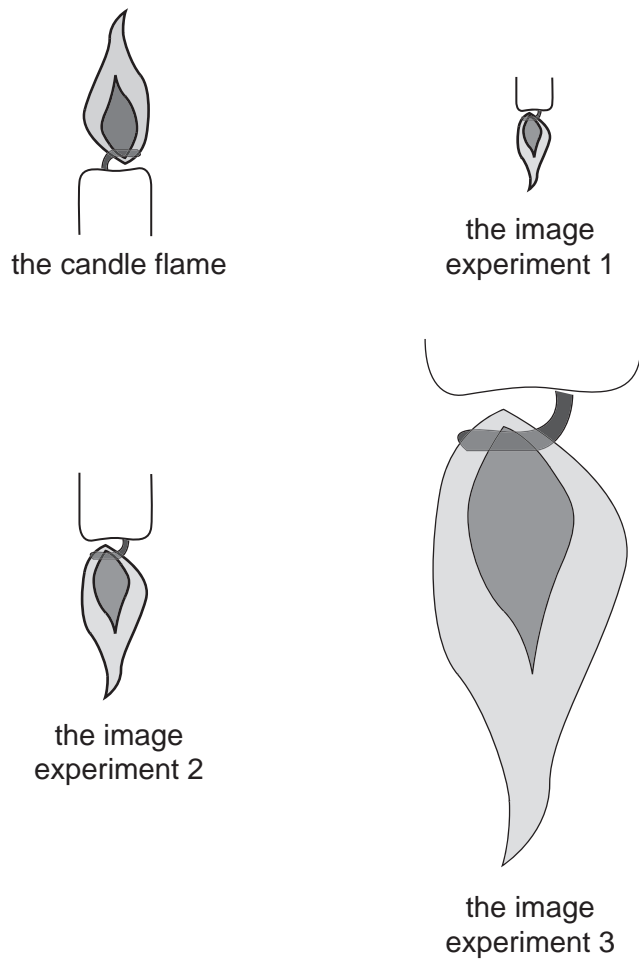


Fig. 3.4

(d) The teacher gives the student an unfinished diagram to show the rays of light that leave the candle, pass through the lens and form the image.

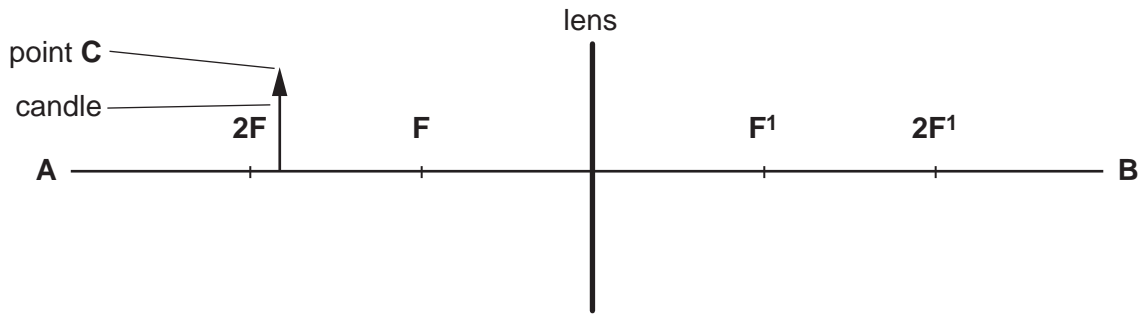


Fig. 3.5

- (i) On Fig. 3.5, draw a horizontal line from point **C**, the candle flame, to the lens, then continue it to pass through the point **F'**.
- (ii) Draw a straight line from point **C** through the centre of the lens, meeting line (i) on the opposite side of the lens. Label point **X**, where lines (i) and (ii) meet.
- (iii) Draw a vertical line from **X** to the line **AB**, cutting **AB** at **Y**.

[1]

(iv) Measure the distance **XY** in millimetres and record the distance in the space below.

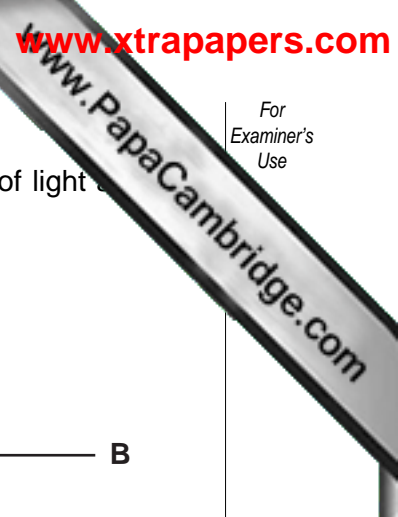
XY mm

[1]

(e) Which of the experiments in Fig. 3.3 is illustrated by your diagram in (d)

experiment number

[1]



4 A student did an experiment to show that when hot and cold water are mixed, the heat lost by the hot water is equal to the heat gained by the cold water.

