International General Certificate of Secondary Education
CAMBRIDGE INTERNATIONAL EXAMINATIONS

PHYSICAL SCIENCE **0652/6**

PAPER 6 Alternative to Practical

OCTOBER/NOVEMBER SESSION 2002

1 hour

Candidates answer on the question paper.
No additional materials are required.

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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	
7	
TOTAL	

This question paper consists of 11 printed pages and 1 blank page.

1 When aqueous sodium thiosulphate reacts with acid, a precipitate of sulphur is formed.
An experiment was done to investigate how the time taken for this reaction varied with temperature.
- 50 cm^3 of aqueous sodium thiosulphate, was placed in a conical flask.
- The conical flask was warmed to a temperature of 30 °C.
- 5 cm^3 of hydrochloric acid was added to the conical flask and a clock was started.
- The flask was placed on top of a black cross drawn on white paper, as shown in Fig. 1.1.
- The time taken for enough precipitate to form, so that the cross could not be seen, was noted in Fig. 1.2.
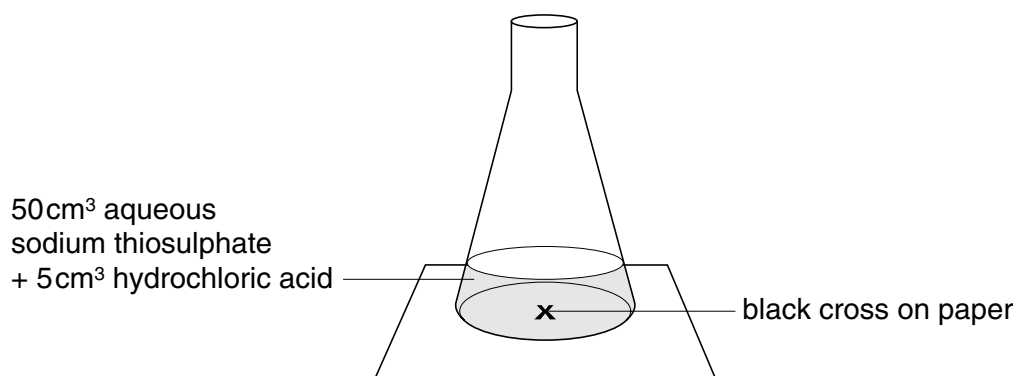
50cm^3 aqueous
sodium thiosulphate
+ 5cm^3 hydrochloric acid ——

—— black cross on paper

Fig. 1.1

temperature/°C	30	40	50	60	70
time taken for cross to disappear/s	75				

Fig. 1.2

The procedure was repeated at four different temperatures.
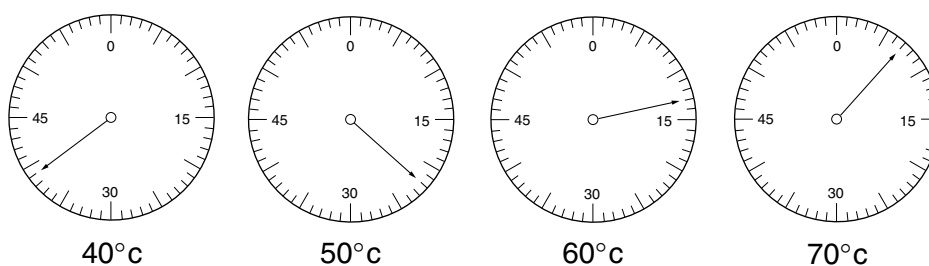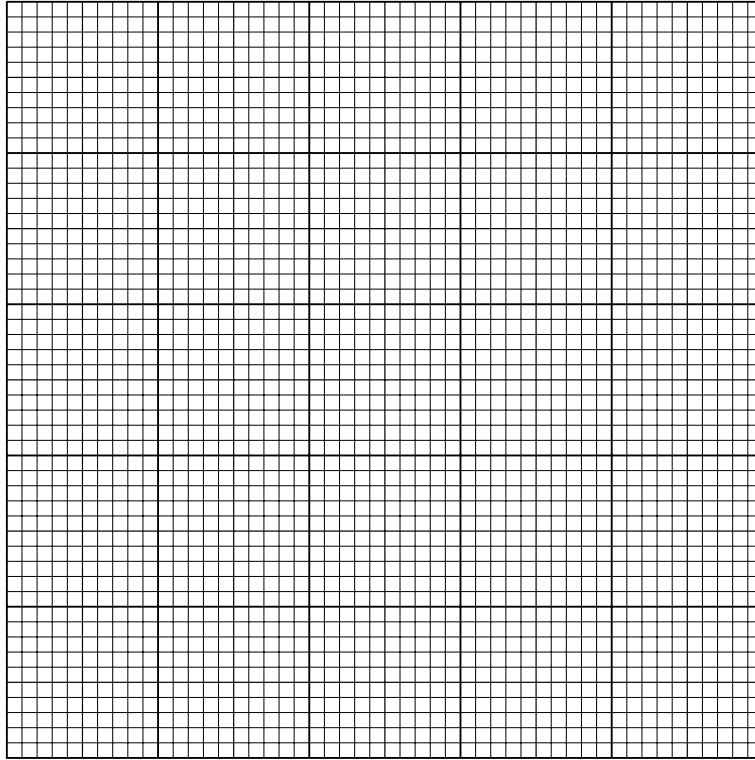The times taken for the precipitates to form are shown in Fig. 1.3.

