AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.1.2

Mixtures

Past-paper questions

Tier	**Foundation**
Question groups	**150**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

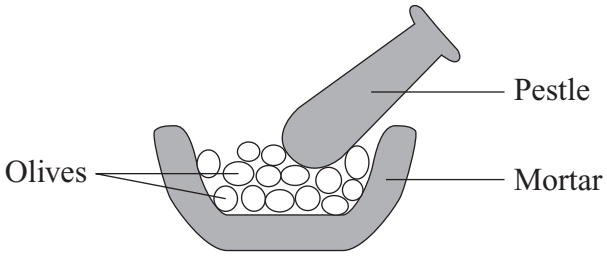
4.1.1.2 Mixtures

Question 01

January 2007 | CHY1F | Original Q2 | Legacy

2 A vegetable oil can be extracted from olives.

(a) The diagram shows the first step in this extraction.



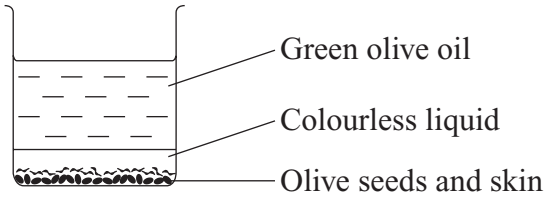
Use the correct word from the box to complete the sentence about this first step.

evaporating	**filtering**	**pressing**

The olive oil is extracted by ..... the olives.

(1 mark)

(b) The contents from the mortar are tipped into a beaker. The mixture is left to settle.



(i) What is the name of the colourless liquid?

.....

(1 mark)

(ii) How can the olive seeds and skins be removed from the liquids?

.....

.....

(1 mark)

3

4.1.1.2 Mixtures

Question 02

January 2007 | CHY1F | Original Q4 | Legacy

4 Limestone contains calcium carbonate.

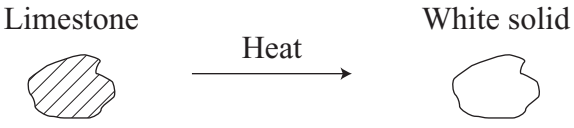
(a) Calcium carbonate has the formula $CaCO_3$.

Complete the sentence by writing in the correct numbers.

The formula of calcium carbonate is made up of 1 calcium atom, ... carbon atom(s) and ..... oxygen atom(s).

(2 marks)

(b) When limestone is heated it forms two other compounds.



$$\mathbf{CaCO_3} \rightarrow \mathbf{CaO} + \mathbf{CO_2}$$

(i) State **one** safety precaution that you should take when heating limestone.

.....

(1 mark)

(ii) Name the white solid produced.

.....

(1 mark)

(iii) Why does a piece of limestone lose mass as it is heated?

.....

.....

(1 mark)

Question 02 · continued

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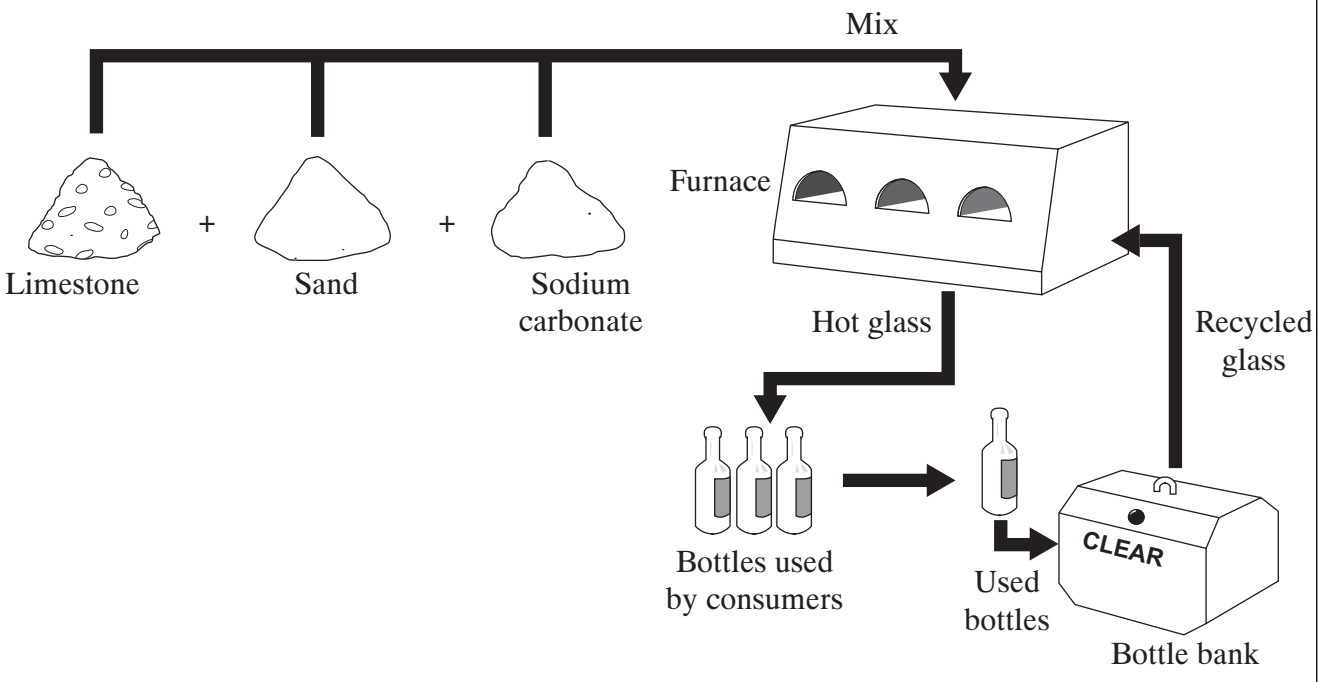
(c) Limestone is used to manufacture glass. Glass is made by heating a mixture of limestone, sand and sodium carbonate in a furnace.
The reaction requires a high temperature. If some recycled glass is added, the reaction takes place at a lower temperature.



