

1: Experimental techniques – Topic questions

Paper 6

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

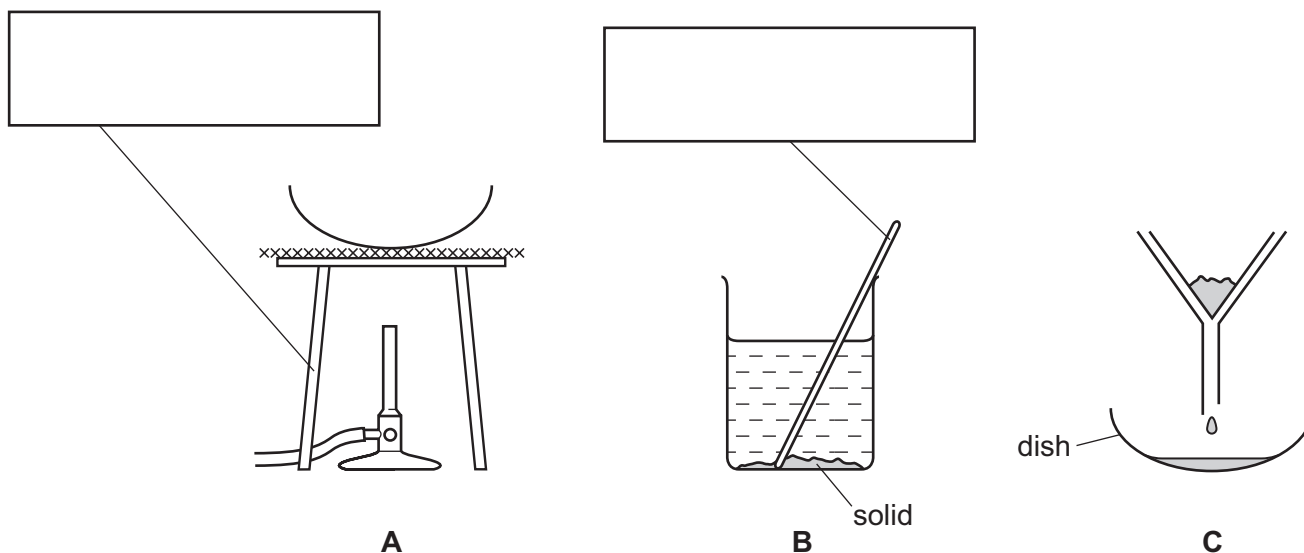
Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2016	March	62
3	2016	March	62
4	2016	March	62

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

- 1 The diagrams show the apparatus used to obtain crystals of calcium chloride from a mixture of solid calcium chloride and solid calcium carbonate.
Calcium chloride is soluble in water and calcium carbonate is insoluble in water.



(a) Complete the boxes to name the apparatus. [2]

(b) (i) Write down the order in which the apparatus should be used in this experiment.

..... [1]

(ii) Name the separation process in C.

..... [1]

(c) (i) What has been added to the mixture in B?

..... [1]

(ii) What is the general name given to the liquid in the dish in C?

..... [1]

(d) How would you know when to stop heating the dish in A?

.....

..... [1]

[Total: 7]

- 2 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 cm³ of distilled water and 40 cm³ of sulfuric acid into a 250 cm³ conical flask.

A small measuring cylinder was used to add 2 cm³ of methyl orange and 5 cm³ of solution **J** to the mixture in the conical flask. The temperature of the mixture was measured.

The reaction was started by adding 5 cm³ 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 cm³ 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.

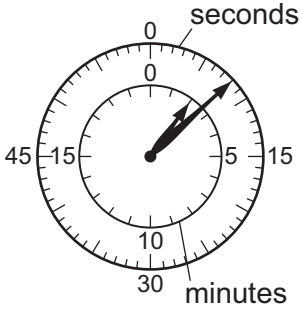
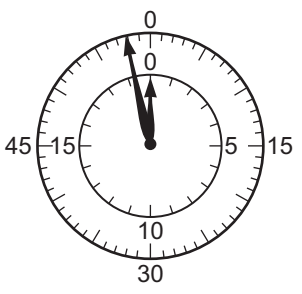
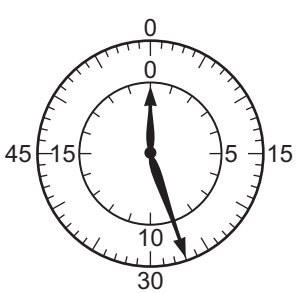
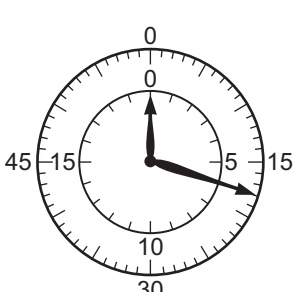
Experiment 4

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.

