Acids, Bases and Salts

Question Paper 1

Level	IGCSE
Subject	Chemistry
Exam Board	CIE
Topic	Acids, Bases and Salts
Sub-Topic	
Paper Type	Alternative to Practical
Booklet	Question Paper 1

Time Allowed: **58 minutes**

Score: **/48**

Percentage: **/100**

1 A teacher investigated the rate of a reaction between two solutions, **J** and **K**, and sulfuric acid at different temperatures.

Four experiments were carried out.

(a) *Experiment 1*

A large measuring cylinder was used to pour 50 cm^3 of distilled water and 40 cm^3 of sulfuric acid into a 250 cm^3 conical flask.
A small measuring cylinder was used to add 2 cm^3 of methyl orange and 5 cm^3 of solution **J** to the mixture in the conical flask. The temperature of the mixture was measured.
The reaction was started by adding 5 cm^3 of solution **K** to the conical flask, immediately starting the timer and swirling the mixture.
The time taken for the mixture to turn pale yellow was measured. The final temperature of the mixture was measured.

Experiment 2

Experiment 1 was repeated but the mixture in the conical flask was heated to about 30 °C **before** adding the solution **K**. The temperature of the mixture was measured.
5 cm^3 of solution **K** was added to the conical flask. The timer was started and the mixture swirled.
The time taken for the mixture to turn pale yellow was measured. The final temperature of the mixture was measured.

Experiment 3

Experiment 1 was repeated but the mixture in the conical flask was heated to about 40 °C before adding the solution **K** to the flask. The same measurements were taken.

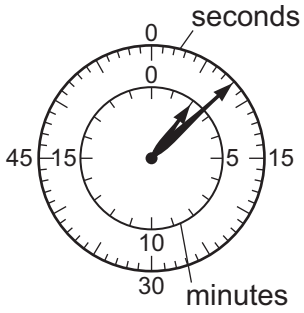
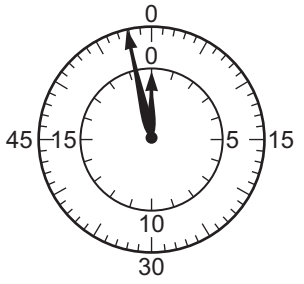
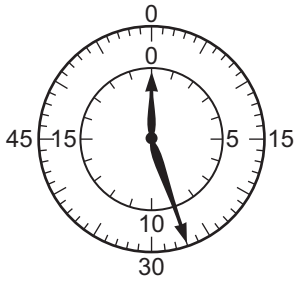
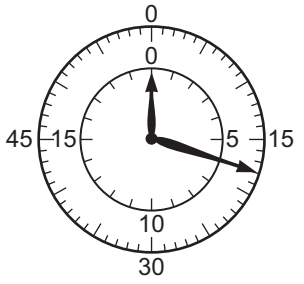
Experiment 4

Experiment 1 was repeated but the mixture in the conical flask was heated to about 50 °C before adding the solution **K** to the flask. The same measurements were taken.

Stop-clock diagrams for these experiments are on page 4.

