

# Criteria of purity

## Question Paper 1

Level	IGCSE
Subject	Chemistry (0620/0971)
Exam Board	Cambridge International Examinations (CIE)
Topic	Experimental techniques
Sub-Topic	Criteria of purity
Booklet	Question Paper 1

**Time Allowed:** 36 minutes

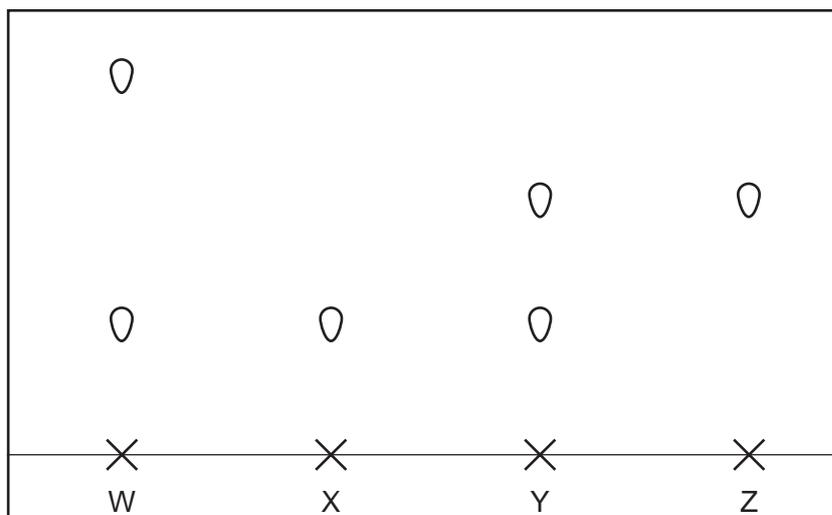
**Score:** /30

**Percentage:** /100

### Grade Boundaries:

9	8	7	6	5	4	3	2	1
>85%	75%	68%	60%	53%	48%	40%	33%	<25%

1 The diagram shows the paper chromatograms of four substances, W, X, Y and Z.



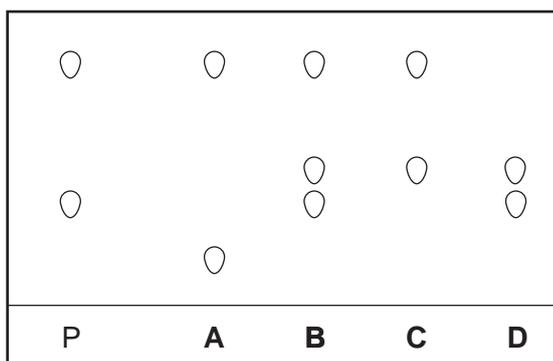
Which two substances are pure?

- A** W and X      **B** W and Y      **C** X and Y      **D** X and Z

2 Chromatography is used to find out if a banned dye, P, is present in foodstuffs.

The results are shown in the diagram.

Which foodstuff contains P?



- 3 A fruit drink coloured orange contains a dissolved mixture of red and yellow colouring agents. One of these colouring agents is suspected of being illegal.

Which method could be used to show the presence of this illegal colouring agent?

- A chromatography
- B distillation
- C evaporation
- D filtration

- 4 A student was provided with only a thermometer, a stopwatch and a beaker.

What could the student measure?

- A 10.5 g solid and 24.8 cm<sup>3</sup> liquid
- B 10.5 g solid and 25 °C
- C 24.8 cm<sup>3</sup> liquid and 45 seconds
- D 25 °C and 45 seconds

- 5 An aqueous solution is coloured.

Which method of separation would show that the solution contains ions of different colours?

- A chromatography
- B crystallisation
- C distillation
- D filtration

- 6 Solid W melts at exactly 54 °C and boils at exactly 302 °C.

Solid X, when dissolved in water and examined using paper chromatography, shows a blue colour and a red colour.