Using a measuring cylinder she put 100 g of water into a glass beaker and 50 g into another. She placed the beaker containing the 100 g of water on a cork mat, well away from any source of heat and measured the temperature of the water.

She heated the 50 g of water in the other glass beaker until the temperature was just above 70 °C. She allowed this water to cool, with stirring, until the temperature was exactly 70 °C, she then poured it into the beaker of cold water.

She stirred the mixture and recorded the highest temperature reached.

The student repeated the experiment, using 100 g of hot water at 70 °C and 50 g of cold water but this time she poured the cold water into the hot.

(a) The thermometer scales, Fig. 4.1, show the temperature of the cold water in both experiments and the final temperature in each case. Record these temperatures in Fig. 4.2. [3]

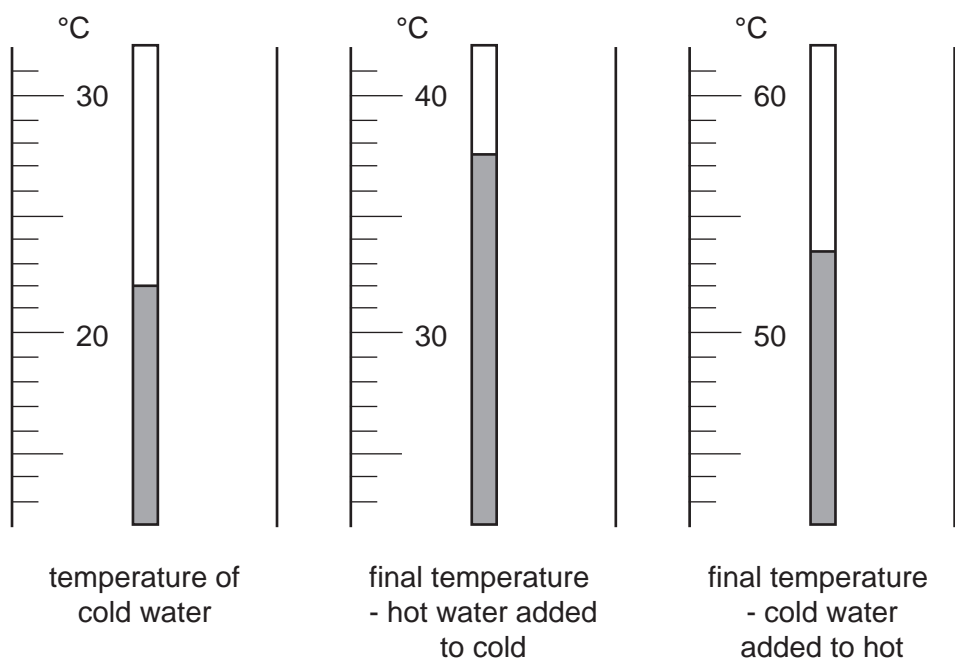
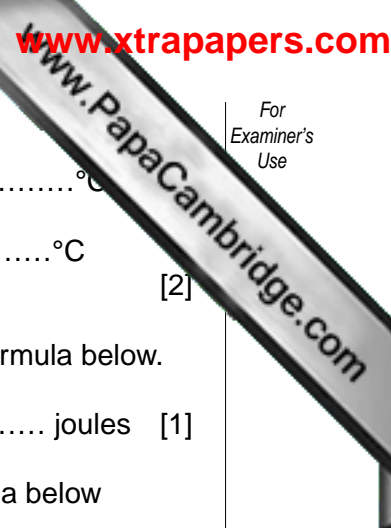


Fig. 4.1

| | | |
|--------------|---|-------|
| | temperature of hot water | 70 °C |
| | temperature of cold water | °C |
| experiment 1 | final temperature – hot water added to cold water | °C |
| experiment 2 | final temperature – cold water added to hot water | °C |

Fig. 4.2



- (b) Calculate the temperature **rise** of the cold water in experiment 1°C
- Calculate the temperature **fall** of the hot water in experiment 2°C

[2]

- (c) Calculate the heat gained by the cold water in experiment 1, using the formula below.

heat gained = $4.2 \times \text{mass of water in g} \times \text{rise in temperature} = \dots\dots\dots$ joules [1]

- (d) Calculate the heat lost by the hot water in experiment 2, using the formula below

heat lost = $4.2 \times \text{mass of water in g} \times \text{fall in temperature} = \dots\dots\dots$ joules [1]

- (e) Explain why the rise in temperature of the cold water in experiment 1 is approximately equal to the fall in temperature of the hot water in experiment 2.