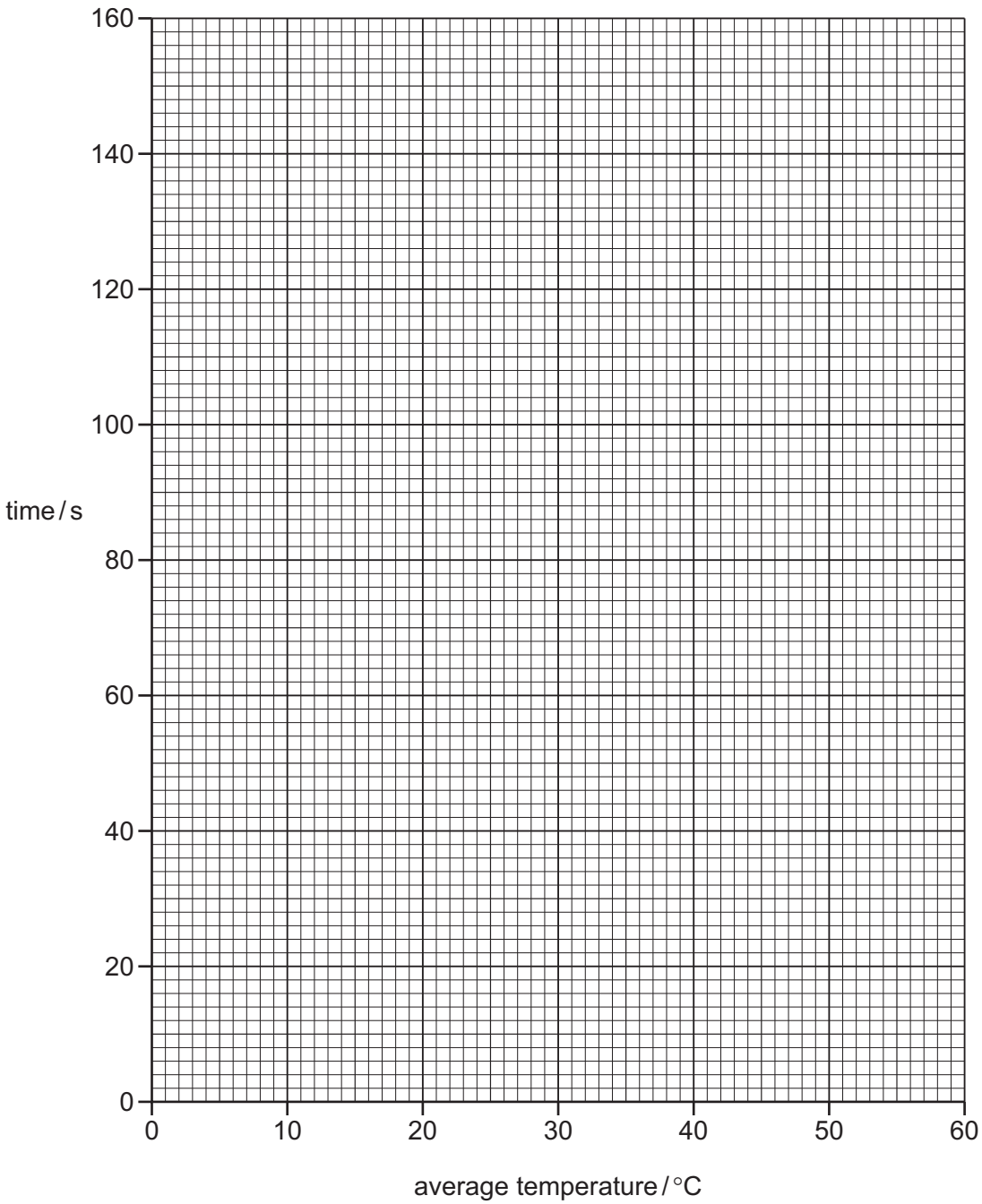
Use the stop-clock diagrams to record the times in the table.

Work out the average temperatures to complete the table.

experiment	stop-clock diagram	time taken for mixture to turn pale yellow / s	initial temperature / °C	final temperature / °C	average temperature / °C
1			17	15	
2			28	26	
3			42	40	
4			51	49	

[4]

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



[4]

(c) **From your graph** deduce the time taken for the mixture to turn pale yellow if Experiment 1 was repeated at an average temperature of 60 °C.
Show clearly **on the grid** how you worked out your answer.

..... [2]

(d) (i) In which experiment was the rate of reaction greatest?

..... [1]

(ii) Explain why the rate of reaction was greatest in this experiment.

.....

.....

..... [2]

(e) (i) Suggest and explain the effect **on the results** of using a burette to measure the volume of solution **J**.

.....

..... [2]

(ii) Suggest and explain one **other** improvement to these experiments.

.....

..... [2]

[Total: 17]

2 A student investigated the reaction of aqueous sodium hydroxide with aqueous solutions of two different acids, **A** and **B**.

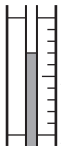
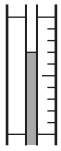
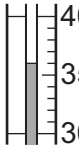
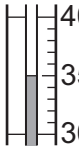
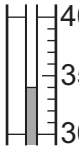
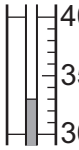
Two experiments were done.

