

## Purity and Separating Mixtures (F)

1. Butane has the molecular formula  $C_4H_{10}$ .

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

- A  $CH_5$
- B  $C_2H_5$
- C  $C_4H_{10}$
- D  $CH_{14}$

Your answer

[1]

2. The formula of magnesium chloride is  $MgCl_2$ .

What is the relative formula mass of magnesium chloride?

(A r: Mg = 24.3, Cl = 35.5)

- A 59.8
- B 95.3
- C 119.6
- D 84.1

Your answer

[1]

3. Which separation technique is this equipment used for?



- A Crystallisation
- B Distillation
- C Evaporation
- D Filtration

Your answer

[1]

4. The molecular formula of hydrogen peroxide is  $\text{H}_2\text{O}_2$ .

What is the **empirical formula** of hydrogen peroxide?

- A  $\text{H}_2\text{O}_2$
- B  $\text{H}_2\text{O}$
- C HO
- D  $\text{H}_2\text{O}_4$

Your answer

[1]

5. The formula of sulfuric acid is  $\text{H}_2\text{SO}_4$ .

What is the **relative formula mass**,  $M_r$ , of sulfuric acid?

The relative atomic mass,  $A_r$ , of H is 1, of S is 32 and of O is 16.

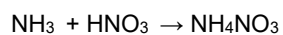
- A 49
- B 98
- C 130
- D 200

Your answer

[1]

6. Ammonium nitrate,  $\text{NH}_4\text{NO}_3$ , is fertiliser made from ammonia.

Ammonium nitrate is made by reacting ammonia with nitric acid.



i. Calculate the mass of **ammonium nitrate** that could be made from 25.5 tonnes of ammonia.

$A_r$ : H = 1.0, N = 14.0, O = 16.0

Mass of ammonium nitrate = ..... tonnes [3]

ii. A student makes some ammonium nitrate in the laboratory.

He predicts that he should make 12.5 g of ammonium nitrate.

His percentage yield is 80%.

Calculate the **actual mass** of ammonium nitrate that the student makes.

Actual mass of ammonium nitrate = ..... g [2]

7 (a). A student is making perfume using violet flowers.

The student does an experiment to extract the perfume from the flowers using the apparatus shown in Fig. 21.1.

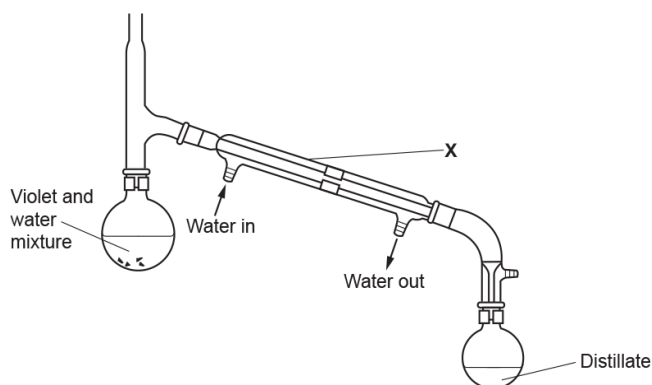


Fig. 21.1

The teacher says the apparatus is not set-up correctly.

i. What is the name of the piece of apparatus labelled X?

..... [1]

ii. Name the process shown in Fig. 21.1.

..... [1]

iii. Suggest **two** changes that the student should make to set-up the apparatus correctly.

1

2

..... [2]

(b). The student finds out that phosphate fertilisers are used to help to grow flowers.

Compound **A** is a fertiliser of a metal **M** with the formula  $M_3PO_4$ .

The relative formula mass of compound **A** is 164.0.

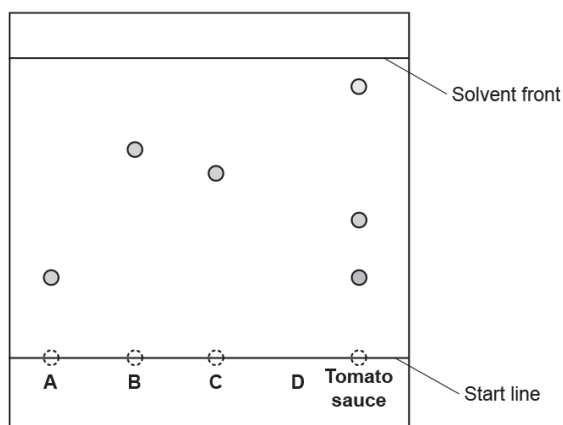
Do a calculation to identify metal **M**.

