Acids, Bases and Salts

Question Paper 4

Level	IGCSE
Subject	Chemistry
Exam Board	CIE
Topic	Acids, Bases and Salts
Sub-Topic	
Paper Type	Alternative to Practical
Booklet	Question Paper 4

Time Allowed: **63 minutes**

Score: **/52**

Percentage: **/100**

1 A student investigated the reaction between two different solutions of deep purple potassium manganate(VII), **A** and **B**, and an acidic solution of hydrogen peroxide.

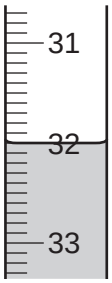
Three experiments were carried out.

Experiment 1

A burette was filled with the solution **A** of potassium manganate(VII) up to the 0.0 cm^3 mark. Using a measuring cylinder, 25 cm^3 of colourless hydrogen peroxide solution was poured into the conical flask.

The potassium manganate(VII) solution **A** was added slowly to the flask, and shaken to mix thoroughly. Addition of potassium manganate(VII) solution was continued until there was a permanent pink colour in the contents of the flask.

(a) Use the burette diagram to record the volume in the table of results and complete the column. [2]

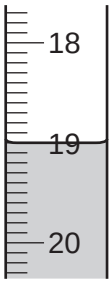


final reading

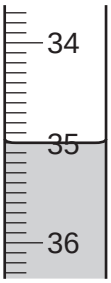
Experiment 2

Experiment 1 was repeated using the solution **B** of potassium manganate(VII) instead of solution **A**.

(b) Use the burette diagrams to record the volumes in the table of results and complete the table. [2]



initial reading



final reading

	experiment 1	experiment 2
final reading / cm^3		
initial reading / cm^3		
difference / cm^3		

Experiment 3

To a little of the hydrogen peroxide solution in a test-tube, manganese(IV) oxide was added.

Rapid effervescence was observed and a glowing splint relit.

(c) Identify the gas given off in Experiment 3.

..... [1]

(d) **(i)** What colour change was observed when potassium manganate(VII) solution was added to the flask?

from ..... to ..... [1]

(ii) Why was an indicator **not** added to the flask?

..... [1]

(e) **(i)** In which experiment was the greatest volume of potassium manganate(VII) solution used?

..... [1]

(ii) Compare the volumes of potassium manganate(VII) used in Experiments 1 and 2.

..... [1]

(iii) Suggest an explanation for the difference in volumes.

.....

.....

..... [2]

(f) If Experiment 2 was repeated using 12.5 cm^3 of the hydrogen peroxide solution, what volume of potassium manganate(VII) solution would be needed to react completely? Explain your answer.

.....

..... [3]

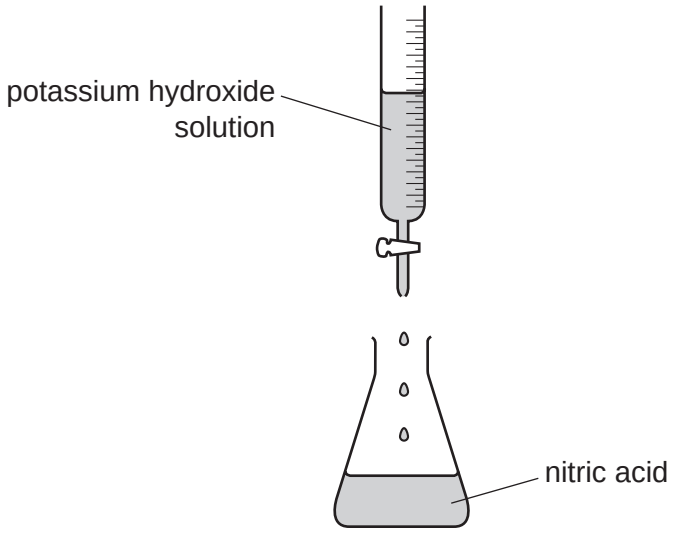
(g) Give **one** advantage and **one** disadvantage of using a measuring cylinder for the hydrogen peroxide solution.

advantage .....

disadvantage ..... [2]

[Total: 16]

2 A student prepared a sample of potassium nitrate by neutralising nitric acid using potassium hydroxide solution.
25.0 cm^3 of nitric acid was poured into a conical flask. Potassium hydroxide was added a little at a time from a burette as shown below.