40°c   50°c   60°c   70°c

Fig. 1.3

(a) Read the clock dials in Fig. 1.3 and record the times in Fig. 1.2. [2]

(b) On the grid provided, plot a graph of time (vertical axis) against temperature, and draw a smooth curve through the points.

[4]

(c) Describe the relationship between the temperature and the time taken for the reaction to occur.

....

....[1]

(d) Use your graph to find the temperature required to give a reaction time of 50 seconds. Show how you do this on the graph.

temperature = ...°C [1]

(e) The graph you have plotted does not show the relationship between the **rate** of reaction and the temperature. Briefly explain what you would do with the results to show such a relationship.

....

....[1]

(f) Briefly describe how you would carry out an experiment at 0 °C to find the reaction time.

....

....[1]

[Turn over

2 The teacher demonstrated the use of a Geiger-Muller tube, connected to a scaler, to investigate a radioactive sample.
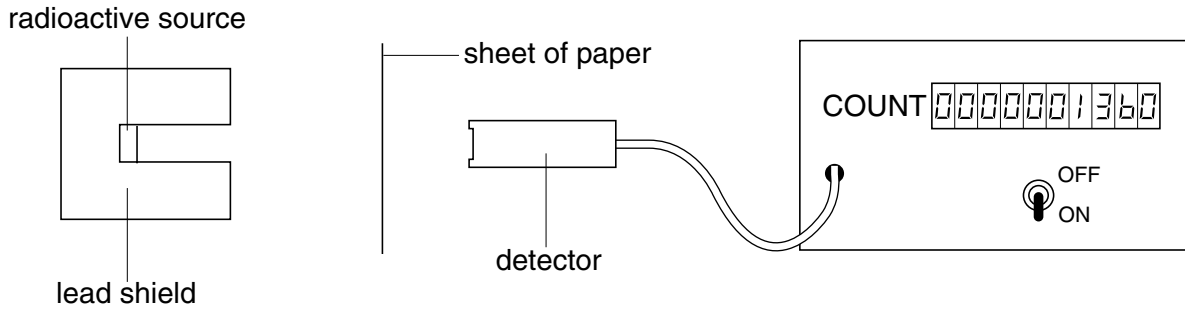The apparatus is shown in Fig. 2.1.

radioactive source

sheet of paper

COUNT 00000001360

OFF

ON

detector

lead shield

Fig. 2.1

In each experiment, the radioactivity was counted for five minutes or for ten minutes.
Fig. 2.2, shows how the count rate was changed when sheets of paper, aluminium and lead were placed in front of the detector and when the radioactive source was removed.

expt. no	how the count was done	total count	time of count/minutes	counts per minute
1	nothing was placed between the source and the detector	3875	5	
2	a sheet of paper was placed between the source and the detector	1760	5	
3	a 1 mm sheet of aluminium was placed between the source and the detector	640	5	
4	a 3 mm thick sheet of aluminium was placed between the source and the detector	335	5	
5	a 3 mm sheet of lead was placed between the source and the detector	170	10	
6	the source was taken away from the apparatus	90	10	

Fig. 2.2

(a) Complete the final column of the table by calculating the counts per minute. [2]

(b) Explain the reason for experiment 6.