.....

.....

.....[2]

- (f) Explain how the student could have improved the accuracy of her results.

.....

.....[1]

5 The apparatus shown in Fig. 5.1 was used to investigate how two black powders, carbon and copper oxide, reacted with three different gases.

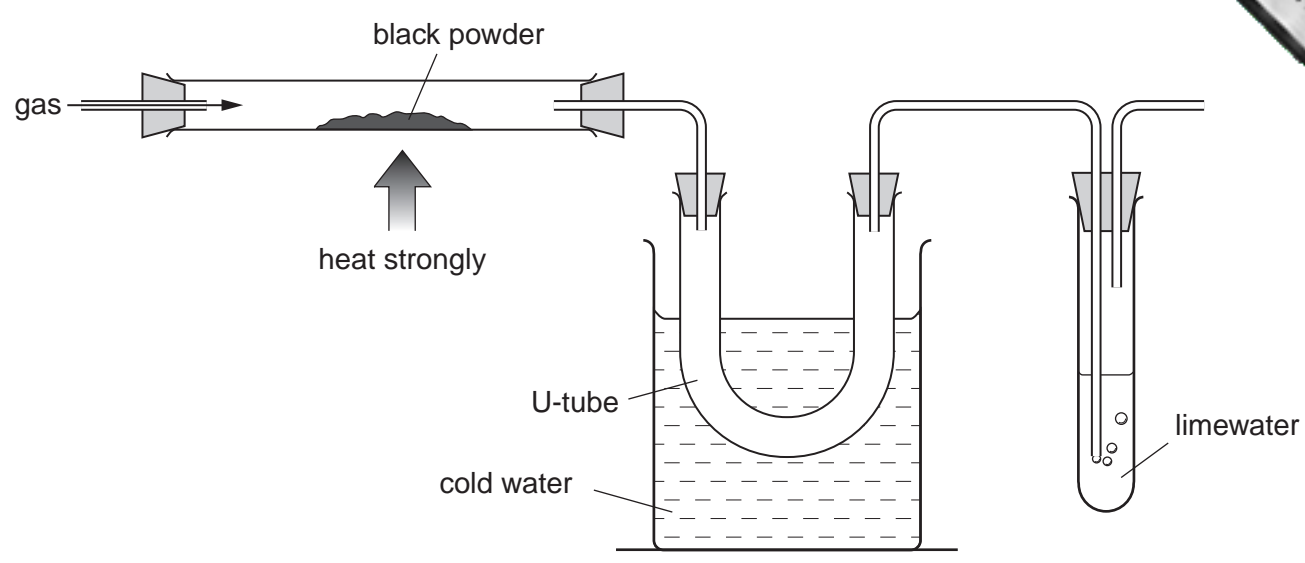


Fig. 5.1

The gases carbon monoxide, hydrogen and oxygen were passed in turn over the heated powders. The products of the reaction passed through a cooled U-tube and then through limewater. Some of the results are shown in Fig. 5.2.

Results for carbon

| expt. no. | gas used | what was seen in heated tube | did liquid collect in U-tube? (yes/no) | did limewater turn cloudy? (yes/no) |
|-----------|-----------------|------------------------------|--|-------------------------------------|
| 1 | carbon monoxide | | | |
| 2 | hydrogen | no change | no | no |
| 3 | oxygen | red glow, powder disappeared | no | yes |

Results for copper oxide

| expt. no. | gas used | what was seen in heated tube | did liquid collect in U-tube? (yes/no) | did limewater turn cloudy? (yes/no) |
|-----------|-----------------|------------------------------|--|-------------------------------------|
| 4 | carbon monoxide | powder turned red/brown | no | yes |
| 5 | hydrogen | | | |
| 6 | oxygen | no change | no | no |

Fig. 5.2

- (a) Complete Fig. 5.2 to show the results for experiments 1 and 5.
- (b) How could you show that any liquid that collects in the U-tube is water?

.....
[2]

- (c) Choose any **one** of the reactions in Fig. 5.2 and use it to explain the meaning of the terms *oxidation* and *reduction*.

