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PHYSICAL SCIENCE

0652/62

Paper 6 Alternative to Practical

October/November 2020

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Blank pages are indicated.

1 A student investigates the rate of reaction of magnesium with sulfuric acid.

She uses 2 different solutions of sulfuric acid, **H** and **J**.

(a) Procedure

The student:

- measures 50 cm^3 sulfuric acid **H** using a measuring cylinder and pours it into a conical flask
- sets up the apparatus shown in Fig. 1.1

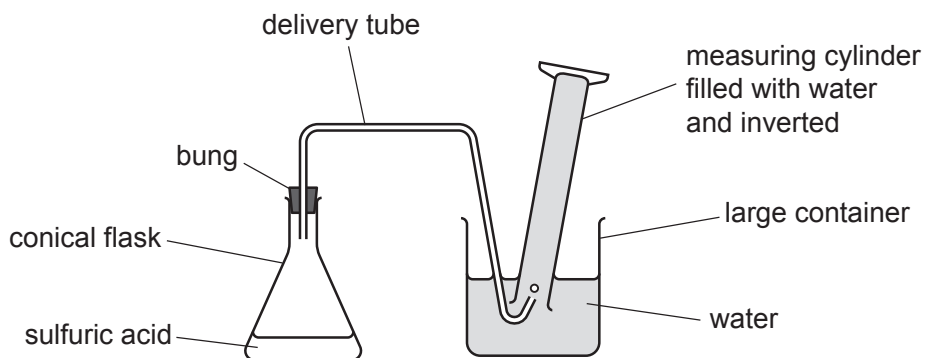


Fig. 1.1

- removes the bung from the conical flask
- adds one 15 cm length of magnesium ribbon to the conical flask
- replaces the bung quickly and starts the stop-clock immediately
- measures the volume of gas produced every 30 seconds for 5 minutes
- repeats the experiment using acid **J**.

Fig. 1.2 shows the volume readings for 90 seconds and 150 seconds for acid **H**. Record these values in Table 1.1 on page 4. [2]

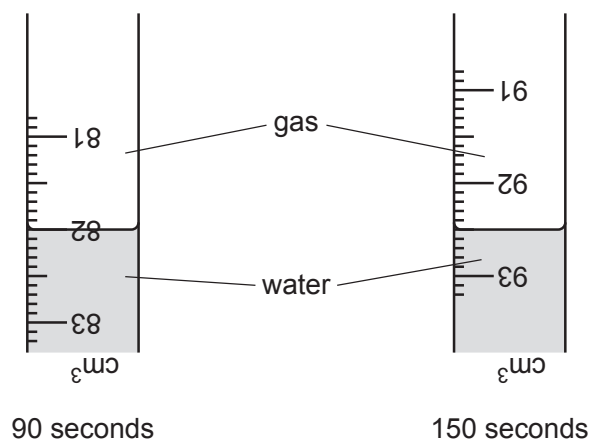


Fig. 1.2

Table 1.1

time/s	sulfuric acid H volume of gas/cm ³	sulfuric acid J volume of gas/cm ³
0	0	0
30	52.0	25.0
60	71.5	44.0
90		58.5
120	88.5	60.5
150		77.5
180	94.0	84.0
210	94.0	89.0
240	94.0	92.0
270	94.0	94.0
300	94.0	94.0

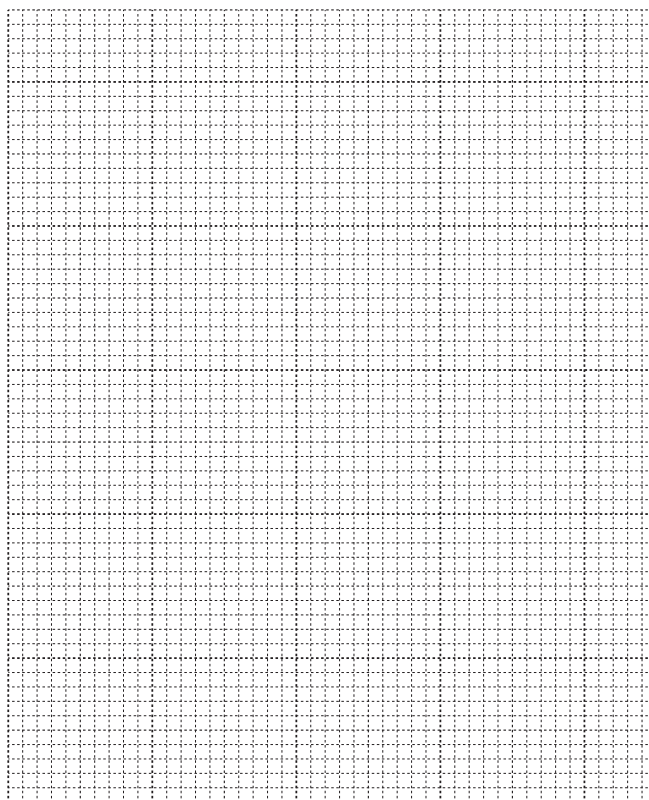
- (b) On the grid provided, plot a graph of volume of gas produced (vertical axis) against time for sulfuric acid H.