Suggest **two** reasons why people are encouraged to recycle glass.

1 .....

.....

2 .....

.....

(2 marks)

Question 4 continues on the next page

Question 02 · continued

BLANK

(d) A company wants to quarry limestone. There are some houses near the quarry.



Residents in the houses say that they do not want a quarry next to them.

(i) Suggest **two** reasons why they do not want the quarry next to them.

1 .....

.....

2 .....

.....

(2 marks)

(ii) Suggest **one** possible benefit to the residents of having a quarry near their houses.

.....

.....

(1 mark)

10

4.1.1.2 Mixtures

Question 03

March 2007 | CHY1A | Original Q1 | Legacy

QUESTION ONE

This question is about crude oil.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A an alkane

B carbon

C crude oil

D sulfur dioxide

An example of a mixture is . . . **1** . . . .

An example of an element is . . . **2** . . . .

An example of a hydrocarbon is . . . **3** . . . .

An example of an acidic gas often made when a fuel burns is . . . **4** . . . .

4.1.1.2 Mixtures

Question 04

March 2007 | CHY1A | Original Q8 | Legacy

QUESTION EIGHT

Crude oil is a non-renewable energy source. Petrol is a fuel obtained from the fractional distillation of crude oil.

Gasohol is also a fuel. It is a mixture of 90 % petrol and 10 % ethanol. The ethanol can be produced from the waste stems and leaves when crops have been harvested. So ethanol is a renewable energy source.

	Mass in grams of gas produced by completely burning 10 cm^3 of fuel		
Fuel	Carbon dioxide from petrol	Carbon dioxide from ethanol	Water vapour
Petrol	26.4	0	12.6
Gasohol	23.8	1.5	12.2

8A What is the total mass of carbon dioxide produced when 10 cm^3 of gasohol is burned?

1 22.3 g

2 23.8 g

3 25.3 g

4 26.4 g

8B How much more carbon dioxide is produced when 10 cm^3 of petrol is burned than when 10 cm^3 of gasohol is burned?

1 0.4 g

2 1.1 g

3 1.6 g

4 24.9 g

4.1.1.2 Mixtures

Question 04 · continued

8C Why is the water vapour produced by burning fuels not a problem?

1 It condenses to a liquid.

2 It does not cause corrosion.

3 It is not a pollutant.

4 Very little is produced.

8D Carbon dioxide causes environmental problems.

Why is carbon dioxide from burning ethanol thought to be less of a problem than carbon dioxide from burning petrol?

1 Not as much carbon dioxide is produced.

2 The carbon dioxide produced has different chemical properties.

3 It is just recycling carbon dioxide removed from the air by plants.

4 The ethanol is not produced from crude oil.

4.1.1.2 Mixtures

Question 05

March 2007 | CHY1B | Original Q8 | Legacy

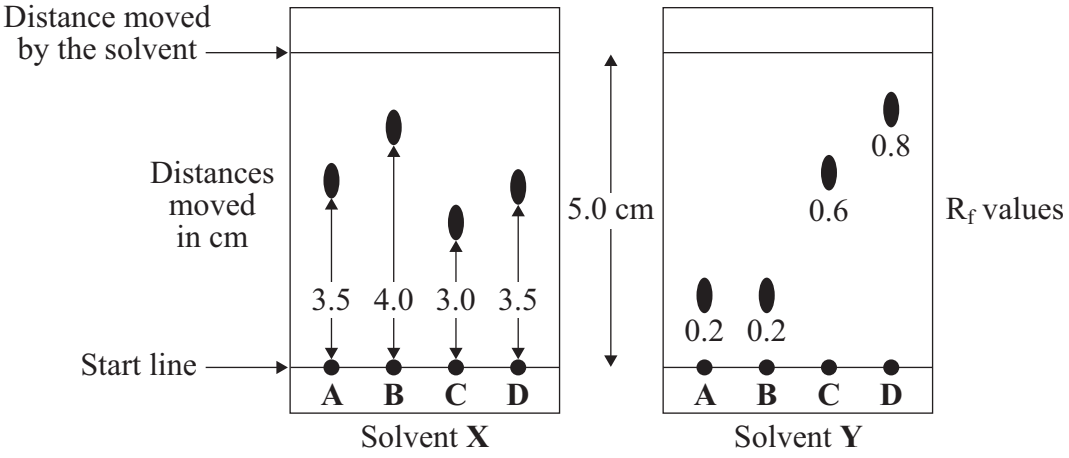
QUESTION EIGHT

In chromatography, substances can be identified by their R_f value.

The R_f value can be calculated using the formula:

$$R_f = \frac{\text{distance moved by the substance}}{\text{distance moved by the solvent}}$$

The R_f value for a substance is different in different solvents.



Four red substances, **A**, **B**, **C** and **D**, were tested. The test was done using two different solvents, **X** and **Y**.

For solvent **X**, the distances the substances moved and the distance the solvent moved are shown (in cm). For solvent **Y**, the R_f values are shown.

8A What is the R_f value of substance **B** in solvent **X**?

1 0.6

2 0.7

3 0.8

4 1.25

Question 05 · continued

8B Which statement is true?

1 Substances **A** and **B** are the same.

2 Substances **A** and **D** are the same.

3 Substances **B** and **D** are the same.

4 The four substances are different.

8C Which statement about chromatography is true?

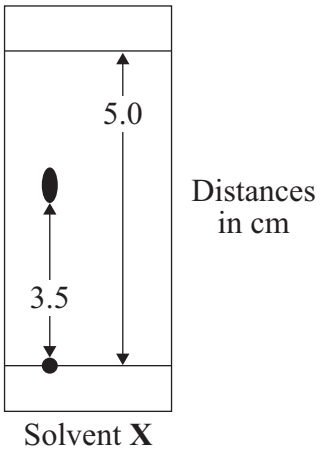
1 Chromatography works only on added artificial colouring.

