Physical and Chemical Changes

Question Paper

Level	IGCSE
Subject	Chemistry
Exam Board	CIE
Topic	Chemical Reactions
Sub-Topic	Physical and Chemical Changes
Paper Type	Alternative to Practical
Booklet	Question Paper

Time Allowed: **71 minutes**

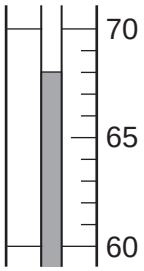
Score: **/59**

Percentage: **/100**

1 A student investigated the solubility of salt **A** in water at various temperatures.
Five experiments were carried out.

Experiment 1

The student was provided with a boiling tube containing 12 g of salt **A**.
A burette was filled with distilled water and 10.0 cm^3 of water was added to the boiling tube.
The mixture of salt **A** and water was heated until all of the solid had dissolved.
The boiling tube was removed from the heat and the solution was stirred with a thermometer and allowed to cool.
The temperature at which crystals first appeared was measured.
Use the thermometer diagram to record the temperature in the table of results.



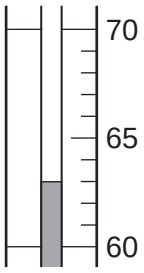
The boiling tube and contents were kept for the next four experiments.

Experiment 2

From the burette, 1.0 cm^3 more of water was added into the boiling tube and contents from Experiment 1.

The experiment was repeated exactly as before to find the temperature at which crystals first appeared.
The boiling tube was dipped for short periods of time in a beaker of cold water to speed up the cooling.

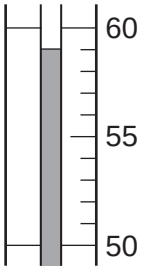
Record, in the table of results, the total volume of water in the boiling tube.
Use the thermometer diagram to record the temperature at which crystals first appeared.



Experiment 3

From the burette 1.0 cm^3 more of water was added into the boiling tube and contents from Experiment 2. The experiment was repeated exactly as before.

Record, in the table of results, the total volume of water used.
Use the thermometer diagram to record the temperature at which crystals first appeared.



This procedure was continued for Experiments 4 and 5 with two more successive additions of 1.0 cm^3 of water. Note all the results in the table.