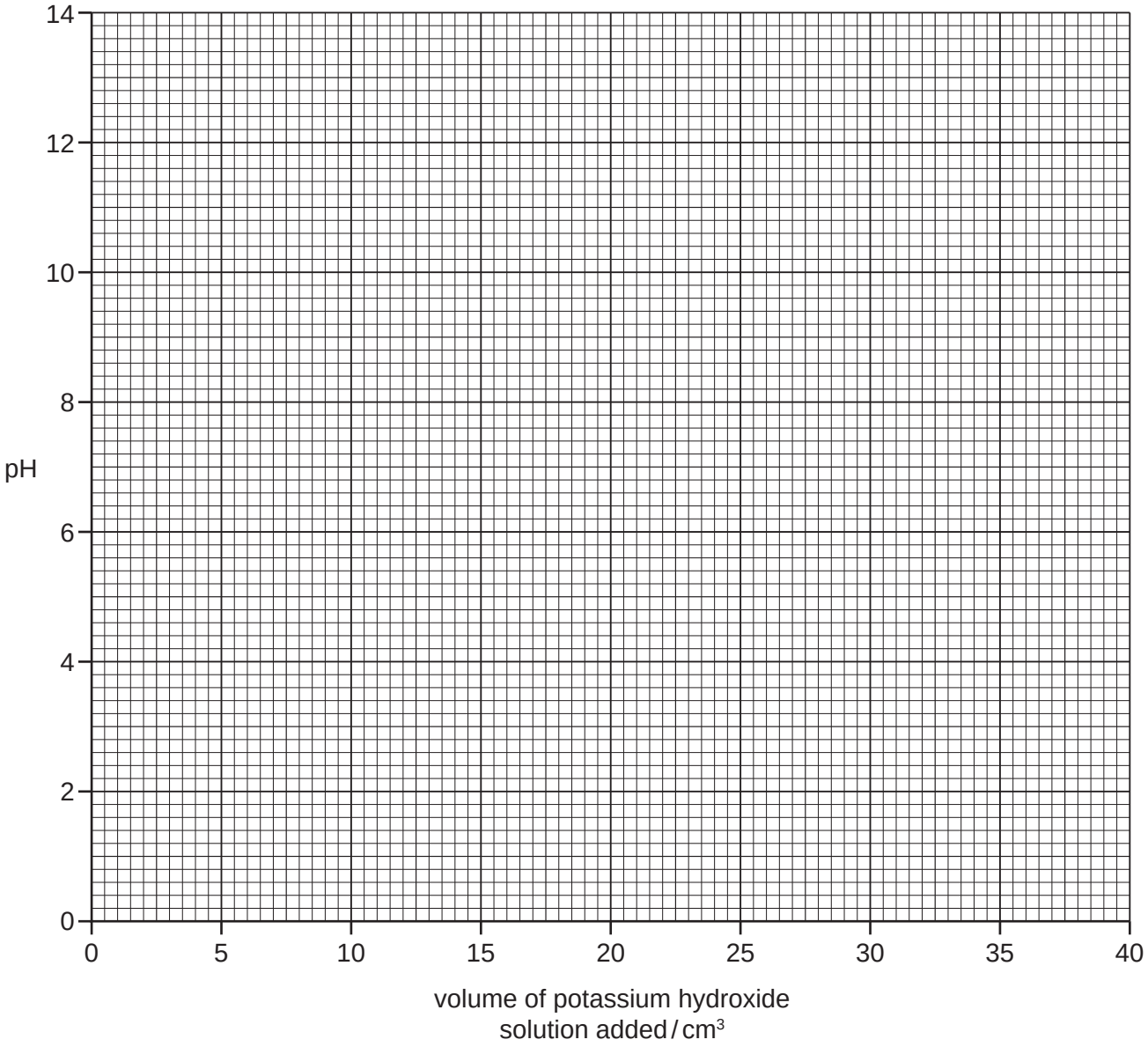


After each addition of potassium hydroxide solution the pH was measured with a pH meter and the values recorded in the table of results.

volume of potassium hydroxide solution added / cm^3	pH value
5.0	1.2
10.0	1.4
15.0	2.6
20.0	2.0
24.0	2.7
24.5	3.0
25.5	11.0
26.0	11.3
30.0	12.0
40.0	13.2

You are going to draw a graph to find the volume of potassium hydroxide solution required to neutralise the 25.0 cm^3 of nitric acid.