2 Chromatography works only on added natural colouring.

3 Chromatography works only on natural colouring already in the food.

4 Chromatography works on any soluble colouring.

8D A red substance was tested. The chromatography strip using solvent **X** is shown.



The R_f value in solvent **Y** is 0.2.

Which statement is true?

1 The red substance could be **A**.

2 The red substance could be **B**.

3 The red substance could be **C**.

4 The red substance could be **D**.

4.1.1.2 Mixtures

Question 06

June 2007 | CHY1B | Original Q1 | Legacy

QUESTION ONE

This question is about oils and food additives.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A an additive

B a catalyst

C an emulsion

D a mixture

Crude oil is . . . **1** . . . .

Droplets of vegetable oil in a solution of vinegar with water form . . . **2** . . . that we call salad cream.

Monosodium glutamate is . . . **3** . . . used to add flavour to some foods.

Nickel is . . . **4** . . . used to speed up the reaction between vegetable oils and hydrogen.

4.1.1.2 Mixtures

Question 07

June 2007 | CHY1B | Original Q5 | Legacy

QUESTION FIVE

This question is about collecting lavender oil from lavender plants.

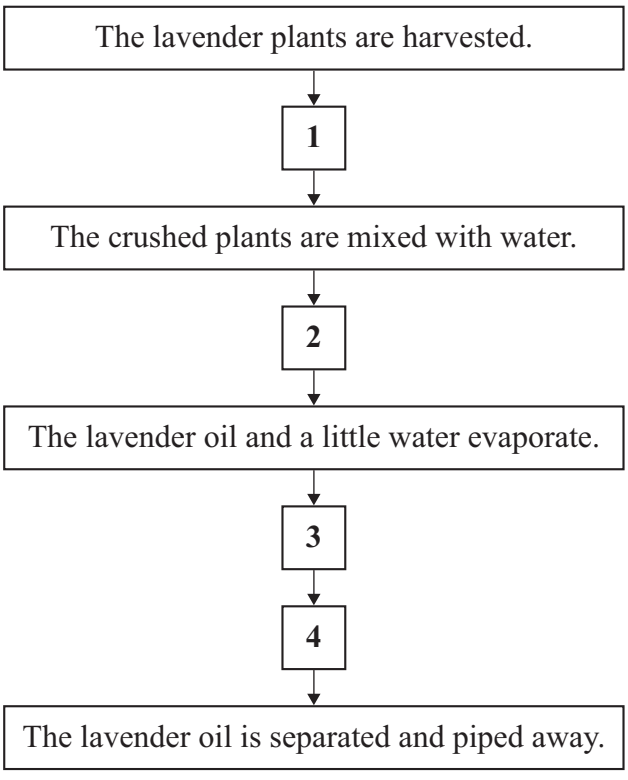
Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A The vapours are cooled and condense.

B The mixture is heated in a distillation flask.

C The lavender oil floats on top of the water.

D The lavender plants are crushed.



4.1.1.2 Mixtures

Question 08

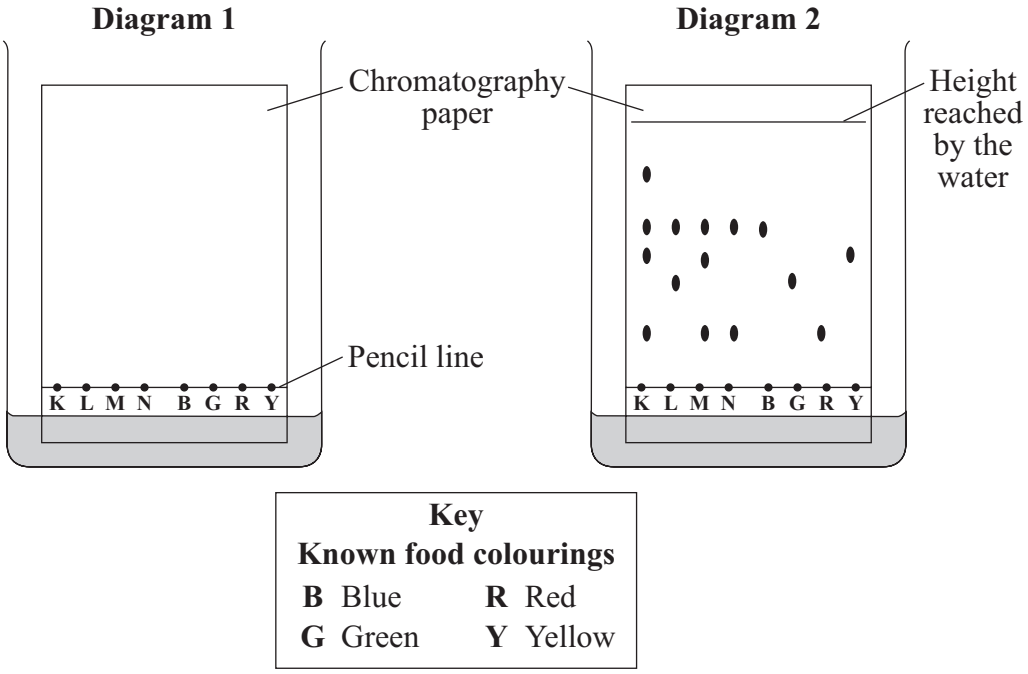
June 2007 | CHY1B | Original Q7 | Legacy

QUESTION SEVEN

A student investigated the coloured substances used in making four different fruit drinks, **K**, **L**, **M** and **N**.

- A spot of each drink was placed on a pencil line on chromatography paper.
- Spots of four single known food colourings, **B**, **G**, **R** and **Y**, permitted in foods, were also placed on the pencil line.
- The paper was then left to stand in water in a beaker.

Diagram 1 shows how the apparatus was arranged. **Diagram 2** shows the result after a short time.



7A Which of the drinks contains the green colouring?

1 drink **K**

2 drink **L**

3 drink **M**

4 drink **N**

4.1.1.2 Mixtures

Question 08 · continued

7B From the evidence on the chromatography paper, the student could conclude that . . .