(a) *Experiment 1*

Using a measuring cylinder, 50 cm^3 of aqueous sodium hydroxide solution was poured into a polystyrene cup. The initial temperature of the solution was measured.

A burette was filled with the solution of acid **A** to the 0.0 cm^3 mark.
5.0 cm^3 of acid **A** was added to the aqueous sodium hydroxide in the cup and the mixture stirred.
The temperature of the solution was measured. Another 5.0 cm^3 of acid **A** was added to the cup and the mixture stirred. The temperature of the mixture was measured.
More 5.0 cm^3 portions of acid **A** were added to the cup until a total volume of 40.0 cm^3 of acid had been added. After each addition, the mixture was stirred and the temperature measured.

Use the thermometer diagrams in the table to record the temperatures.

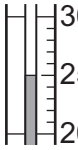
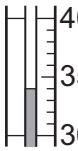
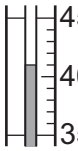
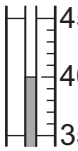
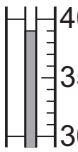
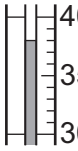
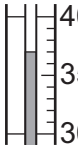
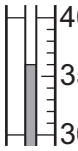
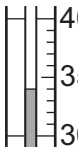
volume of acid **A** added / cm^3	thermometer diagram	temperature of solution in polystyrene cup / °C
0.0		
5.0		
10.0		
15.0		
20.0		
25.0		
30.0		
35.0		
40.0		

[3]

The burette was emptied and rinsed with distilled water, and then with acid **B**. This acid was discarded. The burette was then filled up to the 0.0 cm^3 mark with acid **B**.