Which row is correct?

	contains only one substance	contains more than one substance
<b>A</b>	W and X	–
<b>B</b>	W	X
<b>C</b>	X	W
<b>D</b>	–	W and X

7 Diagram 1 shows the paper chromatogram of substance X.

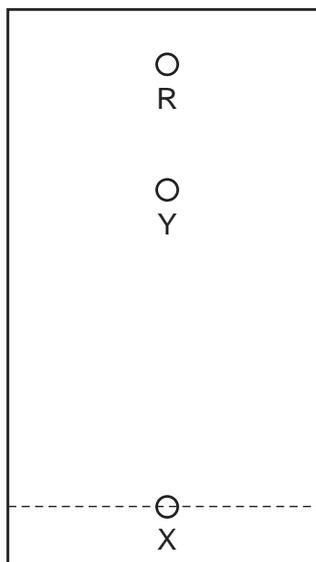


diagram 1

Diagram 2 shows the cooling curve for substance Y.

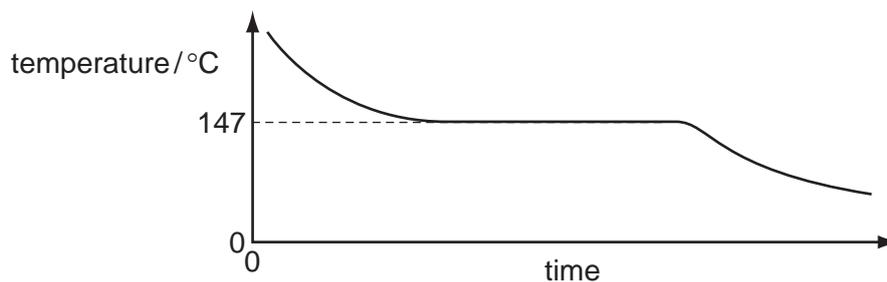
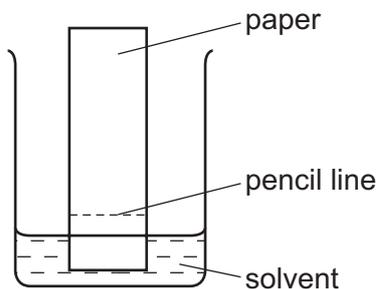


diagram 2

Which statement about X and Y is correct?

- A** X is a mixture and Y is a pure substance.
- B** X is a pure substance and Y is a mixture.
- C** X and Y are mixtures.
- D** X and Y are pure substances.

8 A student is investigating a coloured mixture using chromatography.



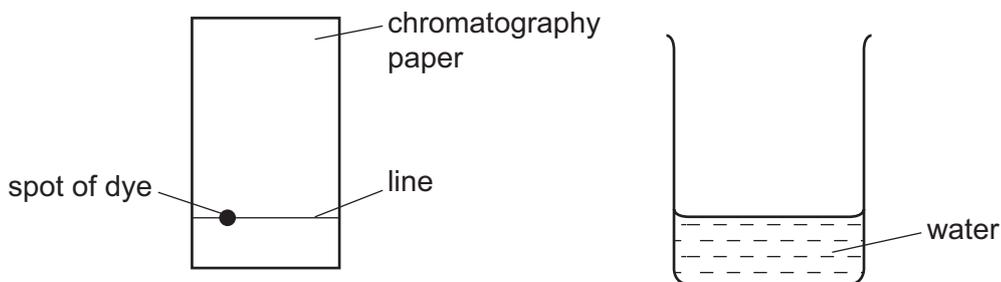
Where should he place the coloured mixture?

- A in the solvent
- B just above the pencil line
- C just below the pencil line
- D on the pencil line

9 A sample of a dye is investigated by chromatography.

A line is drawn across a piece of chromatography paper and a spot of the dye is placed on it.

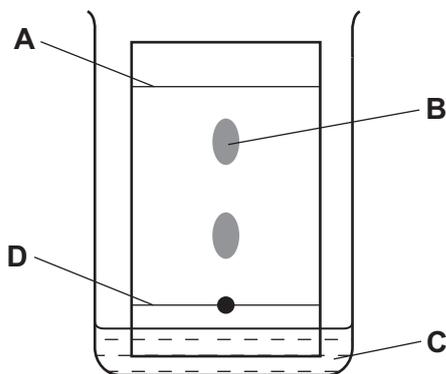
The paper is placed in water.