1 red, blue, green and yellow are the only food colourings allowed in fruit drinks.

2 all four drinks contain the same number of food colourings.

3 red, blue, green and yellow food colourings are soluble in water.

4 fruit drink **L** is a lighter colour than the other drinks.

7C Why should the student make further checks on fruit drink **K**?

1 It is too dark in colour.

2 It contains too many food colourings.

3 Its colour may mean that consumers will not buy the drink.

4 It contains a colour that he has not identified.

7D A fruit drink that is on sale in the shops is found to contain a food colouring that may be harmful.

What immediate action should the manufacturers take?

1 stop production of all fruit drinks

2 stop production of this particular fruit drink

3 in future, make this fruit drink without the potentially harmful food colouring

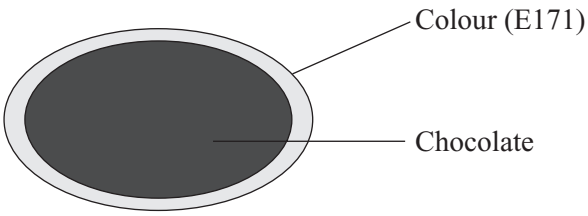
4 withdraw the fruit drink from all shops and advise the public not to drink it

4.1.1.2 Mixtures

Question 09

June 2007 | CHY1F | Original Q2 | Legacy

2 A packet contains colour-coated, chocolate sweets. The label on the packet lists the ingredients. Some of these are given E-numbers.



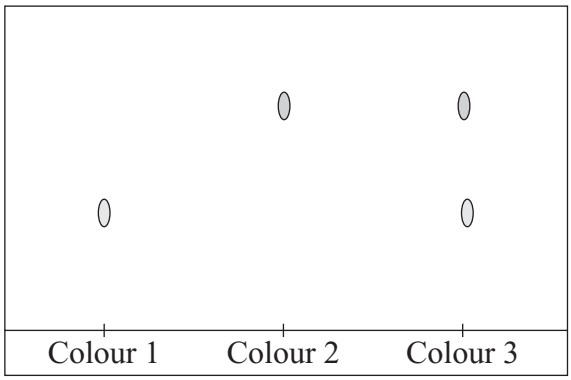
(a) Use the correct word from the box to complete the sentence.

additive	**element**	**fuel**

An E-number is used to identify a permitted food ..... .

(1 mark)

(b) Chromatography was used to compare three of the colours used to coat the chocolate sweets.



What do these results tell you about these three colours?

.....

.....

.....

.....

.....

.....

(3 marks)

4

4.1.1.2 Mixtures

Question 10

June 2007 | CHY1F | Original Q3 | Legacy

3 Crude oil is a natural resource from which useful fuels can be separated.

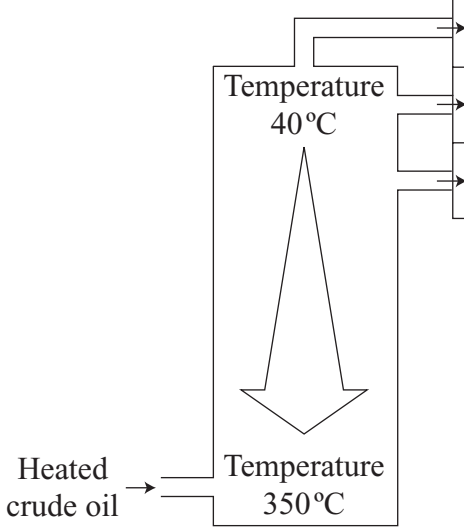
(a) Crude oil is a mixture of hydrocarbons.

Complete the sentence about a hydrocarbon molecule.

A hydrocarbon molecule is made up of ..... and carbon atoms only.

(1 mark)

(b) Many fuels come from crude oil. Some of these fuels are shown in the diagram.



Fraction	Number of carbon atoms in each molecule
gases	1–4
petrol	5–12
diesel	15–25

Suggest **two** properties of these fuels that allow them to be separated from crude oil.

.....

.....

.....

.....

(2 marks)

4.1.1.2 Mixtures

Question 10 · continued

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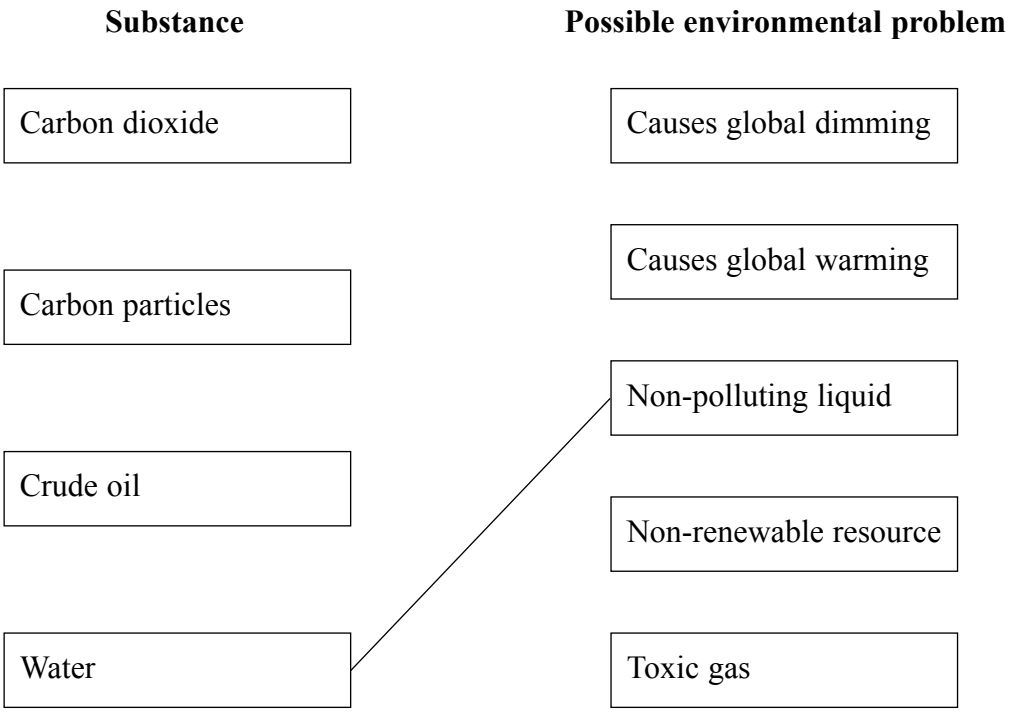
(c) Fuels from crude oil burn to provide heat energy.

