Purity and Separating mixtures – 2021/20 GCSE Gateway Chemistry Combined Science A

1. Nov/2021/Paper_J250/03/No.4

Which substance is a **formulation**?

A Air

B An alloy

C Carbon dioxide

D Distilled water

Your answer ☐ **[1]**

2. Nov/2021/Paper_J250/03/No.5

Which equation shows that the mass of the solid **decreases** as the solid reacts?

A $Ca(s) + Cl_2(g) \rightarrow CaCl_2(s)$

B $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

C $2Cu(s) + O_2(g) \rightarrow 2CuO(s)$

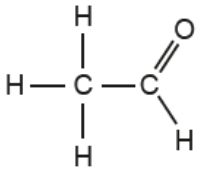
D $2Mg(s) + TiCl_4(l) \rightarrow Ti(s) + 2MgCl_2(s)$

Your answer ☐ **[1]**

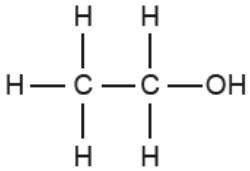
3. Nov/2021/Paper_J250/03/No.7

Which molecule has the **empirical formula** CH_2O?

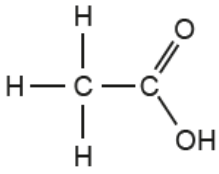
A



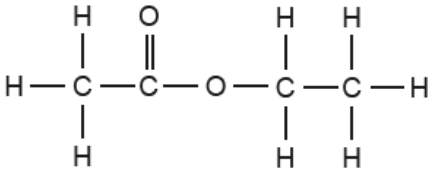
B



C



D

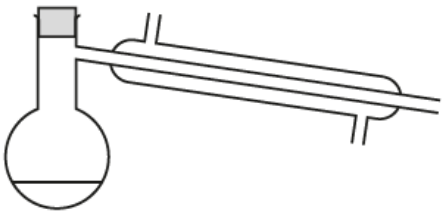
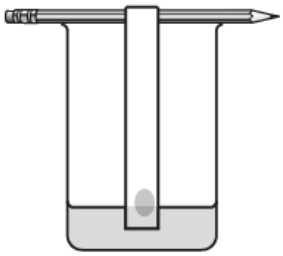
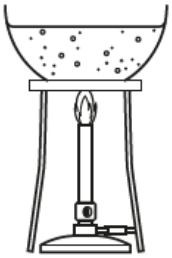


Your answer ☐ **[1]**

4. Nov/2021/Paper_J250/03/No.11

Different separation techniques are used to separate different types of mixtures.

Draw lines to connect each separation technique with its correct description.

Separation technique	Description
 **Simple distillation**	Separates a solvent from a solution.
 **Chromatography**	Separates a dissolved solid from a solution.
 **Filtration**	Separates a mixture of dissolved substances from one another.
 **Crystallisation**	Separates an insoluble solid from a liquid.

[4]

5. Nov/2021/Paper_J250/03/No.12

Copper can form many different compounds.

The table shows the formulae of five different compounds of copper.

Compound	Formula
A	$CuCl_2$
B	Cu_2O
C	$CuCO_3$
D	Cu_2S
E	$CuSO_4$

(a) Which compound, **A**, **B**, **C**, **D** or **E**, is made from copper, carbon and oxygen?

..... **[1]**

(b) Which compound, **A**, **B**, **C**, **D** or **E**, is made when copper is oxidised as copper reacts with oxygen?

..... **[1]**

(c) Which compound, **A**, **B**, **C**, **D** or **E**, reacts with dilute hydrochloric acid to make carbon dioxide?

..... **[1]**

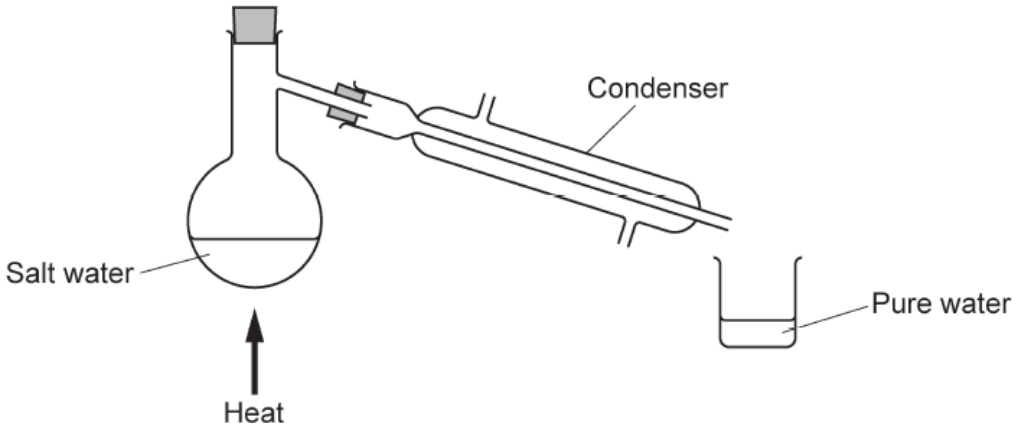
(d) Calculate the relative formula mass of compound **D**.