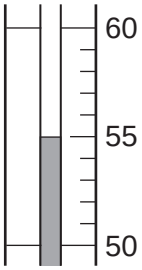


diagram for Experiment 4

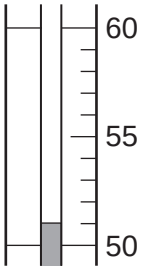


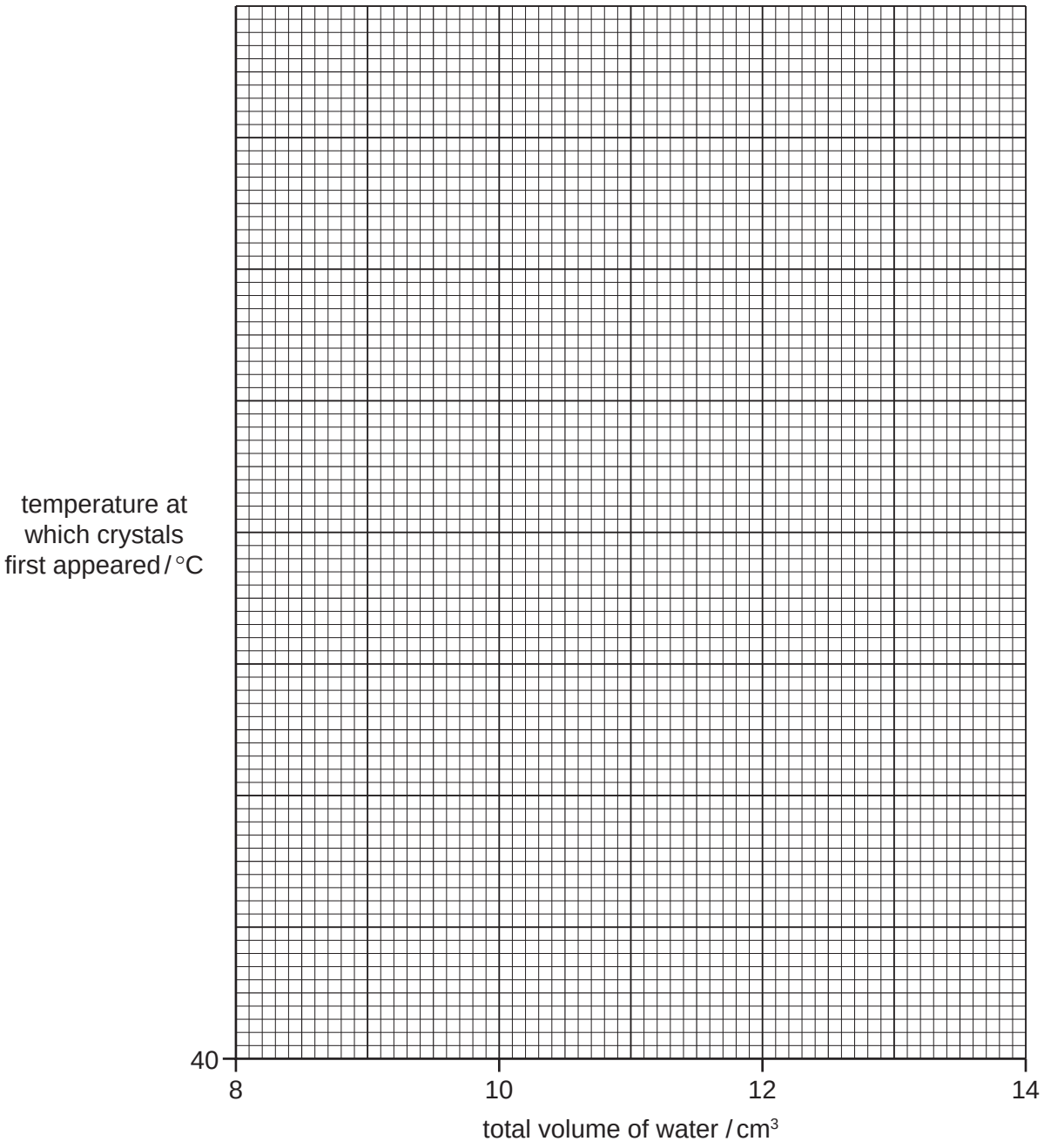
diagram for Experiment 5

Table of results

experiment	total volume of water / cm^3	temperature at which crystals first appeared / °C
1	10.0	
2		
3		
4		
5		

[5]

(a) Plot the results on the grid below and draw a straight line graph.



[6]

(b) How did the student know when salt **A** was completely dissolved in the water?

..... [1]

(c) **From your graph**, find the temperature at which crystals of salt **A** would first appear if the total volume of water in the solution was 9.0 cm^3.

Show clearly **on the grid** how you worked out your answer.

..... [2]

(d) Suggest, with a reason, how the results would be different if 6 g of salt **A** were used instead of 12 g of salt **A**.

.....

..... [2]

(e) Salt **B** is more soluble in water than salt **A**.
Sketch on the grid the graph you would expect for salt **B**. Label this graph. [2]

(f) Explain **one** improvement you could make to the experimental procedure to obtain more accurate results in this investigation.

improvement .....

explanation ..... [2]

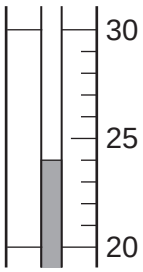
[Total: 20]

2 A student investigated the addition of four different solids, **A**, **B**, **C** and **D**, to water.

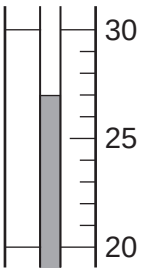
Five experiments were carried out.

Experiment 1

By using a measuring cylinder, 30 cm^3 of distilled water was poured into a polystyrene cup and the initial temperature of the water was measured. 4 g of solid **A** was added to the cup and the mixture stirred with a thermometer. The temperature of the solution was measured after 2 minutes.



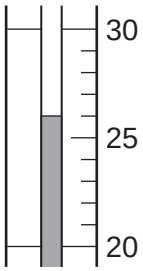
initial temperature



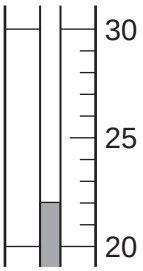
final temperature

Experiment 2

Experiment 1 was repeated using 4 g of solid **B**.



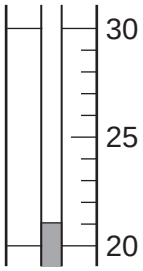
initial temperature



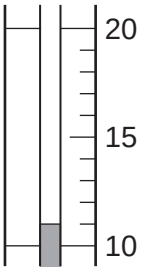
final temperature

Experiment 3

Experiment 1 was repeated using 4 g of solid **C**.