When a fuel burns, it combines with oxygen in the air and produces carbon dioxide and water. When there is not enough oxygen, the fuel burns and also produces carbon monoxide and carbon particles.

Draw a straight line from each substance that links it to a possible environmental problem.

One has been done for you.



(3 marks)

6

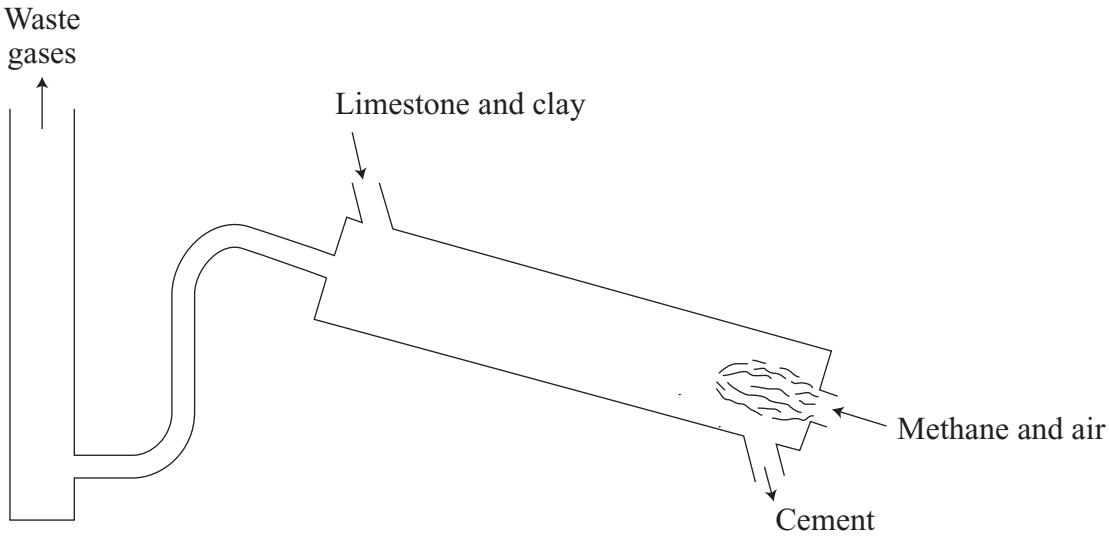
4.1.1.2 Mixtures

Question 11

June 2007 | CHY1F | Original Q6 | Legacy

6 Limestone contains the compound calcium carbonate, $CaCO_3$.

(a) Limestone is used to make cement in a rotary kiln.



Use the information in the diagram to name the **two** main waste gases from this rotary kiln.

1 .....

2 .....

(2 marks)

4.1.1.2 Mixtures

Question 11 · continued

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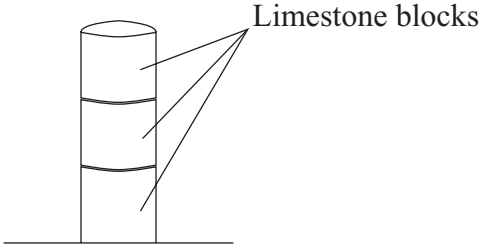
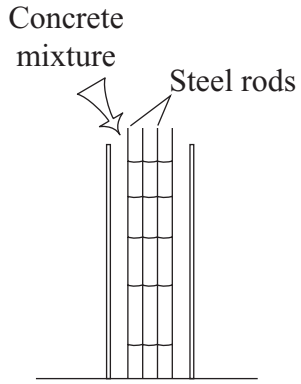
(b) Columns used as supports for buildings can be made from materials such as limestone blocks or concrete.





Concrete is a mixture of
cement, sand, small stones and water

From the diagrams, name which you think is the better material for making a column.

.....

Give **three** advantages for your choice of material.

1 .....

.....

2 .....

.....

3 .....

.....

(3 marks)

5

4.1.1.2 Mixtures

Question 12

November 2007 | CHY1A | Original Q6 | Legacy

QUESTION SIX

This question is about fractional distillation of crude oil.

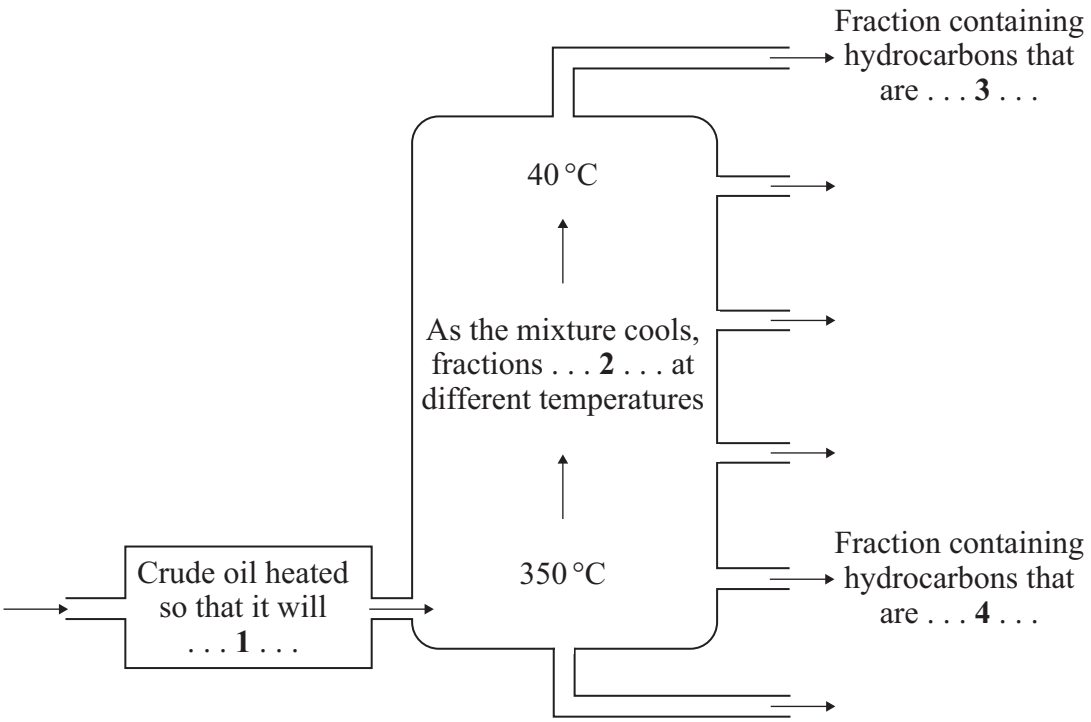
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences on the diagram.