....

....[1]

(c) Use the data in the table to suggest

    (i) what type of radiation was detected in experiment 5,

                            .... [1]

    (ii) what types of radiation were stopped by the aluminium in experiment 4,

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

    (iii) what type of radiation was stopped by the paper in experiment 2.

                            .... [1]

(d) State one rule for the safety of the teacher and the class when a radioactive source is being used in an experiment.

....[1]

(e) State how the radioactive source should be stored when it is not in use.

....

....[2]

[Turn over

3 A student did an experiment to find the energy change when a weighed mass of solid **Z** dissolved in a measured volume of water in a glass beaker.
The energy change during the reaction was shown by the change in temperature of the beaker and the water.
Fig. 3.1 shows the balance reading when the beaker was weighed.
Fig. 3.2 shows the balance reading when the beaker containing solid **Z** was weighed.
Fig. 3.3 shows the temperature of the 25 cm^3 of water.
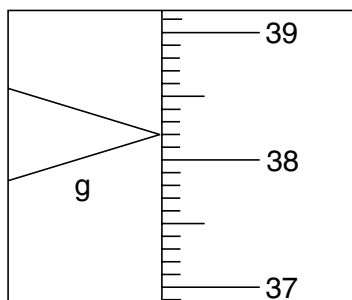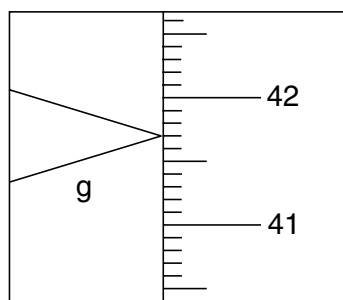Fig. 3.4 shows the temperature of the water after solid **Z** had dissolved.

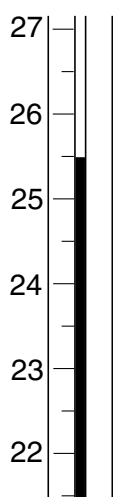**Fig. 3.1**   **Fig. 3.2**
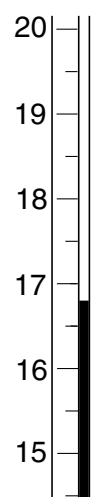
Fig. 3.3   **Fig. 3.4**

(a) Read the balance and the thermometer scales and then complete Fig. 3.5.

mass of beaker	M_1 = ...g
mass of beaker + solid **Z**	M_2 = ...g
mass of solid **Z**	M_3 = ...g
temperature of the 25 cm^3 of water	T_1 = ...°C
temperature of the solution of **Z** in water	T_2 = ...°C

[5]

Fig. 3.5

(b) Calculate the temperature change, $T_2 - T_1$.

temperature change, $T_2 - T_1$ = ...°C [1]

(c) (i) Convert M_1, the mass of the beaker in grams, into kilograms.

mass of the beaker in kilograms = ...kg [1]

(ii) Multiply this mass by 670. This gives the heat energy stored by the beaker, **H** joules, for each degree Celsius change.

heat energy stored by the beaker, **H** = ... joules [1]

(d) Using your answers to **(b)** and **(c) (ii)**, calculate the total heat energy change when solid **Z** dissolved in water, using the formula below.

total heat energy change = $(T_2 - T_1)$ x $(H + 105)$ joules

total heat energy change = ... joules [1]

(e) Is the dissolving of **Z** in water exothermic or endothermic? Explain your answer.

....

....[1]

[Turn over

4 Lemon juice contains citric acid which gives it a sour taste.
Citric acid reacts with sodium hydroxide to form the salt sodium citrate.
Study the information given in Fig. 4.1 and Fig. 4.2. Use the information to answer the questions which follow.

name of substance	appearance	solubility in water
citric acid	white crystals	soluble
sodium citrate	white crystals	soluble

Fig. 4.1

name of indicator	colour at pH5	colour at pH9
phenolphthalein	colourless	purple

Fig. 4.2

(a) Describe how you could make a sample of citric acid crystals from the juice of a lemon.

