5-8 Chemical analysis – Trilogy

1.0 This question is about pure substances and mixtures.

1.1 Which **two** substances are mixtures?

[2 marks]

Tick **two** boxes.

Air	☐
Copper oxide	☐
Diamond	☐
Stainless steel	☐
Water vapour	☐

1.2 Draw **one** line from each context to the correct meaning.

[2 marks]

Context	Meaning
	A substance that has had nothing added to it
Pure substance in chemistry	A single element or a single compound
	A complex mixture with specific properties
Pure substance in everyday life	A substance that can be separated by distillation
	A substance that can be separated by filtration

2.0 This question is about chemical analysis and chromatography.

2.1 What is the test for chlorine gas?

[1 mark]

Tick **one** box.

A glowing splint relights ☐

A lighted splint gives a pop ☐

Damp litmus paper turns white ☐

Limewater turns milky ☐

2.2 What is the test for hydrogen gas?

[1 mark]

Tick **one** box.

A glowing splint relights ☐

A lighted splint gives a pop ☐

Damp litmus paper turns white ☐

Limewater turns milky ☐

2.3 A manufacturer of children's drinks adds food colourings to the drinks.

Suggest why.

[1 mark]

Tick **one** box.

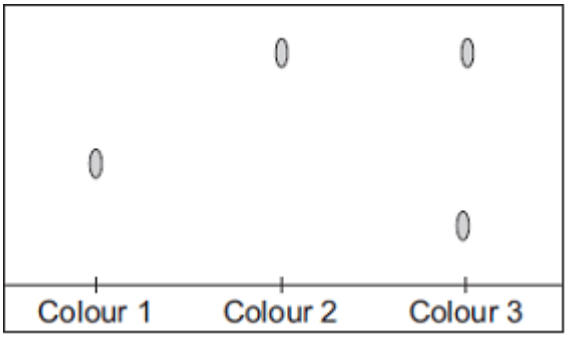
To make the drink healthier ☐

To improve the appearance of the drink ☐

Because they are expensive ☐

Because they make the drink fizzy ☐

2.4 Chromatography was used to compare three colours used as food colourings.

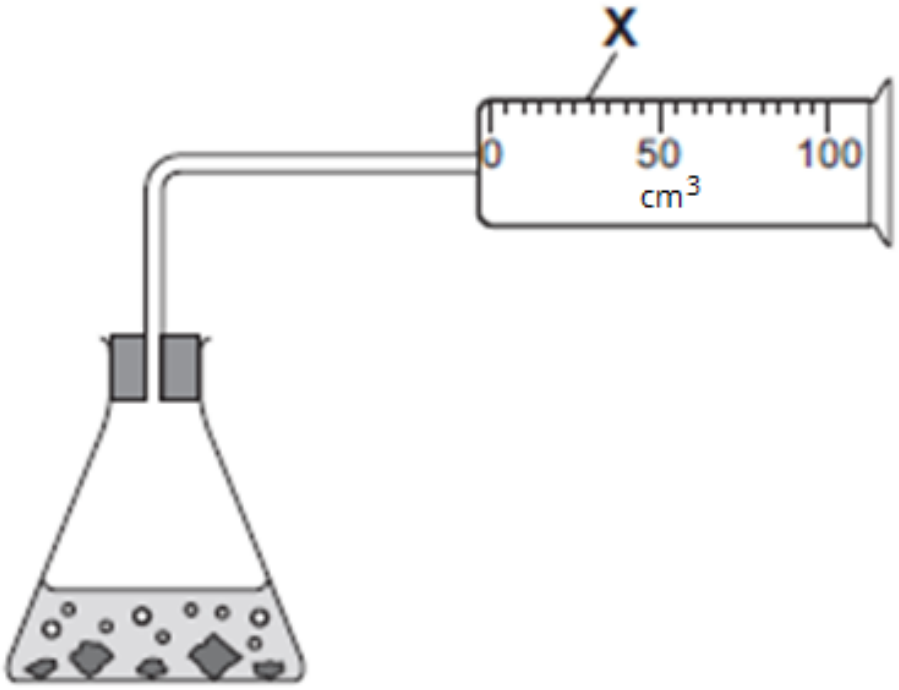


What do these results tell you about these three colours?

[3 marks]

3.0 A student collected and measured the volume of the hydrogen gas produced in a reaction.

The apparatus the student used is shown below.



3.1 Give the name of the apparatus labelled **X**.

[1 mark]

_____

3.2 State the resolution of the apparatus labelled **X**.

Include the unit.

[1 mark]

_____ unit: _____

3.3 The student's results are shown in the table below.

Experiment	Volume of hydrogen collected in one minute in cm^3
1	49.3
2	50.2
3	35.1
4	48.9

Calculate the mean volume of hydrogen collected in one minute. Give your answer to 3 significant figures.

[2 marks]

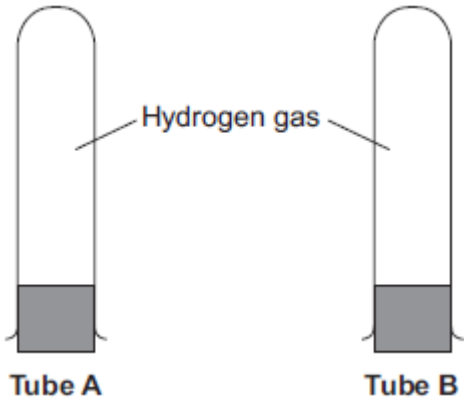
Mean volume = _____ cm^3

3.4 State what the student did to reduce the effect of random errors in the experiment.

[1 mark]

_____

3.5 A teacher collected two tubes full of hydrogen gas.



She tested tube **A** for hydrogen as soon as she took the bung out.