Draw the line of best fit and label it H.

On the same grid, plot a graph of volume of gas produced (vertical axis) against time for sulfuric acid J.

Draw the line of best fit and label it J.

[5]



(c) Draw a ring around the anomalous point. [1]

(d) State which acid, **H** or **J**, is more concentrated.

Explain your answer by referring to the graph.

acid

explanation

..... [1]

(e) A student repeats the experiment with acid **H** but first heats the acid to 50°C. The same length of magnesium ribbon is used.

The reaction happens more quickly.

Draw a line on the grid to show the results expected. Label the line **D**. [2]

(f) Suggest **one** change to the apparatus to improve the accuracy of the investigation.

.....

..... [1]

(g) Suggest which reagent is in excess.

Explain your answer with reference to the graph.

reagent in excess

explanation

..... [1]

[Total: 13]

2 A student measures the spring constant k of a spring by two different methods.

The spring constant k of a spring is a measure of the stiffness of the spring.

The spring is shown in Fig. 2.1.

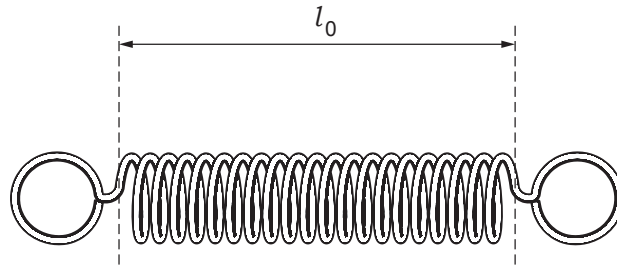


Fig. 2.1

Method 1

(a) Measure the unstretched length l_0 of the spring in centimetres, to the nearest millimetre.

$l_0 = \dots\dots\dots$ cm [1]

The student:

- attaches the spring to a clamp
- hangs a 300 g mass on the spring, as shown in Fig. 2.2

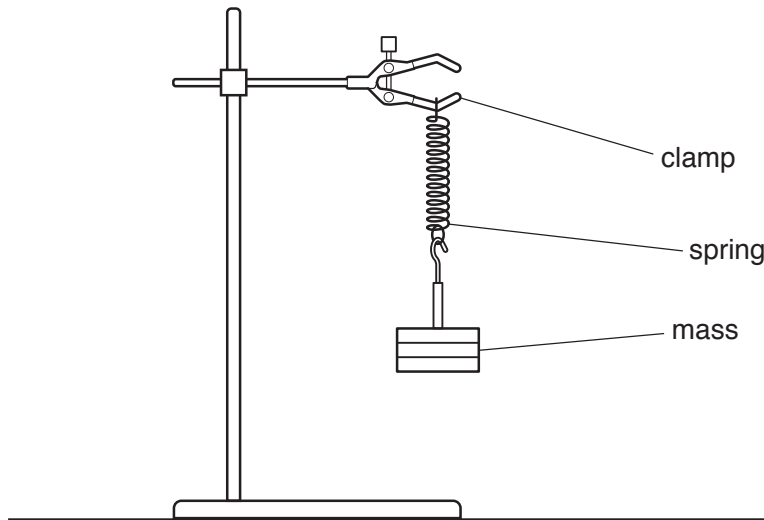


Fig. 2.2 (not to scale)

- measures and records the new length l_1 of the spring, as shown in Fig. 2.3.