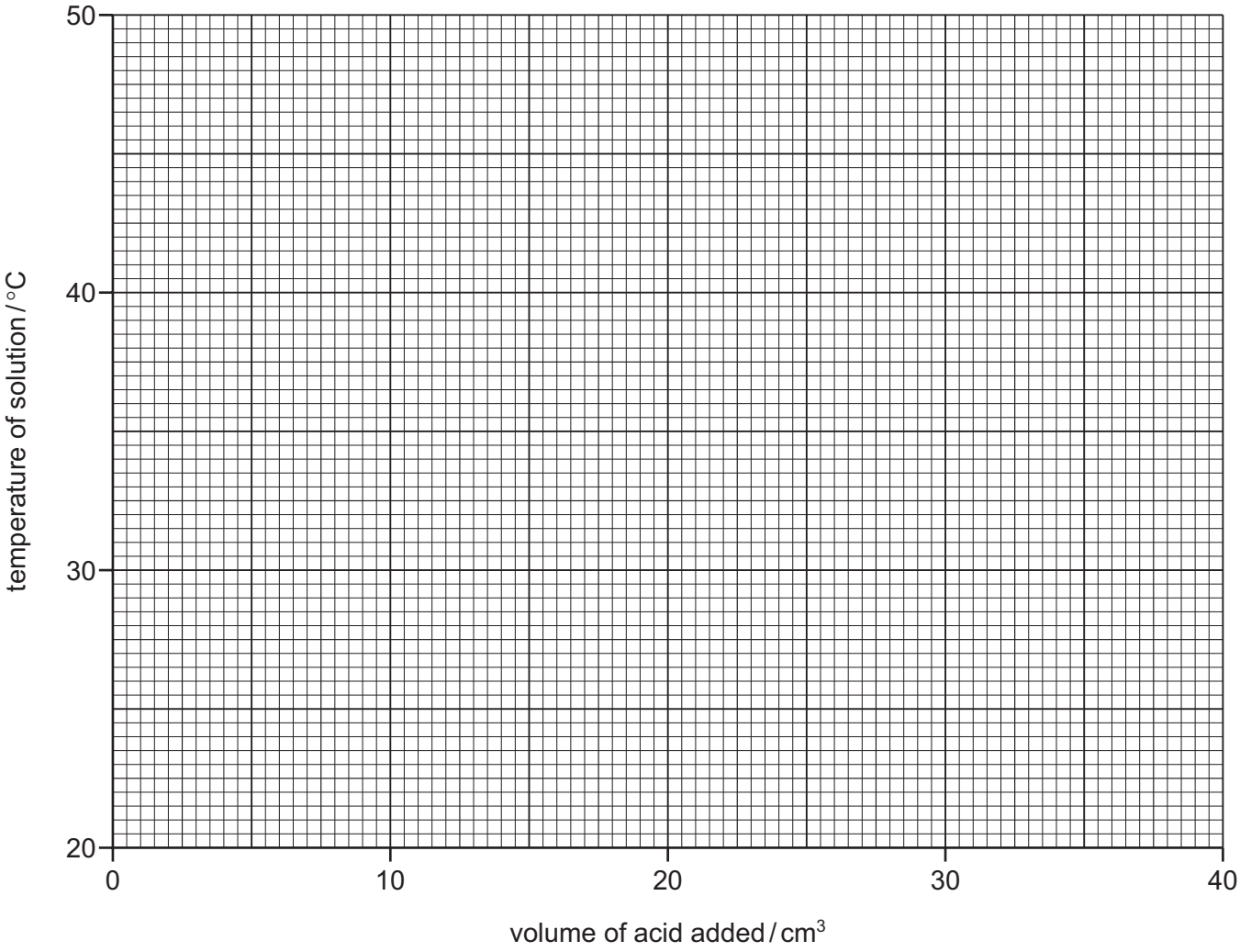
(b) *Experiment 2*

Experiment 1 was repeated using acid **B** instead of acid **A**.
Use the thermometer diagrams in the table to record the temperatures.

volume of acid **B** added / cm^3	thermometer diagram	temperature of solution in polystyrene cup / °C
0.0		
5.0		
10.0		
15.0		
20.0		
25.0		
30.0		
35.0		
40.0		

[3]

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



[5]

(d) **Use your graph** to estimate the temperature of the reaction mixture when 8.0 cm^3 of acid **B** were added to 50 cm^3 of aqueous sodium hydroxide.

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

..... [2]

(e) What type of chemical reaction, other than neutralisation, occurred when acid **A** reacted with sodium hydroxide?

..... [1]

(f) Why was the burette rinsed firstly with distilled water and then with acid **B** before starting Experiment 2?

.....

..... [2]

(g) The solutions of acids **A** and **B** are the same concentration.

(i) In which experiment was the maximum temperature change greater?

..... [1]

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

.....

..... [1]

(h) Describe one source of error in Experiment 2. Suggest one improvement to reduce this source of error.

source of error .....

improvement .....

[2]

[Total: 20]

3 Solid **C** was analysed. Solid **C** was a mixture of salts containing aluminium ions, sulfate ions and another cation (positive ion).
Tests on solid **C**, and some of the observations, are in the table.
Complete the observations in the table.

tests	observations
<u>tests on solid **C**</u> **(a)** Appearance of solid **C**.	white solid
(b) A little of solid **C** was heated gently and then strongly.	condensation was formed at the top of the test-tube
The gas given off was tested with damp pH indicator paper.	pungent gas, pH = 10
<u>tests on a solution of **C**</u> Water was added to solid **C** to produce an aqueous solution, solution **C**. **(c)** Drops of aqueous sodium hydroxide were added to solution **C** using a teat pipette.	.....
Excess aqueous sodium hydroxide was then added to the mixture.	..... [3]
The mixture was boiled gently and any gases given off were tested.	pungent gas, pH = 10
(d) Excess aqueous ammonia was added to solution **C**.	..... [1]
(e) A few drops of dilute nitric acid and aqueous silver nitrate were added to solution **C**.	..... [1]
(f) A few drops of dilute nitric acid and barium nitrate solution were added to solution **C**.	..... [2]

(g) What does the formation of condensation in test **(b)** tell you about the nature of solid **C**?

..... [1]

(h) What does test **(e)** tell you about the nature of solid **C**?

..... [1]

(i) **(** Name the gas given off in test **(b)**.

..... [1]

(ii) What is your conclusion about the identity of the other cation in solid **C**?

..... [1]

[Total: 11]