A condense

B vaporise

C viscous

D volatile



4.1.1.2 Mixtures

Question 13

November 2007 | CHY1B | Original Q6 | Legacy

QUESTION SIX

This question is about the manufacture of margarine spreads from sunflower oil.

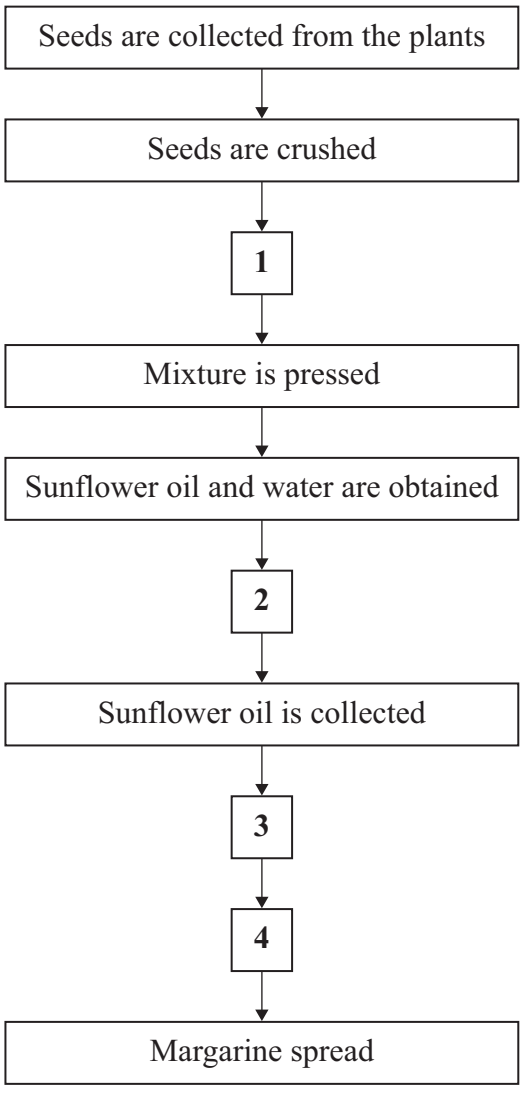
Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A Oil hardens and additives are mixed in.

B Sunflower oil separates from the water.

C Water is added and the mixture is stirred.

D Sunflower oil is reacted with hydrogen.

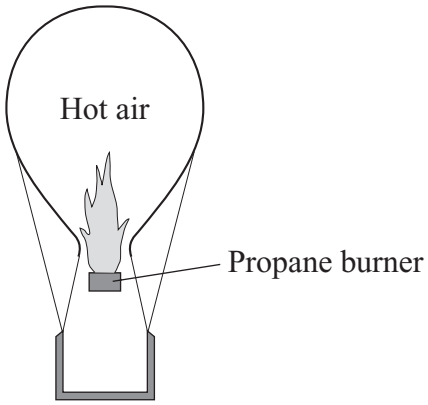


4.1.1.2 Mixtures

Question 14

January 2008 | CHY1F | Original Q1 | Legacy

1 Hot air balloons burn hydrocarbons to heat the air.



(a) The hot air contains these gases:

nitrogen, N_2
oxygen, O_2
argon, Ar
carbon dioxide, CO_2
water vapour, H_2O

(i) Argon is an *element*.

What is an *element*?

.....

.....

(1 mark)

(ii) Name **one** other gas in the hot air that is also an element.

.....

(1 mark)

4.1.1.2 Mixtures

Question 14 · continued

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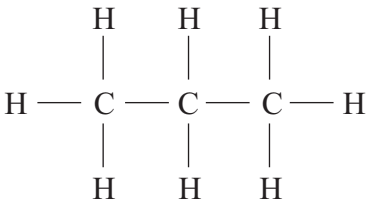
(b) Propane, C_3H_8, can be represented as:



Use the correct words from the box to complete the sentences.

bond	**carbon**	**compound**	**element**	**mixture**

(i) Propane is a ..... and is made up of atoms of hydrogen and ..... .

(2 marks)

(ii) Each line between the atoms in propane represents a chemical ..... .

(1 mark)

5

4.1.1.2 Mixtures

Question 15

January 2008 | CHY1F | Original Q2 | Legacy

2 There are six main groups of food additives.

(a) Use the correct food additive from the box to complete the sentences below.

acidity regulators	**antioxidants**	**colours**
emulsifiers	**flavourings**	**preservatives**

(i) To make orange drinks look orange we would add ..... .

(1 mark)

(ii) To improve the coating ability of salad creams we would add ..... .

(1 mark)

(iii) To make the food 'stay fresh' as long as possible we would add ..... .