She tested tube **B** for hydrogen a few seconds after taking the bung out.

Explain why tube **B** gave a different result to tube **A**.

[1 mark]

_____

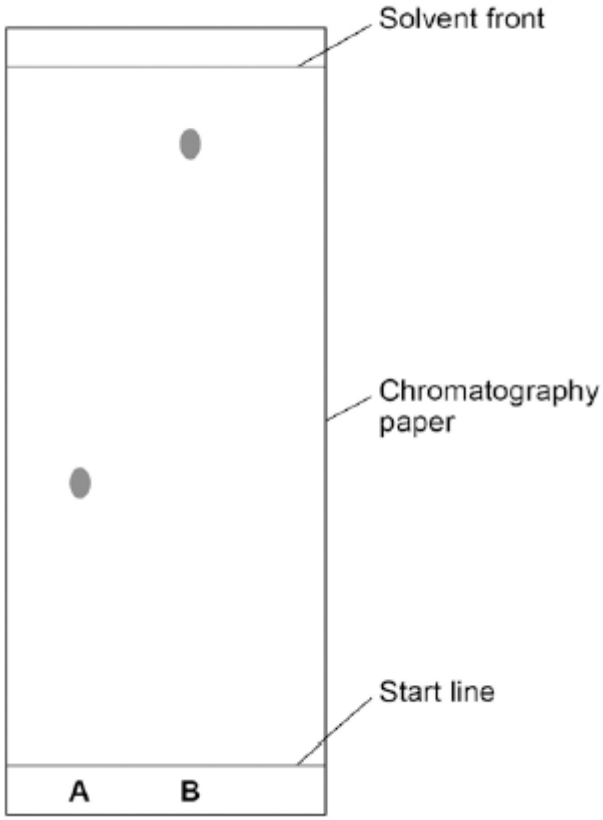
_____

4.0 A farmer has had his prize goat kidnapped! A ransom note, written in marker pen, has been left. The police arrest two suspects and search their houses. They find a marker pen at each house which could have been used to write the note. They decide to use paper chromatography to see whether the ink in the marker pens match the ransom note.

4.1 Describe how you would use chromatography to test whether the ink in the marker pens matches the ink on the note.

[4 marks]

4.2 The chromatogram shown below was taken from the suspects' marker pens.



Calculate the Rf value for ink spot **A**. Give your answer to 3 significant figures.

[3 marks]

Rf value for ink spot A _____

4.3 Explain why the inks move by different amounts during paper chromatography.
You should refer to the stationary and mobile phases in your answer.

[4 marks]

_____

_____

_____

_____

4.4 The ink on the ransom note had an Rf value of 4.10.

Was the ink taken from the ransom note the same as the ink taken from marker pen A?

Explain your answer.

[3 marks]

MARK SCHEME

Qu No.		Extra Information	Marks
1.1	Air Stainless steel		1 1
1.2	*(Substance in chemistry)* A single element or a single compound *(Substance in everyday life)* A substance that has had nothing added to it		1 1

Qu No.		Extra Information	Marks
2.1	Damp litmus paper turns white		1
2.2	A lighted splint gives a pop		1
2.3	To improve the appearance of the drink		1
2.4	• Colours 1 and 2 contain only one colour / dye • Colour 3 contains two colours / dyes • Colour 3 is a mixture of colour 1 and a different dye (that is not colour 2)		1 1 1

Qu No.		Extra Information	Marks
3.1	Gas syringe		1
3.2	5 cm^3	Both value and unit required for the mark	1
3.3	$\frac{49.3 + 50.2 + 48.9}{3}$ (treat expt 3 as anomaly) 49.5 (cm^3)	Award **2** marks for an answer of 49.5 (cm^3) without any working. Allow **1** mark for an answer of 45.9 (cm^3)	1 1
3.4	Repeated the experiment		1
3.5	Idea of mixing with oxygen / air	Allow gas leaked out	1

Qu No.		Extra Information	Marks
4.1	Any **four** from: • Use chromatography paper • Draw pencil line on paper • Add a drop of ink from each marker pen to the line • Place in solvent • Solvent level to be below pencil line • Leave to run • Compare with ink from ransom note		4
4.2	(Distance moved by A) 3.7cm and 9.2 cm (Distance moved by solvent) $\frac{3.7}{9.2}$ 0.402	Allow values in range 3.6 – 3.8 cm and 9.1 – 9.3 cm Distances must be verified on print out from school Accept 0.402 without working shown for **3** marks Allow ecf from incorrect measurement to final answer for max of **2** marks if given to 3 significant figures	1 1 1
4.3	• Separation depends on the amount of time substances spend in the mobile and stationary phase • Ink that travels towards the top has a greater attraction to the mobile phase/solvent • Ink that stays near to the starting position has a greater attraction to the stationary phase/paper • So A has a greater attraction to the mobile phase / solvent **or** So **C** has a greater attraction to the stationary phase / paper		1 1 1 1
4.4	Yes/No • Rf value is close • But not the same • If yes: Difference likely due to small errors in measurement If no: Rf values should be the same for the same substance	(No mark awarded) Distances must be verified on print out from school	 1 1 1