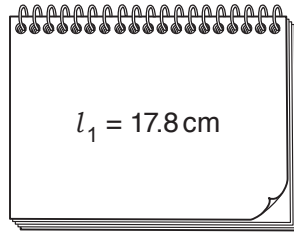


Fig. 2.3

- (b)** Calculate the extension e of the spring produced by the mass. Use the equation:

$$e = l_1 - l_0$$

$$e = \dots\dots\dots \text{cm} \quad [1]$$

- (c)** Calculate the spring constant k of the spring. Use the equation:

$$k = \frac{W}{e}$$

where the weight W of the mass = 3 N.

$$k = \dots\dots\dots \text{N/cm} \quad [1]$$

(d) Method 2

The student:

- pulls the mass down a small distance and releases it.

The mass oscillates up and down. The period T of the oscillations is the time taken for **one** oscillation.

The student:

- measures the time t for 20 oscillations
- records the value in Table 2.1.

Explain why measuring the time for 20 oscillations, rather than for 1 oscillation, gives a more accurate value for T .

.....
 [1]

mass m/kg	time for 20 oscillations t/s	period T/s	T^2/s^2
0.30	13.82		

Table 2.1

(e) (i) Calculate the period T , the time for one oscillation of the mass. Record this value in Table 2.1. [1]

(ii) Calculate the value of T^2 . Record your answer in Table 2.1 to two significant figures. [1]

(f) Calculate the spring constant k of the spring. Use the equation:

$$k = \frac{0.12}{T^2}$$

$k =$ N/cm [1]

(g) Compare your values of k from (c) and (f).

State and explain whether they agree with each other within the limits of experimental error.

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

(h) In both methods, it is important to avoid line-of-sight (parallax) errors when measuring the length of the spring and when timing the oscillations.

Describe how this error is avoided in each method.

length of the spring method

.....
.....

timing the oscillations method

.....
.....

[2]

[Total: 10]

3 A student investigates the effective resistance of two different combinations of lamps.

The student:

- sets up the circuit shown in Fig. 3.1. This is circuit 1

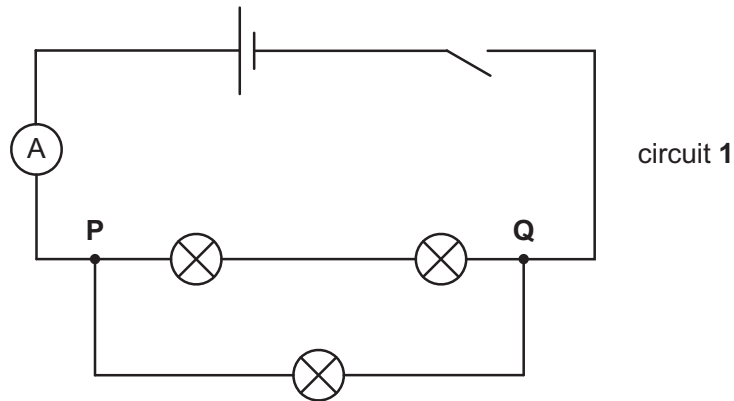


Fig. 3.1

- connects a voltmeter into circuit 1 to measure the potential difference (p.d.) between **P** and **Q**
- closes the switch
- measures and records the potential difference V and the current I
- opens the switch.

(a) The circuit contains a voltmeter but Fig. 3.1 does not show a voltmeter.

On Fig. 3.1, draw the symbol for a voltmeter connected to measure the potential difference between points **P** and **Q**. [1]

(b) Fig. 3.2 shows the readings on the voltmeter and the ammeter.

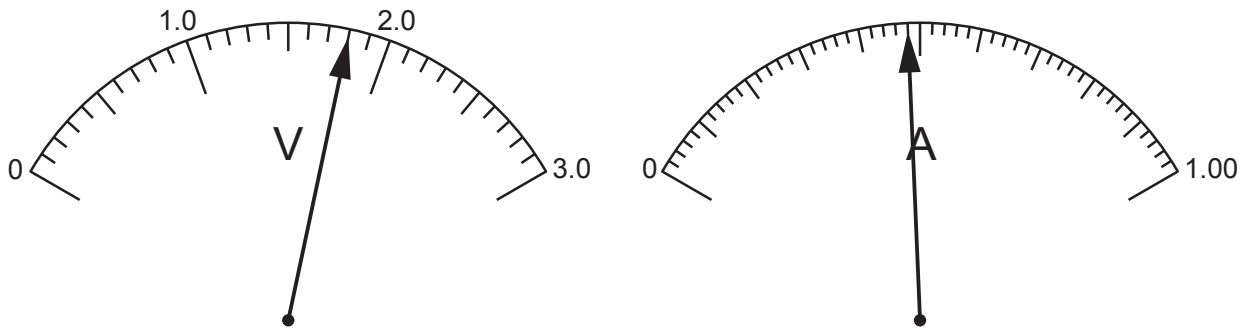


Fig. 3.2

(i) Read the scales of the meters in Fig. 3.2 and record the values of potential difference V and current I in the first row of Table 3.1. [2]