Which row is correct?

	what is used to draw the line	position of spot
<b>A</b>	ink	above the level of the water
<b>B</b>	ink	below the level of the water
<b>C</b>	pencil	above the level of the water
<b>D</b>	pencil	below the level of the water

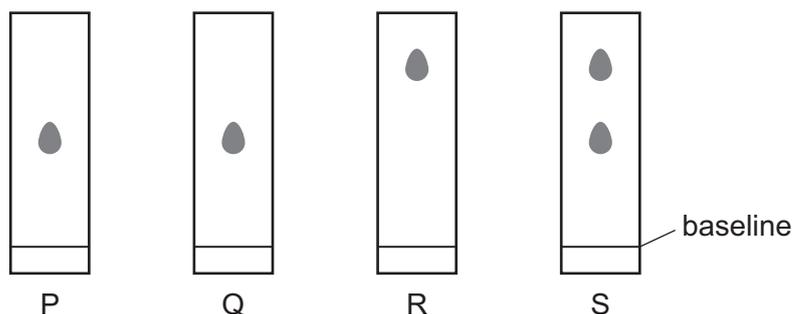
10 In the chromatography experiment shown, which label represents the solvent front?



11 Chromatography experiments are carried out on four substances, P, Q, R and S.

The same solvent is used in each experiment.

The resulting chromatograms are shown below.

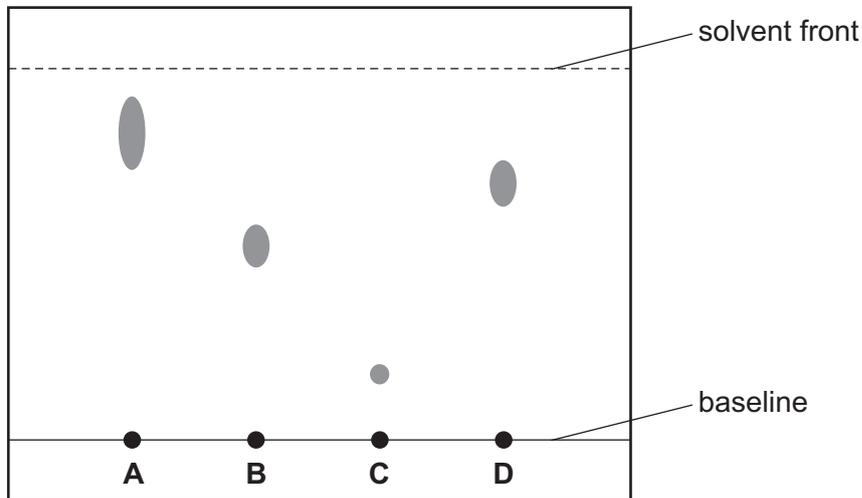


Which statement is **not** correct?

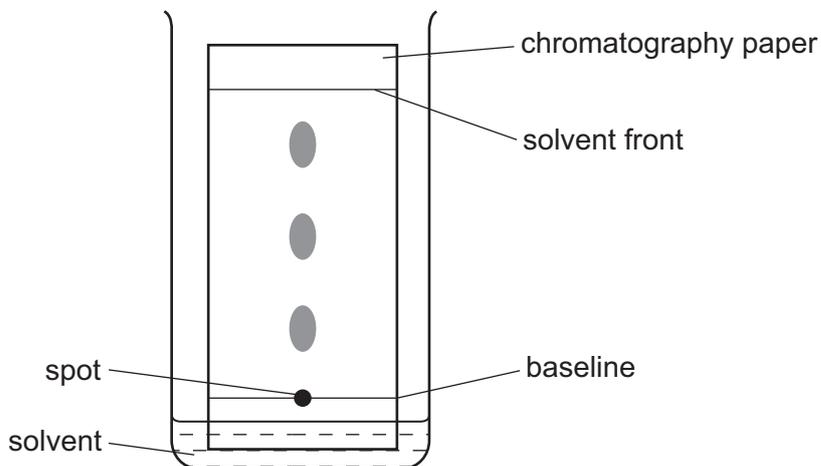
- A P and Q are pure substances.
- B P and R are different substances.
- C R and S are pure substances.
- D S is a mixture of substances.

12 The paper chromatogram below was obtained from four different dyes.

Which dye has an  $R_f$  value of 0.7?