Use the relative atomic masses in the Periodic Table.

Metal **M** = ..... [3]

8(a). A scientist analyses a sample of tomato sauce using chromatography.

The tomato sauce is compared to four known food additives, **A**, **B**, **C** and **D**, as shown in the chromatogram.



The start line is **not** drawn in ink.

Explain why.

-----

----- [1]

(b). Food additive **D** is insoluble in the solvent used.

**Draw** on the diagram the spot for food additive **D** at the end of the experiment.

[1]

(c). Which additive is in the **tomato sauce**?

Tick (✓) **one** box.

**A**

**B**

**C**

[1]



10 (a). The table shows the properties of different substances.

Substance	Melting point (°C)	Boiling point (°C)	Soluble in water?	Conducts electricity in solid state?	Conducts electricity in molten state?
A	-210	-196	No	No	No
B	1084	2562	No	Yes	Yes
C	605	1137	Yes	No	Yes
D	-78	-34	Yes	No	No

i. Which **two** substances are gases at room temperature?

Tick (✓) **two** boxes.

A

B

C

D

[1]

ii. Substance **C** is an ionic substance.

Use the information in the table to explain why.

[2]

(b). You are provided with a mixture of substances **B** and **C**.

Substance **B** is insoluble in water. Substance **C** is soluble in water.

i. Describe how you could separate substance **B** from the mixture.

[3]

ii. Describe how you would then obtain substance **C** after separating substance **B**.

[2]

**11 (a).** An alloy is a mixture of a metal with one or more other elements.

When lithium is mixed with aluminium it makes an alloy that can be used in aircraft.

Adding different amounts of lithium to the aluminium changes the properties of the alloy.

Alloy	Percentage of lithium (%)	Density (g / cm <sup>3</sup> )	Melting point (°C)	Strength (MPa)
<b>A</b>	2.00	2.58	670	550
<b>B</b>	2.20	2.56	580	555
<b>C</b>	2.45	2.55	655	565

A scientist thinks that alloy **C** is best for making an aircraft.

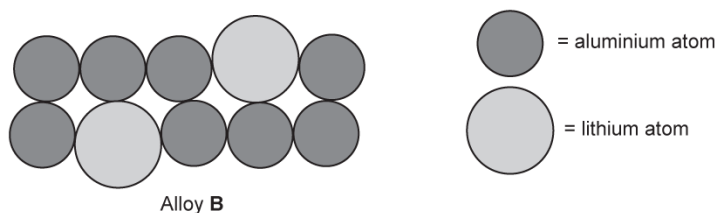
Is she correct?

Explain your answer using evidence from the table.

[2]

**(b).** The scientist uses the particle model to show the elements present in alloy **B**.

Look at her diagram.



**not to scale**

- i. Calculate the **percentage of lithium atoms** in the diagram of alloy **B**.

Percentage of lithium atoms = ..... % **[1]**

- ii. Use your answer to part **(c)(i)** to explain if the diagram accurately shows the structure of alloy **B**.

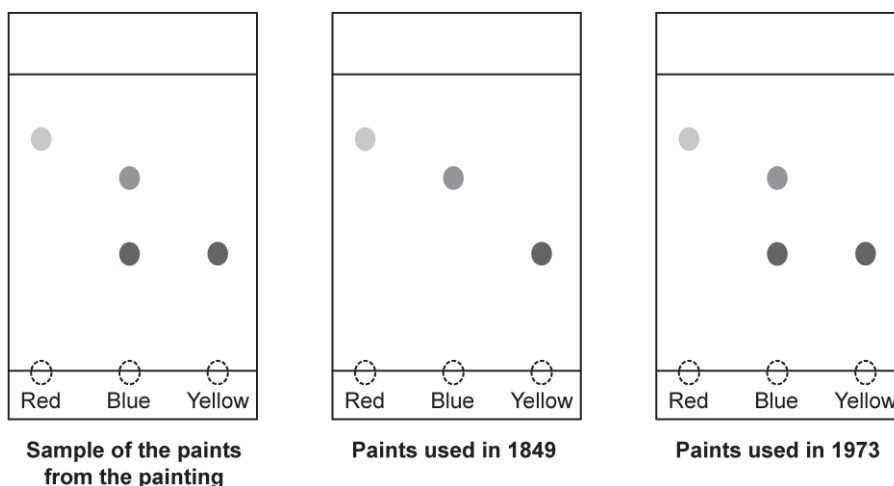
[1]