(1 mark)

4.1.1.2 Mixtures

Question 15 · continued

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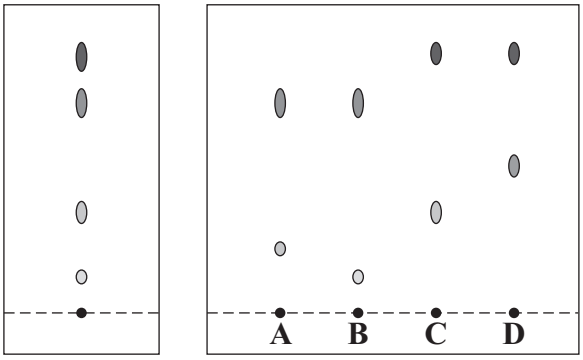
(b) Chromatography was carried out on a sample of soft drinks to check that they contained only colours that were safe. This is the result.



Safe colours Colours from the soft drinks

What conclusions about the safety of the colours in the soft drinks **A**, **B**, **C** and **D** can be made from the results shown by chromatography?

.....

.....

.....

.....

(2 marks)

5

4.1.1.2 Mixtures

Question 16

8 Soda-lime glass is made by heating, to above 1500 °C, a mixture of:

soda (sodium carbonate), Na_2CO_3

limestone (calcium carbonate), $CaCO_3$

sand (silicon dioxide), SiO_2

(a) (i) Which element do all of these compounds contain?

.....

(1 mark)

(ii) Explain what the formula Na_2CO_3 shows about the compound.

.....

.....

.....

.....

(2 marks)

(b) Calcium carbonate breaks down when heated to above 1500 °C.

(i) Write a word equation to show what happens.

..... → ..... + ...

(2 marks)

(ii) What is the name of this type of chemical reaction?

.....

(1 mark)

(c) The melting point of soda-lime glass is about 750 °C.
The raw materials for making soda are limestone and common salt (sodium chloride).
There are almost unlimited amounts of the raw materials available to manufacture soda-lime glass.

From the information given, what is the most important reason for recycling soda-lime glass?

.....

.....

(1 mark)

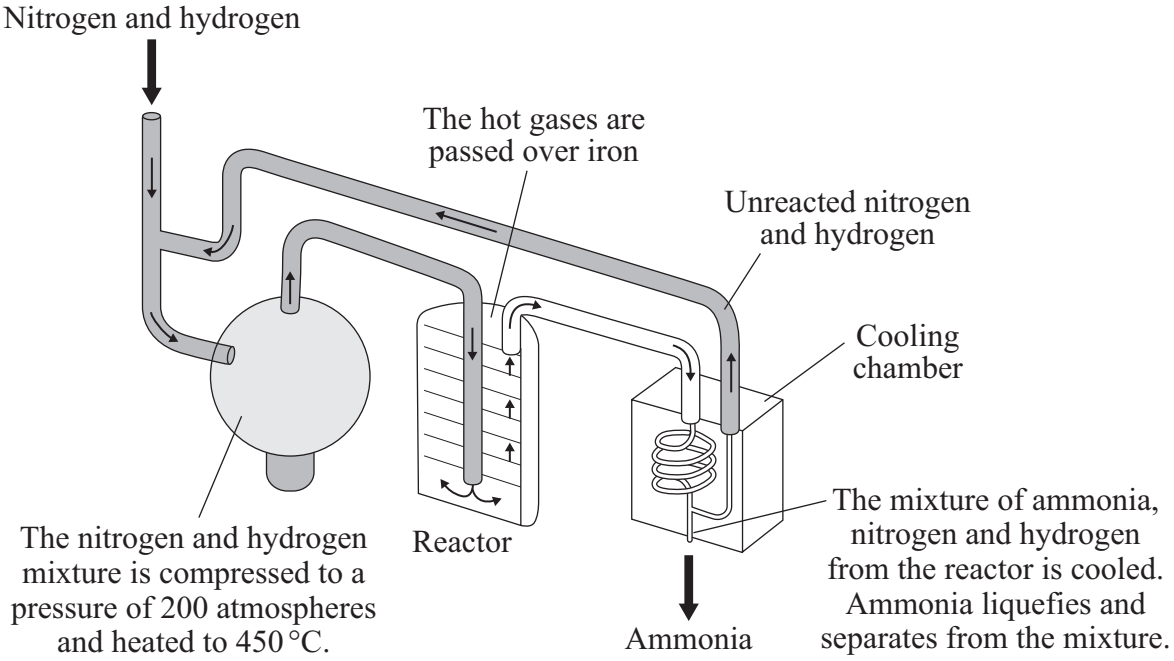
7

4.1.1.2 Mixtures

Question 17

January 2008 | CHY2F | Original Q5 | Legacy

5 The Haber process is named after the German chemist, Fritz Haber.
The diagram shows the main stages in the Haber process.



(a) Use the diagram to help you to answer these questions.

(i) Complete the word equation for the reaction that takes place in the reactor.

nitrogen + ... ⇌ .....

(1 mark)

(ii) What does the symbol ⇌ mean?

.....

(1 mark)

(iii) What is the purpose of the iron in the reactor?

.....

(1 mark)

(iv) Ammonia is separated from unreacted nitrogen and hydrogen.
Draw a ring around the physical property that allows this separation to take place.

boiling point **density** **melting point**

(1 mark)

(v) What is done with the unreacted nitrogen and hydrogen?

.....

(1 mark)

4.1.1.2 Mixtures

Question 17 · continued

BLANK

(b) Some of the products that can be made from ammonia are:

- fertilisers
- dyes
- explosives
- medicines
- plastics

(i) The Haber process was invented a few years before the start of the First World War. It is thought that the First World War would have finished earlier if the Germans had **not** invented the Haber process.

Suggest why.

.....

.....

(1 mark)

(ii) The Haber process has helped to increase food production.

Explain why.

.....

.....

(1 mark)

(c) Factories that make ammonia are very large and operate night and day.

(i) Ammonia factories are often near towns.

Suggest why.

.....

(1 mark)

(ii) Suggest and explain **one** reason why local people might not want an ammonia factory near their town.

.....

.....

.....

.....