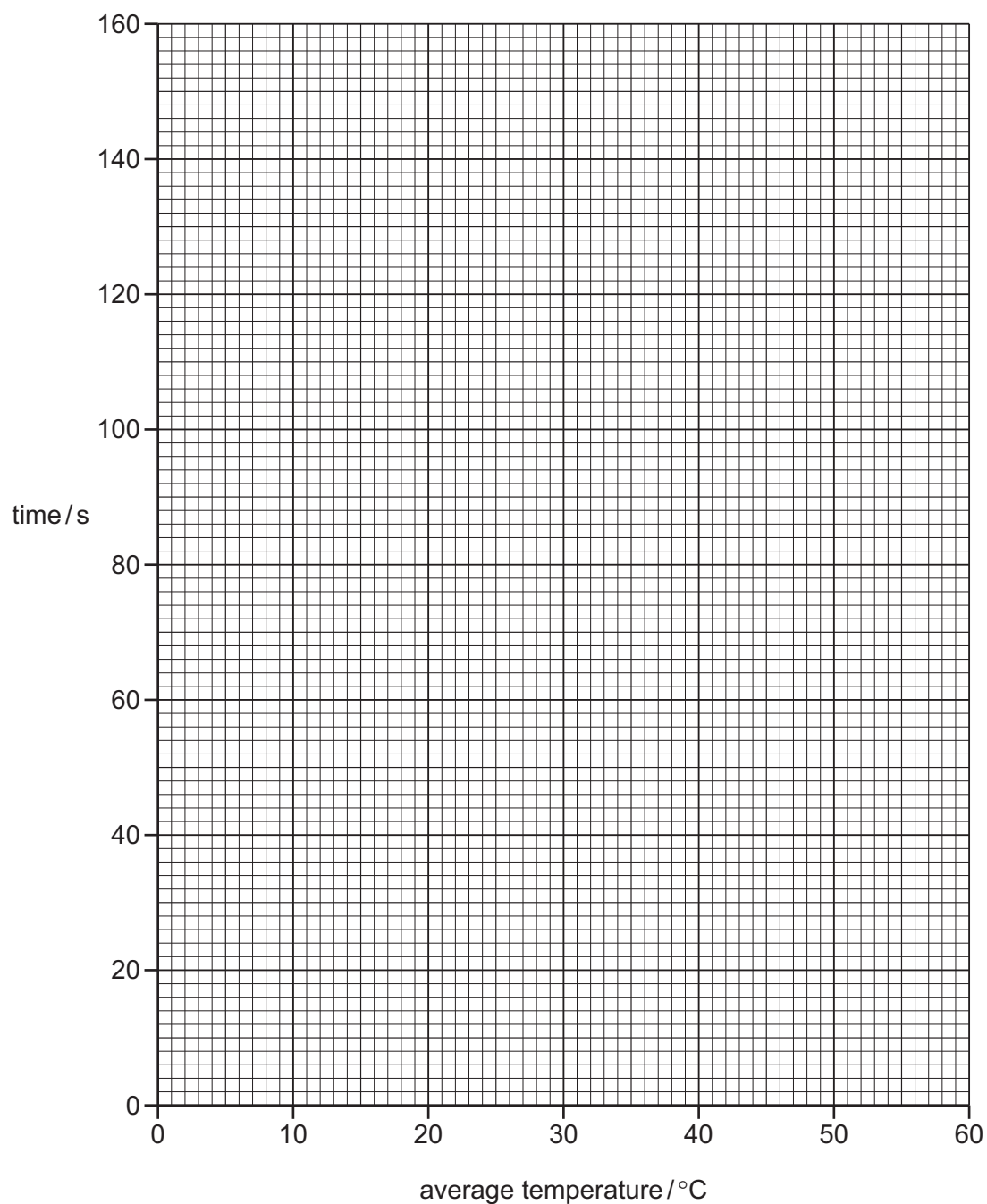
Use the stop-clock diagrams to record the times in the table.

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.

.....
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..... [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.

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..... [2]

[Total: 17]

4 The label on a bottle of orange drink stated ‘contains no artificial colours’. A scientist thought that the orange colour in the drink was a mixture of two artificial colours:

- Sunset Yellow E110
- Allura Red E129

Plan an investigation to show that the orange colour in the drink did **not** contain these two artificial colours.

You are provided with samples of E110, E129 and the orange colouring from the drink. You are also provided with common laboratory apparatus.

You may draw a diagram to help answer the question.

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..... [6]

[Total: 6]

Question	Answer	Mark
1 (a) (i)	tripod stirring rod/stirrer	2
1 (b) (ii)	B, C, A	1
1 (b) (ii)	filtration	1
1 (c) (i)	water	1
1 (c) (ii)	filtrate	1
1 (d)	solid/crystal appearing on edge/glass rod test	1
		Total: 7
3 (a)	blue/green (solid/crystals)	1
3 (b) (i)	(pale) blue precipitate royal/deep blue dissolves/solution	4
3 (b) (ii)	(pale) blue precipitate	1
3 (b) (iii)	white precipitate	1
3 (b) (iv)	no reaction/change/precipitate	1
3 (c)	ammonium; iodide	2
		Total: 10
4	any 6 from: chromatography (pencil) baseline/origin apply orange colour to paper add samples of both E110 and E129 solvent/names solvent check heights of spots of E colours against orange drink conclusion/allow comparison to known R_f values	6
		Total: 6