13 The diagram shows the apparatus used to separate the different components of a mixture by chromatography.

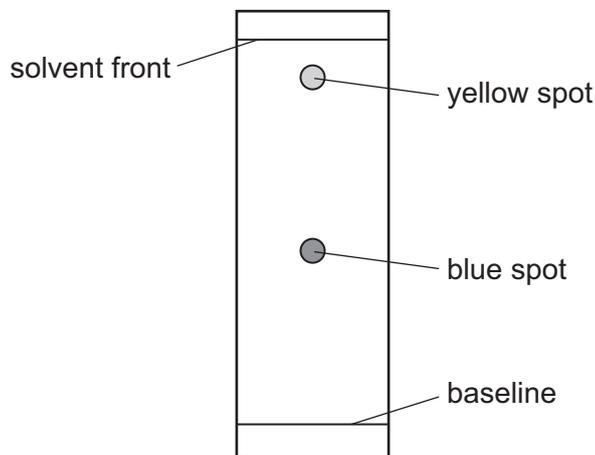


Which statement about this experiment is correct?

- A A locating agent is used to find the position of the solvent front.
- B The components to be separated must be soluble in the solvent.
- C The baseline on which the spot of the mixture is placed is drawn in ink.
- D The  $R_f$  value is calculated by  $\frac{\text{the distance travelled by the solvent front}}{\text{the distance travelled by the component}}$

- 14 A sample of a green food colouring was separated into its component colours using paper chromatography.

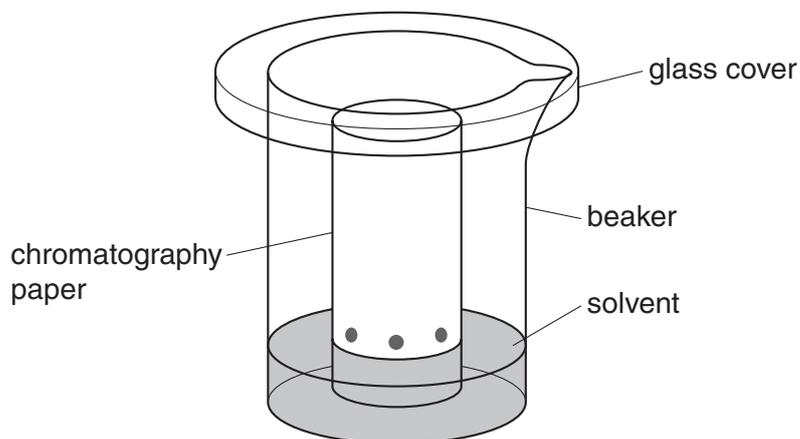
The results obtained are shown.



What is the  $R_f$  value of the blue spot?

- A** 0.45      **B** 0.90      **C** 1.10      **D** 2.20

- 15 Amino acids are colourless and can be separated and identified by chromatography.



What additional apparatus is required to identify the amino acids present in a mixture?

- A** a locating agent  
**B** a ruler  
**C** a ruler and a locating agent  
**D** neither a ruler or a locating agent

16 What is always true for a pure substance?

- A It always boils at 100 °C.
- B It contains only one type of atom.
- C It has a sharp melting point.
- D It is solid at room temperature.

17 A sample of liquid X turns blue cobalt(II) chloride paper pink. The sample boils at 102 °C.

Which statements are correct?

- 1 X contains water.
- 2 X is impure water.
- 3 X freezes above 0 °C.

- A 1, 2 and 3      B 1 and 2 only      C 1 and 3 only      D 2 and 3 only

18 The results obtained from a chromatogram are shown.

	distance travelled / cm
solvent	5.0
substance X	3.0
substance Y	2.5

Which row gives the  $R_f$  values of substance X and substance Y?