The relative atomic mass, A_r, of Cu is 63.5 and of S is 32.1

Relative formula mass = ... **[2]**

6. Nov/2020/Paper_J250/03/No.1

The diagram shows how pure water can be separated from salt water by simple distillation.



Which **two** changes of state happen during simple distillation?

A Condensation and freezing

B Evaporation and condensation

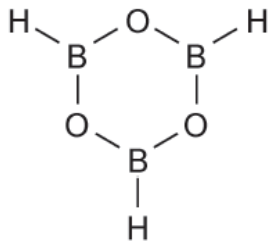
C Freezing and evaporation

D Melting and freezing

Your answer ☐ **[1]**

7. Nov/2020/Paper_J250/03/No.7

Look at the molecule below.



What is the **empirical formula** of the molecule?

A BHO

B BHO_2

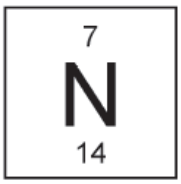
C $B_3(OH)_3$

D $B_3H_3O_3$

Your answer ☐ **[1]**

8. Nov/2020/Paper_J250/03/No.10

Look at the information about a nitrogen atom.



How many **electrons** are in a nitride ion, N^{3-}?

A 4

B 10

C 11

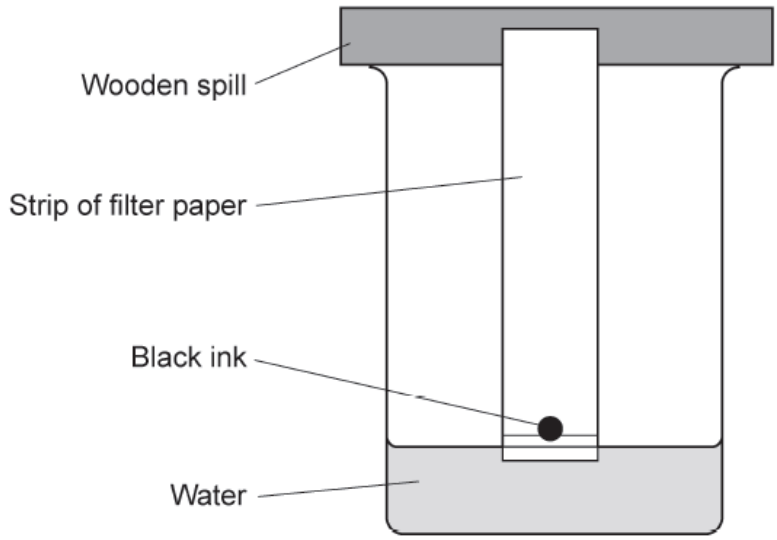
D 17

Your answer ☐ **[1]**

9. Nov/2020/Paper_J250/03/No.13

A student investigates which colour dyes are found in a black ink.

Look at the diagram. It shows her experiment.



The black ink separates into five different colours.

The student calculates an R_f **value** for each colour in the black ink.

Look at **Table 13.1**. It shows the student's R_f values.

Colour	R_f value
purple	0.24
green	0.38
orange	0.49
red	0.75
yellow	0.89

Table 13.1

(a) What is the name of this method of separation?

Tick (✓) **one** box.

Chromatography ☐

Crystallisation ☐

Distillation ☐

Filtration ☐

[1]

(b) (i) What is the **mobile phase** in the experiment?

..... **[1]**

(ii) Give a reason why the student chose the substance in **(b)(i)** as the mobile phase.

.....

..... **[1]**

(c) The student knows that the R_f value of a **different** dye is 0.46.

She thinks that this R_f proves that the dye is the same orange dye found in the black ink.