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



[3]

(b) Which point appears to be inaccurate?

..... [1]

(c) **(i)** **Use your graph** to find the pH of the solution when 35.0 cm^3 of potassium hydroxide was added.

..... [1]

(ii) **Use your graph** to find the pH of 25.0 cm^3 of nitric acid.

Show clearly **on the grid** how you obtained your answer.

..... [2]

(d) **(i)** What is the pH of the solution when all of the nitric acid has just been neutralised?

..... [1]

(ii) What volume of potassium hydroxide was required to neutralise 25.0 cm^3 of nitric acid?

..... [1]

(e) Describe how the student should modify the experiment to obtain pure crystals of potassium nitrate.

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.....

.....

..... [3]

[Total: 12]

3 Seawater contains sodium chloride and other salts.
Plan an experiment to find the mass of salts in 1 dm^3 of seawater.
You will be provided with a small bottle of seawater.
You should include details of the method and any apparatus used.
(1 dm^3 = 1000 cm^3)

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.....

.....

.....

.....

..... [6]

[Total: 6]

4 A student investigated the reaction of aqueous sodium hydroxide with two different acids, acid **C** and acid **D**.

Two experiments were carried out.

Experiment 1

By using a measuring cylinder, 20 cm^3 of aqueous sodium hydroxide was poured into a conical flask and the initial temperature of the solution was measured.

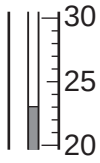
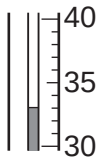
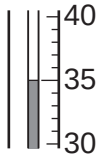
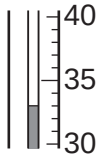
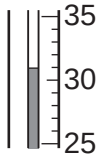
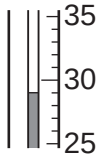
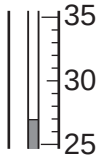
A burette was filled with acid **C** up to the 0.0 cm^3 mark.

5 cm^3 of acid **C** was added to the sodium hydroxide in the flask. The temperature of the mixture was measured.

Further 5 cm^3 portions of acid **C** were added to the mixture in the flask, stirring with the thermometer until a total volume of 30 cm^3 of acid **C** had been added. The temperatures after each 5 cm^3 portion had been added were measured.

(a) Use the thermometer diagrams to record the temperatures in the table of results.

Table of results

volume of acid **C** added / cm^3	thermometer diagrams	temperature / °C
0		
5		
10		
15		
20		
25		
30		

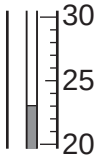
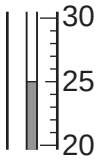
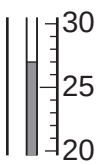
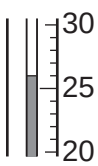
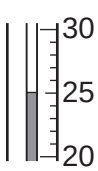
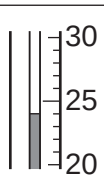
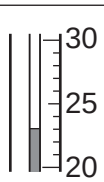
[2]

Experiment 2

The burette was emptied and rinsed with water. Experiment 1 was repeated using acid **D**.