	$R_f$ (X)	$R_f$ (Y)
A	0.5	0.6
B	0.6	0.5
C	1.6	2.0
D	2.0	1.6

19 A student carried out paper chromatography on a mixture of amino acids.

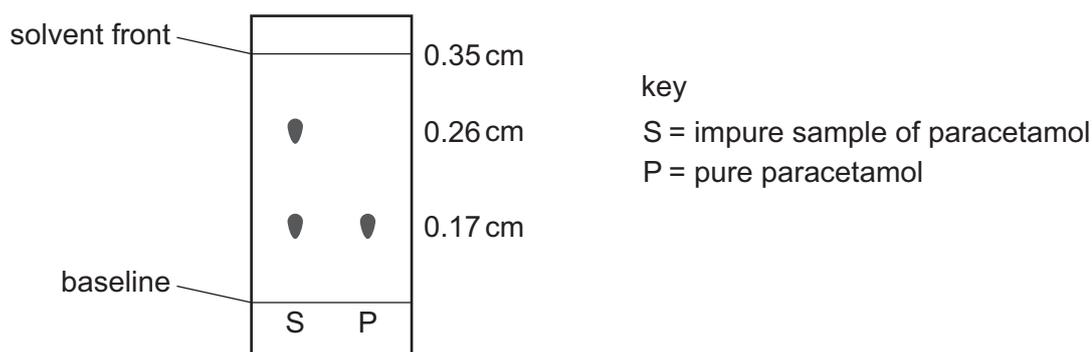
The student sprayed the dried chromatogram with a locating agent.

What is the function of the locating agent?

- A to dissolve the amino acids
- B to form coloured spots with the amino acids
- C to preserve the amino acids
- D to stop the amino acids reacting

20 The painkiller paracetamol is synthesised from 4-aminophenol.

Chromatography was carried out on an impure sample of paracetamol. The results are shown (not drawn to scale).



The sample of paracetamol was contaminated with 4-aminophenol only.

What is the  $R_f$  value of 4-aminophenol?

- A 0.49
- B 0.65
- C 0.74
- D 1.35

21 Pure water has a boiling point of 100 °C and a freezing point of 0 °C.

What is the boiling point and freezing point of a sample of aqueous sodium chloride?

	boiling point / °C	freezing point / °C
A	98	-2
B	98	2
C	102	-2
D	102	2

22 Impurities change the melting and boiling points of substances.

Sodium chloride is added to a sample of pure water.

How does the addition of sodium chloride affect the melting point and boiling point of the water?

	melting point	boiling point
<b>A</b>	increases	increases
<b>B</b>	increases	decreases
<b>C</b>	decreases	increases
<b>D</b>	decreases	decreases

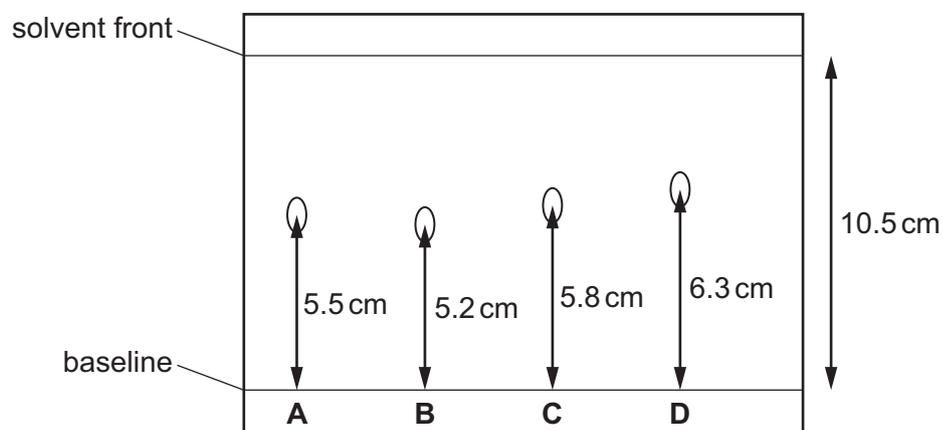
23 A compound, X, has a melting point of 71 °C and a boiling point of 375 °C.

Which statement about X is correct?

- A** It is a liquid at 52 °C and a gas at 175 °C.
- B** It is a liquid at 69 °C and a gas at 380 °C.
- C** It is a liquid at 75 °C and a gas at 350 °C.
- D** It is a liquid at 80 °C and a gas at 400 °C.