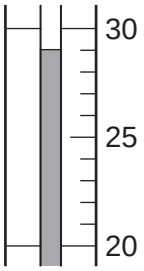
initial temperature



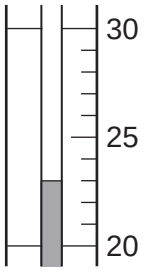
final temperature

Experiment 4

Experiment 1 was repeated using 4 g of solid **D**.



initial temperature



final temperature

Experiment 5

A little of the solution from Experiment 4 was added to a little of the solution from Experiment 2 in a test-tube. The observations were recorded.

observations *A fast reaction. Vigorous effervescence and bubbles produced.*

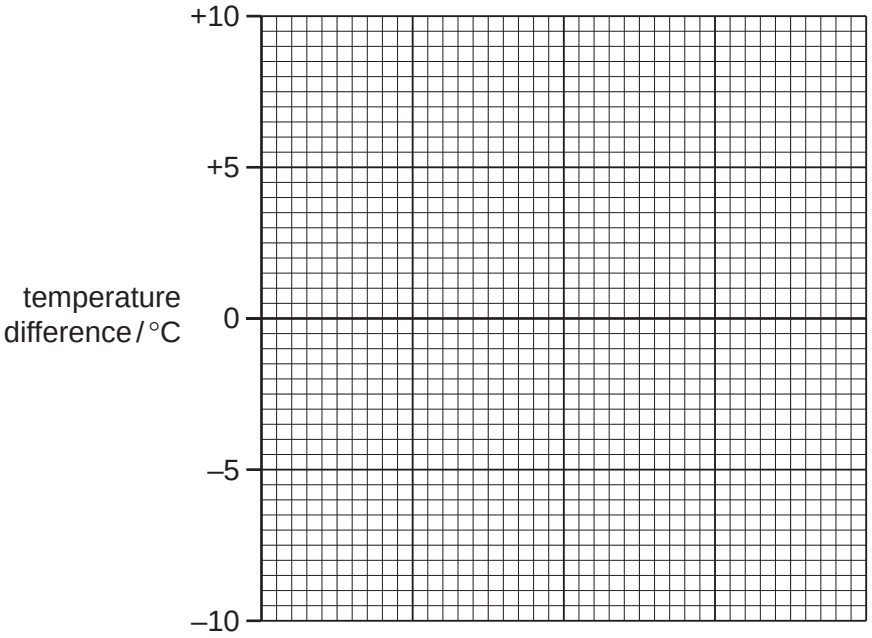
(a) Use the thermometer diagrams for Experiments 1-4 to record the initial and final temperatures in Table 4.1.
Calculate and record the temperature difference in Table 4.1.

Table 4.1

experiment	temperature / °C	fina temperature / °C	differen / °C
1			
2			
3			
4			

[4]

(b) Draw a labelled bar chart of the results to Experiments 1, 2, 3 and 4 on the grid below.



[4]

Use the results and observations from Experiments 1-5 to answer the following questions.

(c) **(i)** Which solid dissolves in water to produce an exothermic reaction?

.....

[1]

(ii) Give a reason why you chose this solid.

.....

[1]

(d) Which Experiment produced the largest temperature change?

.....

[1]

(e) Predict the temperature change that would happen if

(i) 8 g of solid **B** were used in Experiment 2,

.....

[1]

(ii) 60 cm^3 of water was used in Experiment 4.

.....

[1]

(iii) Explain your answer to **(e)(ii)**.

.....

.....

[2]

(f) Suggest an explanation for the observations in Experiment 5.

.....

.....