12 (a). A painting has arrived at a local museum for a new exhibit.

To make sure the painting is genuine, a sample of the paints from the painting is sent to a laboratory for analysis.

The laboratory uses thin-layer chromatography to compare the sample of the paints from the painting with some paints used in 1849 and 1973.

The chromatograms are shown below.



- i. Look at the chromatogram for the sample of the paints from the painting.

Which paint colour(s) is/are **pure**?

[1]

- ii. The red, blue and yellow paint from the painting are dissolved in different solvents, **X**, **Y** and **Z**.

The results are shown below.

		Solvent used		
		X	Y	Z
Paint colour	Red	Red solid left in tube	Clear red solution	Clear red solution
	Blue	Blue solid left in tube	Clear blue solution	Clear blue solution
	Yellow	Yellow solid left in tube	Clear yellow solution	Yellow solution with some yellow solid left in tube

Which solvent, **X**, **Y** or **Z**, should the laboratory use for the thin-layer chromatography?

Explain why this would be better than the other solvents.

[2]



iii. Scientists use  $R_f$  values to compare the different spots on the chromatogram.

Calculate the  $R_f$  value for the **red paint** in the sample of paints from the painting.

Use the equation:  $R_f = \frac{\text{distance travelled by the substance}}{\text{distance travelled by the solvent}}$

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

$R_f = \dots\dots\dots$  [3]

(b). The laboratory think that the painting was completed in 1849.

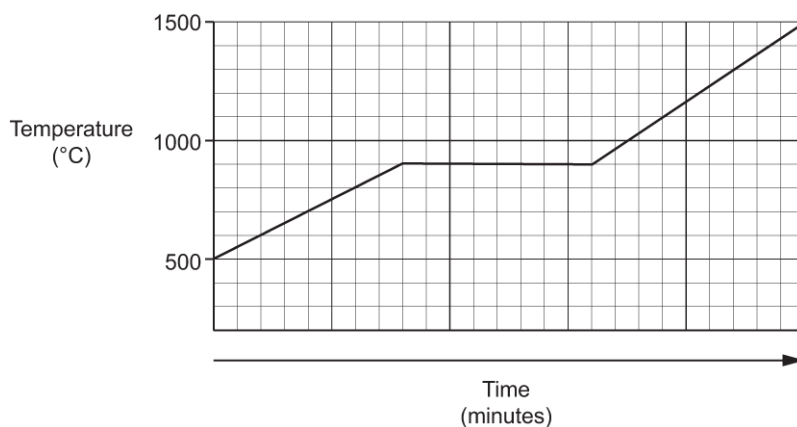
Is the laboratory correct?

Explain your answer.

[1]

13. A new solid, compound **X**, has been discovered. Scientists investigated the effect of heat on compound **X**.

Look at the graph. It shows how the state of compound **X** changes as it is heated.



- i. What is the **melting point** of compound **X**?

Melting point = ..... °C [1]

- ii. A scientist describes compound **X** as a **pure** substance.

Explain what scientists mean when they describe compounds as pure.

[1]

- iii. Explain how the scientists tell from the graph that compound **X** is a pure substance.

[1]

14 (a). A student is given a mixture of iron filings and sulfur powder.

Suggest a method that he could use to separate the iron and sulfur.

[1]

(b). Different mixtures can be separated using different methods.

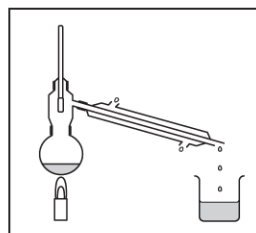
Draw a line from each **separation process** to the **apparatus used**.