Do you agree with the student?

Yes ☐

No ☐

Give a reason for your answer using information from **Table 13.1**.

.....

.....

..... **[1]**

(d) Another student repeats the experiment but uses a pure blue ink.

He measures the distance travelled by the blue ink and the water.

Look at **Table 13.2**. It shows his results.

	Distance travelled (mm)
Blue ink	21
Water	53

Table 13.2

Calculate the R_f value of the blue ink.

Give your answer to **2** significant figures.

R_f value of the blue ink = ... **[3]**

10. Nov/2020/Paper_J250/03/No.17

This question is about compounds of magnesium.

(a) Magnesium hydroxide contains magnesium ions, Mg^{2+}, and hydroxide ions, OH^-.

Write the **formula** of magnesium hydroxide.

..... **[1]**

(b) Magnesium carbonate, $MgCO_3$, reacts with dilute hydrochloric acid, HCl.

Magnesium chloride, $MgCl_2$, water and carbon dioxide are made.

Write the **balanced symbol equation** for the reaction.

..... **[2]**

(c) A compound of magnesium contains an unknown element, **X**.

X is an element found in Group 7 of the Periodic Table.

The compound has the formula $Mg\mathbf{X}_2$.

The relative formula mass of the $Mg\mathbf{X}_2$ is 184.1.

(i) Calculate the relative atomic mass of **X**.
A_r Mg = 24.3

Relative atomic mass of **X** = ... **[2]**

(ii) Identify element **X**.

Use the Periodic Table on the Data Sheet to help you.

..... **[1]**

11. Nov/2020/Paper_J250/04/No.5

A mixture contains two liquids, hexane and decane.

The table shows the boiling points of hexane and decane.

	Boiling point (°C)
Hexane	69
Decane	174

Which method is used to separate and collect **hexane** from a mixture of hexane and decane?

A Crystallisation

B Evaporation

C Filtration

D Fractional distillation

Your answer ☐ **[1]**

12. Nov/2021/Paper_J250/09/No.3

Look at the symbol for boron.

5
B
11

Which is the symbol for the element with an atom that contains 1 more proton **and** 2 more neutrons than an atom of boron?

A

6
C
11

B

6
C
12

C

6
C
13

D

6
C
14

Your answer ☐ **[1]**

13. Nov/2021/Paper_J250/09/No.5

A scientist wants to find out the amount of each chemical in a mixture.

Which row in the table shows the chromatographic techniques that the scientist could use?

	Paper chromatography	Thin layer chromatography	Gas chromatography
A	✓	✗	✗
B	✓	✓	✗
C	✗	✗	✓
D	✗	✓	✓

Your answer ☐ **[1]**

14. Nov/2021/Paper_J250/09/No.10

Which term is defined as 'The sum of the relative atomic masses of all the atoms in a chemical formula'?

A Mass number

B Molecular formula

C Relative formula mass

D The Avogadro constant

Your answer ☐ **[1]**

15. Nov/2021/Paper_J250/09/No.13

Solder is a mixture of lead and tin. Solder can be used to join two electrical wires together as shown in **Fig. 13.1**.

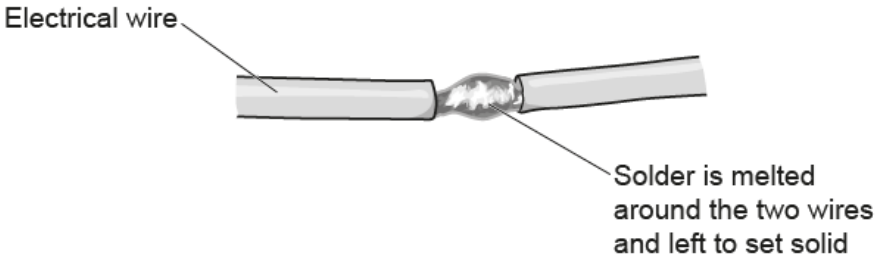


Fig. 13.1

The table shows how the melting point of solder changes with the percentage of tin it contains.

Percentage of tin in solder (%)	Melting point (°C)
0	320
20	280
40	240
80	220
90	230
100	240

(a) Plot the data on the grid shown in **Fig. 13.2**.