Table 3.1

	p.d. V/V	current I/A	resistance $R/ \dots\dots\dots$
circuit 1			
circuit 2	1.9	0.23	

(ii) Complete the column headings in Table 3.1 by giving the unit for resistance R . [1]

(c) The student:

- changes the arrangement of the lamps between **P** and **Q** (shown without voltmeter) as shown in Fig. 3.3. This is circuit 2

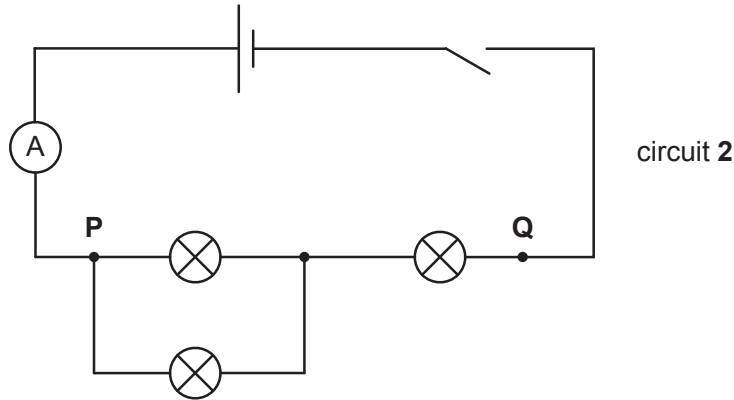


Fig. 3.3

- closes the switch
- measures and records the potential difference V and the current I
- opens the switch.

Her readings are shown in Table 3.1 on page 11.

Calculate and record in Table 3.1, the resistance R of circuits **1** and **2**.

Use the equation:

$$R = \frac{V}{I}$$

[2]

(d) A teacher makes the following statement:

'If each lamp has the same resistance,

$$\frac{\text{resistance of circuit 2}}{\text{resistance of circuit 1}} = 2.25.'$$

State whether the results support the teacher's suggestion. Justify your answer by using the values of R you have calculated in Table 3.1.

.....

[1]

- (e) The resistance of a lamp is altered by a change in the temperature of its filament.

During the experiment, a student observes that the lamps in the circuits have different brightnesses.

Suggest how this might have affected the results of this experiment.

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

- (f) The student decides to extend the investigation. The circuit is rearranged to measure the effective resistance of the lamps when all three lamps are connected in parallel with each other. This is circuit 3.

Draw the circuit diagram for circuit 3.

The circuit must include a power source, 3 lamps, 1 ammeter, 1 voltmeter and a switch.

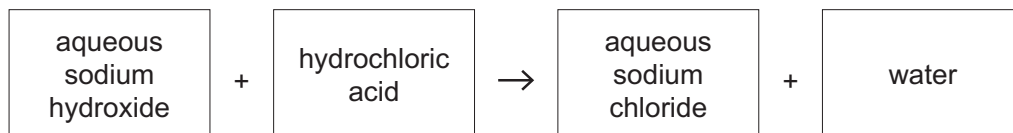
[2]

[Total: 10]

4 Aqueous sodium hydroxide is an alkali.

When aqueous sodium hydroxide reacts with hydrochloric acid, a neutralisation reaction takes place and aqueous sodium chloride is made.

The word equation for this reaction is shown.



To make **pure** aqueous sodium chloride, the amount of aqueous sodium hydroxide added needs to be the exact amount to just neutralise the hydrochloric acid.

Plan an experiment to make a pure sample of sodium chloride **solid**.

You may use any common laboratory apparatus, aqueous sodium hydroxide, hydrochloric acid and any named indicator.

Your plan should include:

- a brief description of the method including the apparatus you would use
- safety precautions **and** explain why these are needed
- how you make sure the sodium chloride is pure
- the measurements you will make.

A diagram is not required but you may draw one if it helps to explain your plan.

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