....

....

....

....[3]

(b) Describe how you could make a sample of sodium citrate crystals using the citric acid crystals from the experiment in **(a)** and the indicator named in Fig. 4.2. You may assume that sodium hydroxide solution and the usual laboratory apparatus are available.

....

....

....

....

....

....

....

....

....[7]

5 The teacher asks a student to place switches in an electrical circuit so that three lamps can be controlled. Fig. 5.1 shows the circuit **without** the switches.
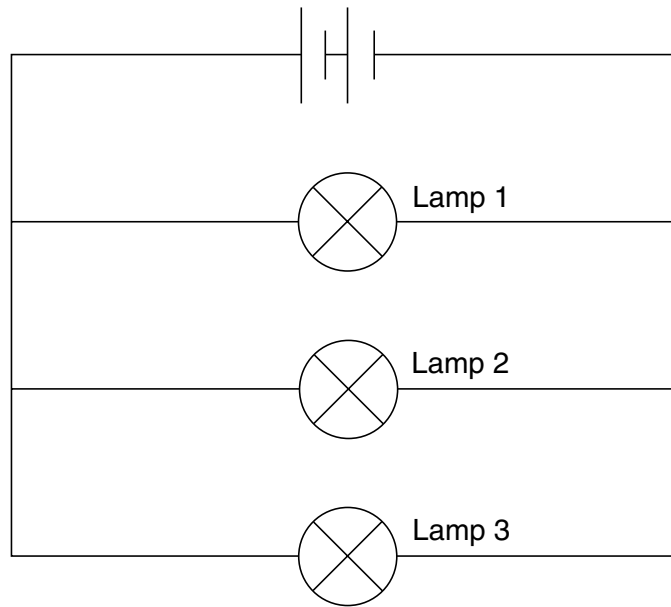

Fig. 5.1

(a) In the space below draw the circuit symbol for an open switch.

[1]

(b) On Fig. 5.1 draw and label a switch to

   (i) switch **off** all of the lamps at the same time, labelled **S1** [1]

  (ii) switch **off** lamp 1 but leave lamps 2 and 3 **on** – labelled **S2** [1]

 (iii) switch **off** lamps 2 and 3 at the same time, but leave lamp **S1** on, labelled **S3** [1]

(c) The student wants to measure the voltage provided by the battery. On Fig. 5.1 draw a symbol for a voltmeter in the correct place to measure this voltage. [2]

[Turn over

6 A student was given three colourless liquids in separate test tubes.
Liquid **A** was dilute sulphuric acid, liquid **B** was aqueous calcium hydroxide and liquid **C** was purified water.
He performed the tests shown in Fig. 6.1 and made the observations shown.
Complete the missing conclusions that the student should make and, in the final column of the table, identify which liquid **A**, **B** or **C** was being used for the test in each case:

	test	observations	conclusions	liquid used? **A**, **B** or **C**?
(a)	liquid added to sodium carbonate	gas evolved that turned limewater milky	the gas was .... [1]	[1]
(b)	liquid tested with pH paper	pH paper turned blue	the pH was .... [1]	[1]
(c)	boiling point of liquid tested	100 °C		[1]
(d)	liquid added to barium nitrate solution	white precipitate	the precipitate was .... [1]	[1]
(e)	carbon dioxide bubbled through the liquid	liquid turned milky	insoluble carbonate formed	[1]

Fig. 6.1

7 A student was asked to find out which coloured inks were present in a mixture, **M**.
She was given a sample of **M**.
She was also given blue, yellow, green and **two** red inks, which were all single substances.
Three of these inks were present in **M**.
In addition, the student was provided with the following apparatus:

a sheet of chromatography paper
a pencil
a ruler
a beaker
teat pipettes
a paper clip

Explain how the student could use the apparatus to find out which three of the five coloured inks were present in the mixture **M**.

You may draw diagrams to help your explanation if you wish.

[6]

12

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