Use only **one** line for each process.

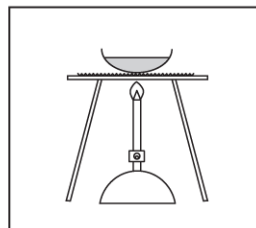
Separation process

Apparatus used

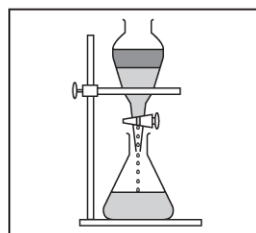
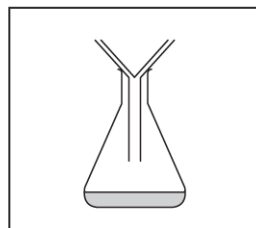
Crystallisation



Filtration



Distillation



[3]

15. Copper sulfate solution can be electrolysed using non-inert copper electrodes.

Describe what happens at the negative copper electrode **and** the positive copper electrode.

[2]

16 (a). Which element is oxidised and which element is reduced?

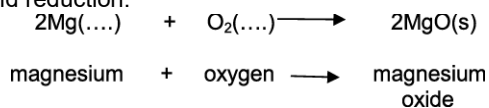
oxidised: .....

reduced: .....

[1]

(b). Magnesium burns in oxygen to make magnesium oxide.

The reaction involves both oxidation and reduction.



Complete the equation above by adding the state symbols for magnesium and oxygen at room temperature.

[2]

17. Rosa tests some compounds to find out if they conduct electricity.

Which row in the table shows the correct results for each compound?

Your answer  
[1]

	Solid ionic compound	Ionic compound dissolved in water	Molten ionic compound
A	<input type="checkbox"/> conducts	does not conduct	conducts
B	<input type="checkbox"/> conducts	conducts	conducts
C	conducts	conducts	does not conduct
D	does not conduct	conducts	conducts

18. Look at the table. It shows some fractions made from the fractional distillation of crude oil and their boiling ranges

fractions

Fraction	Boiling range (°C)
LPG	less than 25
petrol	85 – 105
diesel	150 – 290
fuel oil	290 – 380
bitumen	greater than 400

A hydrocarbon called eicosane has a boiling point which is 3.5 times the boiling point of petrol.

To which fraction does eicosane belong?

- A. diesel
- B. LPG
- C. fuel oil
- D. bitumen

Your answer

[1]

19. The **molecular formula** of decene is  $C_{10}H_{20}$ .

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

- A.  $CH_2$
- B.  $C_2H_4$
- C.  $C_5H_{10}$
- D.  $C_{20}H_{40}$

Your answer

[1]

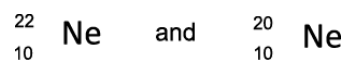
20. What is the best description of the particles in a liquid?

	Distance between particles	Movement of particles
A	close together	in continuous random motion
B	close together	vibrating about a fixed point
C	far apart	in continuous random motion
D	far apart	vibrating about a fixed point

Your answer

[1]

21. Two isotopes of neon are:



Isotopes have different:

- A. numbers of protons
- B. numbers of neutrons
- C. charges
- D. numbers of electrons

Your answer

[1]

22. When 12 g of carbon, C, burns in oxygen, O<sub>2</sub>, 44 g of carbon dioxide, CO<sub>2</sub>, is formed.

What mass of C would need to burn to form 11 g of CO<sub>2</sub>?

- A. 3 g
- B. 4 g
- C. 11 g
- D. 12 g

Your answer

[1]

23. Which technique is the best for separating pure water from a solution of sodium chloride in water?

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

Your answer

[1]

24. A student has a solution of ammonium sulfate.

Describe how he can obtain a pure dry sample of ammonium sulfate.

[1]

25. The **molecular formula** of cyclohexane is C<sub>6</sub>H<sub>12</sub>.

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

- A. CH
- B. CH<sub>2</sub>
- C. C<sub>6</sub>H<sub>12</sub>
- D. C<sub>12</sub>H<sub>24</sub>

Your answer

[1]

END OF QUESTION PAPER