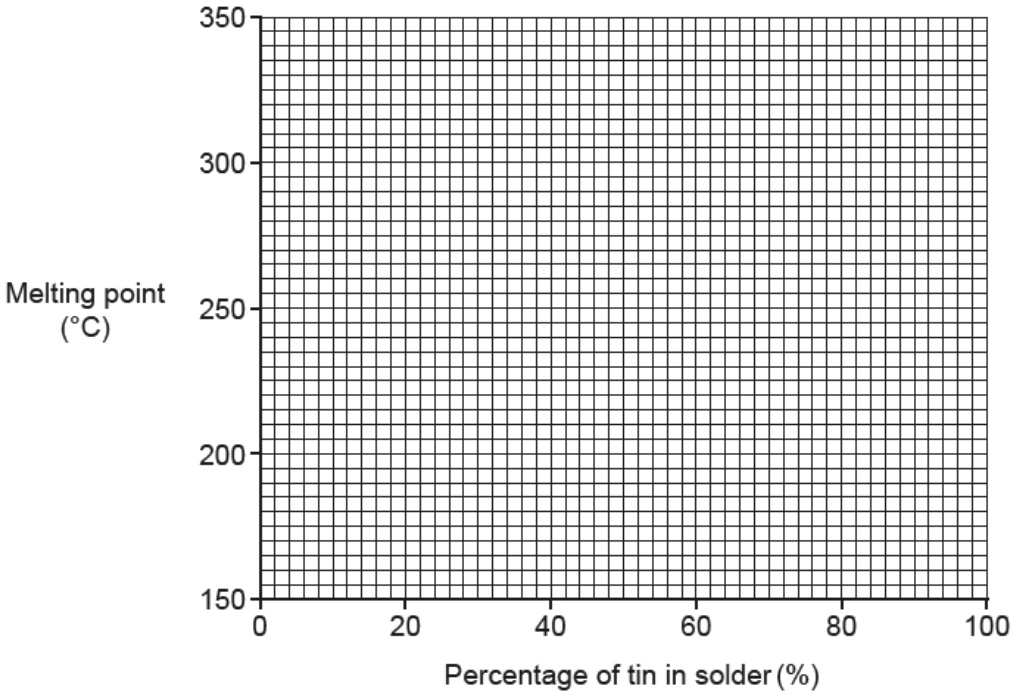


Fig. 13.2 **[2]**

16. Nov/2020/Paper_J250/09/No.3

Relative atomic mass compares the average mass of an atom to which element?

A Carbon

B Hydrogen

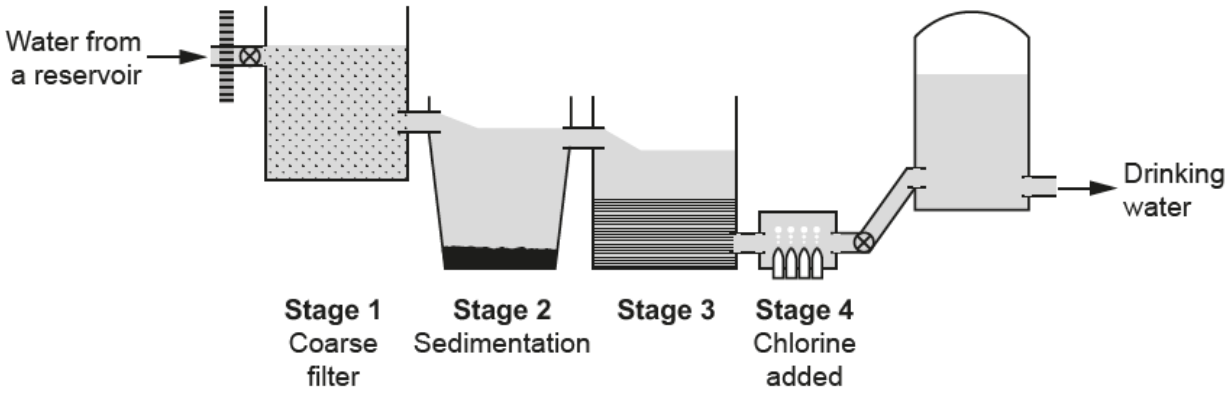
C Nitrogen

D Oxygen

Your answer ☐ **[1]**

17. Nov/2020/Paper_J250/10/No.4

The diagram shows how drinking water can be produced from water from a reservoir.



What happens at **Stage 3**?

A Any remaining solids are removed.

B Bacteria are used to break down sludge.

C Harmful bacteria are killed.

D The pH of the water is checked and corrected.

Your answer ☐ **[1]**