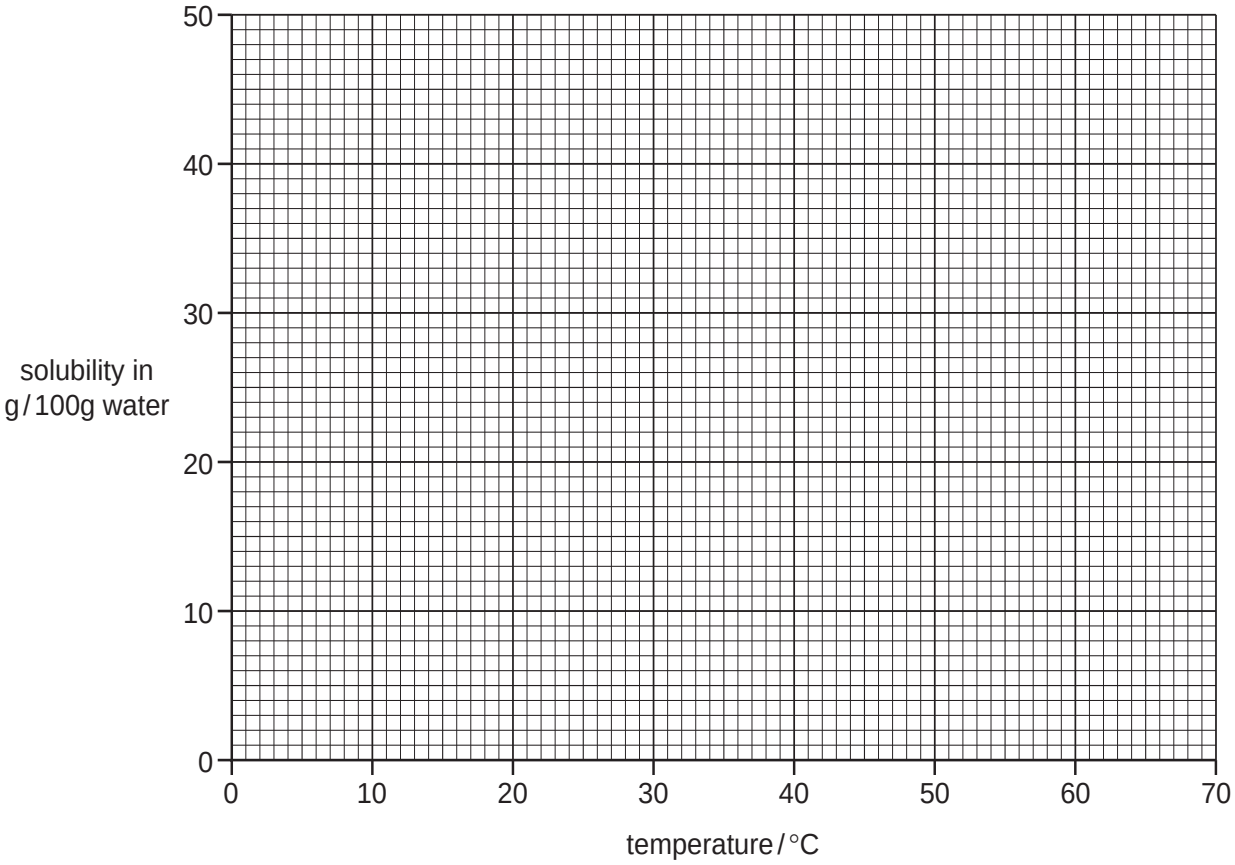
[2]

[Total: 17]

3 An experiment was carried out to determine the solubility of potassium chlorate at different temperatures. The solubility is the mass of potassium chlorate that dissolves in 100 g of water.
The results obtained are shown in the table below.

temperature / °C	0	**10**	2				
solubility in g / 100 g water	14	**17**	2				

(a) On the grid, draw a smooth line graph to show the solubility of potassium chlorate at different temperatures.



[4]

(b) Use your graph to determine the solubility of potassium chlorate at 70 °C. Show clearly on the graph how you obtained your answer.

.....

[2]

(c) What would be the effect of cooling a saturated solution of potassium chlorate from 60 °C to 20 °C?

.....

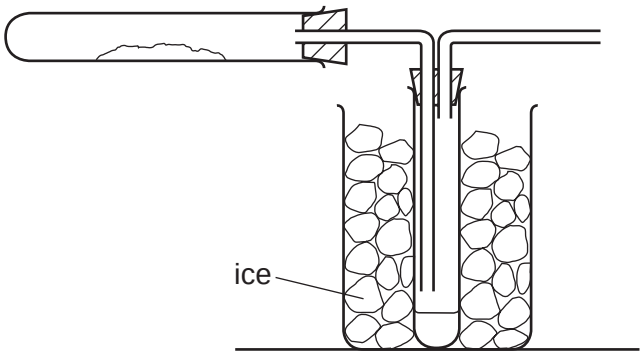
.....

.....

[2]

[Total: 8]

4 Hydrated copper sulphate crystals, $CuSO_4.5H_2O$ were heated in the apparatus shown below.



(a) Indicate on the diagram using arrows

(i) where the copper sulphate crystals are placed,

(ii) where heat is applied. [2]

(b) What is the purpose of the ice?

..... [1]

(c) The crystals changed colour from ..... to ..... [2]

[Total: 5]

5 The following paragraph was taken from a student's notebook.

To make potassium chloride

25.0 cm^3 of aqueous potassium hydroxide were placed in a flask and a few drops of indicator were added. Dilute hydrochloric acid was added to the flask until the indicator changed colour. The volume of acid used was 19.0 cm^3.

(a) What piece of apparatus should be used to measure the aqueous potassium hydroxide?

.....[1]

(b) **(i)** Name a suitable indicator that could be used.

.....[1]

(ii) The indicator colour would change

from.....

to..... [2]

(c) Which solution was more concentrated? Explain your answer.

.....

.....[2]

(d) How could **pure** crystals of potassium chloride be obtained from this experiment?

.....

.....

.....

.....[3]