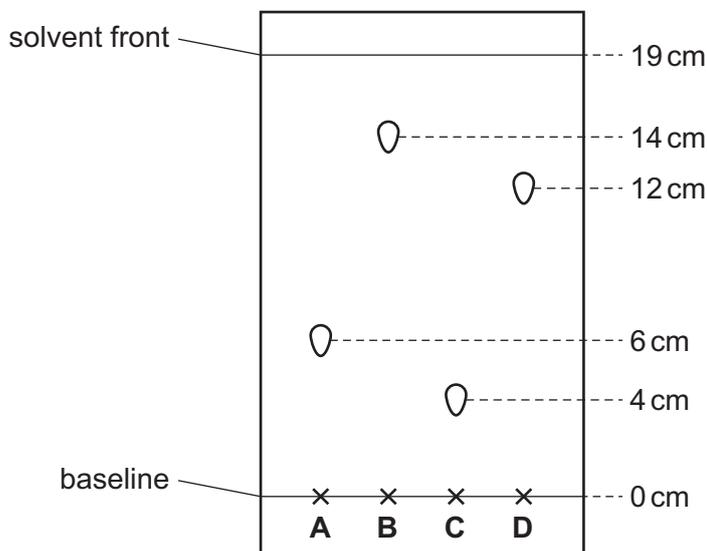
24 A chromatogram obtained from the chromatography of four substances is shown.

Which substance has an  $R_f$  value of 0.6?



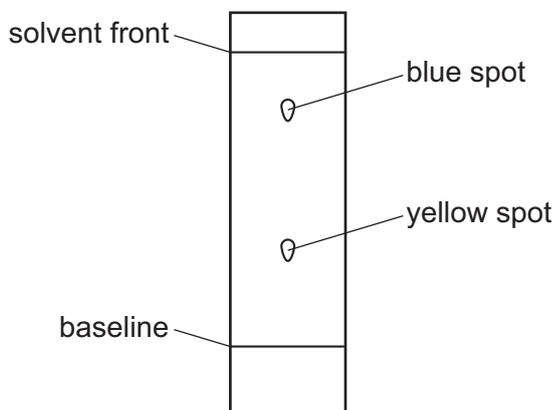
25 The diagram shows a chromatogram of four substances.

Which substance has an  $R_f$  value of approximately 0.32?



26 A student used chromatography to analyse a green food colouring.

The chromatogram obtained is shown.



The table lists some yellow food dyes and their  $R_f$  values.

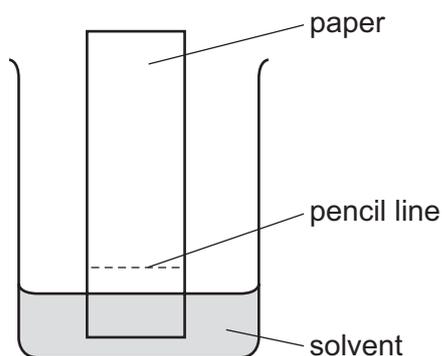
Which yellow food dye does the green food colouring contain?

	yellow food dye	$R_f$ value
<b>A</b>	Quinolene Yellow	0.48
<b>B</b>	Sunset Yellow	0.32
<b>C</b>	tartrazine	0.69
<b>D</b>	Yellow 2G	0.82

27 How can the amino acids in a protein be separated and identified?

- A Add a locating agent to the protein.
- B Hydrolyse the protein and then use chromatography.
- C Polymerise the protein and then add a locating agent.
- D Use chromatography on a solution of the protein.

28 A student is investigating a coloured mixture using chromatography.



Where should the student place the coloured mixture?

- A in the solvent
  - B just above the pencil line
  - C just below the pencil line
  - D on the pencil line
- 29 Propanone,  $C_3H_6O$ , is a liquid at room temperature.

What is the boiling point of pure propanone?

- A  $-61\text{ }^{\circ}\text{C}$  to  $-51\text{ }^{\circ}\text{C}$
- B  $-56\text{ }^{\circ}\text{C}$
- C  $51\text{ }^{\circ}\text{C}$  to  $61\text{ }^{\circ}\text{C}$
- D  $56\text{ }^{\circ}\text{C}$

**30** Substance Q boils at  $445^{\circ}\text{C}$  and is a yellow solid at room temperature.

Which temperature could be the melting point of pure Q?

- A**  $-9^{\circ}\text{C}$
- B**  $72^{\circ}\text{C}$  to  $78^{\circ}\text{C}$
- C**  $116^{\circ}\text{C}$
- D**  $116^{\circ}\text{C}$  to  $126^{\circ}\text{C}$