.....

[2]

6 The teacher sets up the apparatus shown in Fig. 6.1 to demonstrate energy changes. A large mass is attached to a cord wound around a spindle. As the mass falls, the spindle turns. The motion is transmitted to a generator. The current from the generator passes through the circuit containing a voltmeter, an ammeter and a light bulb. The mass falls a distance of 1 metre in 10 seconds and hits the workbench.

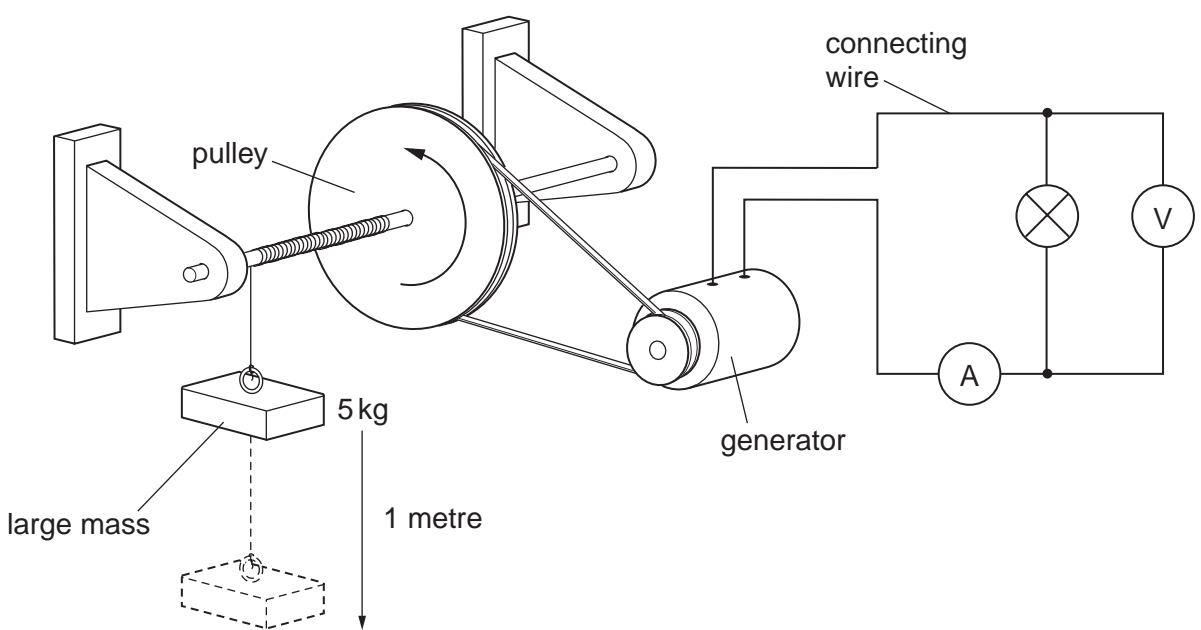


Fig. 6.1

- (a) Energy conversions occur while the mass falls.
 In what form is the energy
 - (i) in the mass,
 - (ii) in the pulley,
 - (iii) in the connecting wire?

(b) Fig. 6.2 shows the ammeter and voltmeter readings when the mass is falling.

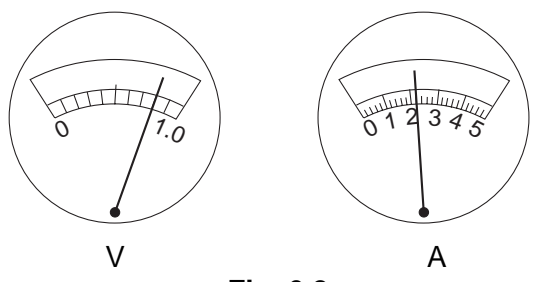


Fig. 6.2

Read and record the current and voltage in the spaces below.

current = A

voltage = V [2]

(c) The 5 kg mass falls through a distance of 1 metre.
Calculate the work done by the falling mass. Take **g**, the acceleration due to gravity, as 10 N/kg. Use the formula below.

work done in joules = mass in kg × distance it falls in metres × **g**

[1]

(d) Find the work done to light the bulb using the formula below.

work done in joules = p.d. in volts × current in amps × time in seconds

[1]

(e) Suggest **two** reasons why the answers to (c) and (d) are not equal.

- 1.
-
- 2.
-[2]

(f) Suggest **one** observation that will be different if the mass moves more quickly.

.....[1]