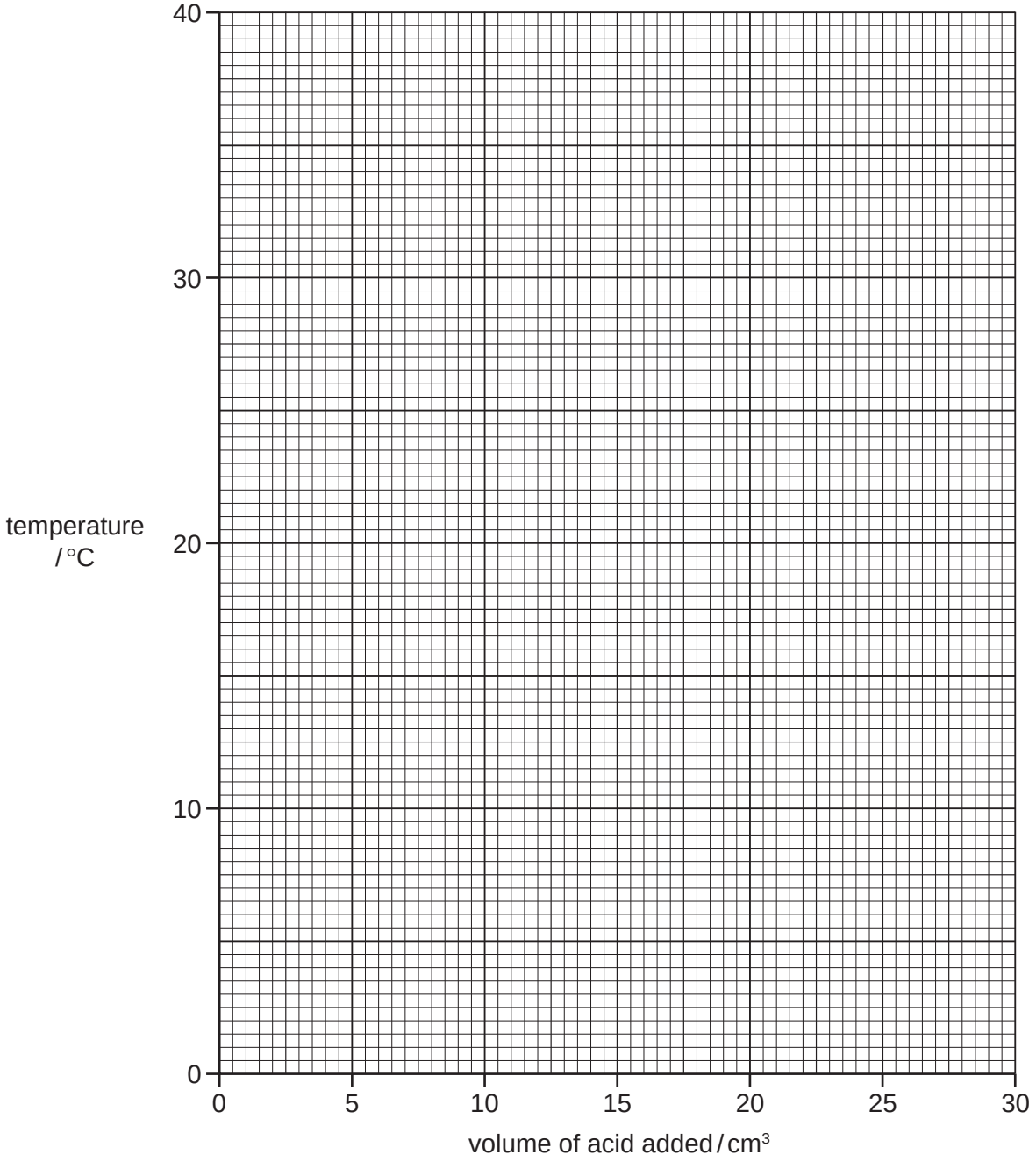
(b) Use the thermometer diagrams to record the temperatures in the table of results.

Table of results

volume of acid **D** added / cm^3	thermometer diagrams	temperature / °C
0		
5		
10		
15		
20		
25		
30		

[2]

(c) Plot the results for Experiments 1 and 2 on the grid and draw two smooth line graphs. Clearly label your graphs.



[6]

(d) From your graph, deduce the temperature of the mixture when 3 cm^3 of acid **C** reacted with sodium hydroxide in Experiment 1.

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

..... °C [2]

(e) **(i)** Which experiment produced the larger temperature change?

..... [1]

(ii) Suggest why the temperature change is greater in this experiment.

.....

.....

..... [2]

(f) Why was the burette rinsed with water in Experiment 2?

.....

..... [1]

(g) Predict the temperature of the reaction mixture in Experiment 2 after 1 hour. Explain your answer.

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..... [2]

[Total: 18]