(2 marks)

10

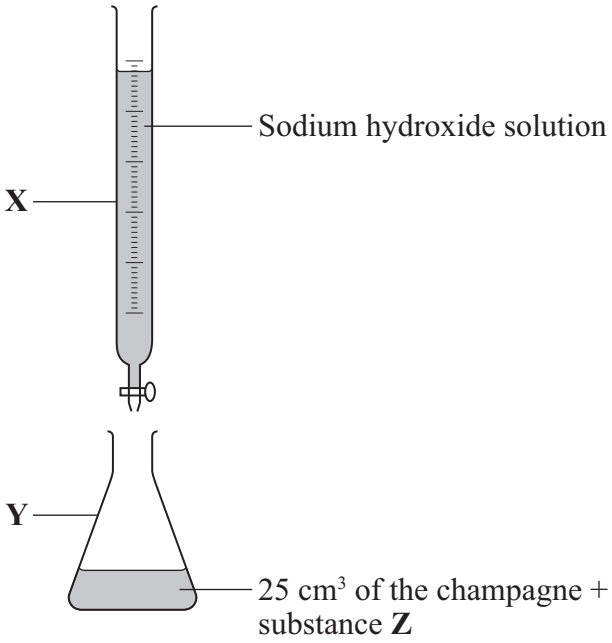
4.1.1.2 Mixtures

Question 18

January 2008 | CHY3F | Original Q3 | Legacy

3 In 1916 a ship was sunk by a German submarine. The ship was carrying bottles of champagne. The wreck was discovered in 1997 and the champagne was brought to the surface and analysed.

The diagram shows the apparatus used to find the amount of acid in 25 cm^3 of the champagne.



(a) Choose the correct words from the box to name apparatus **X** and **Y**.

beaker	**burette**	**conical flask**	**measuring cylinder**

(i) Apparatus **X** is a ..... .

(1 mark)

(ii) Apparatus **Y** is a ..... .

(1 mark)

Question 18 · continued

BLANK

(b) Sodium hydroxide solution was added to this champagne until substance **Z** showed that the reaction was complete. The volume of sodium hydroxide used was recorded. The result was used to calculate the amount of acid present.

Complete these sentences by drawing a ring around the correct answer.

(i) Substance **Z** is

a catalyst

a conductor

an indicator

.

(1 mark)

(ii) The reaction was complete when substance **Z**

changed colour

formed a gas

gave a precipitate

.

(1 mark)

(iii) The name of this method of analysis is

distillation

filtration

titration

.

(1 mark)

(c) 250 cm^3 of this champagne were found to contain 1 g of acid.

Calculate the mass of acid in 750 cm^3 of this champagne.

.....

.....

.....

Mass = ... g

(2 marks)

Question 3 continues on the next page

4.1.1.2 Mixtures

Question 18 · continued

BLANK

(d) (i) Which **one** of the following ions makes champagne acidic?

Draw a ring around your answer.

chloride **hydrogen** **sodium**

(1 mark)

(ii) The acid in champagne is a *weak* acid.

Complete this sentence by drawing a ring around the correct answer.

The word *weak* means that the acid

- has a low boiling point
- is dilute
- is partially ionised

.

(1 mark)

9

4.1.1.2 Mixtures

Question 19

June 2008 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The engine of a car is made of aluminium, to which other metals have been added to make it stronger. In the engine, petrol vapour burns as it reacts with oxygen. Petrol is made up of several alkanes.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A alkane

B engine

C oxygen

D petrol vapour

	Type of substance
1	mixture of metals
2	element
3	compound
4	mixture of gases

4.1.1.2 Mixtures

Question 20

June 2008 | CHY1F | Original Q4 | Legacy

4 The label on a bottle of salad dressing shows that the dressing contains the following ingredients.

Ingredients	
Water Vegetable oil Egg yolk Sugar Flour Vinegar Salt	Extract of spices Preservative E202 Emulsifier E405

4 (a) One of the main ingredients in salad dressing is vegetable oil.

4 (a) (i) Use the correct word from the box to complete the sentence about the extraction of vegetable oil.

crushed	**evaporated**	**hardened**

To extract the vegetable oil, the fruits or seeds of plants are first

..... . *(1 mark)*

4 (a) (ii) The liquids can be separated from the solid parts of the fruits or seeds by filtering.

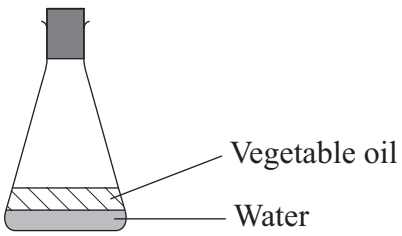
Suggest **one** reason why separation by filtering is better than separation by distilling.

.....

.....

(1 mark)

4 (b) (i) A mixture of vegetable oil and water is shaken and left to stand for several minutes. The diagram shows the result.



Complete the following sentence.

The vegetable oil and water ..... .

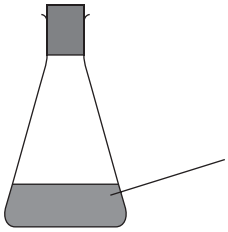
(1 mark)

4.1.1.2 Mixtures

Question 20 · continued

for mark

4 (b) (ii) A mixture of vegetable oil, water and egg yolk is shaken and left to stand for several minutes.
The diagram shows the result.



Use words from the box to complete the sentence.

additive	**distil**	**emulsion**	**extract**	**mix**	**separate**

The egg yolk causes vegetable oil and water to .....

and form an ..... .

(2 marks)

5

4.1.1.2 Mixtures

Question 21

November 2008 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about copper and its alloys.

Match descriptions, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A a mixture

B expensive to extract from its ore

C a good conductor

D hard-wearing

It is worth recycling copper because it is . . . **1** . . . .

Copper is difficult to separate from an alloy because the alloy is . . . **2** . . . .

Bronze (a copper alloy), has been used for hundreds of years for making coins because it is . . . **3** . . . .

Copper is used for electrical wiring because it is . . . **4** . . . .

4.1.1.2 Mixtures

Question 22

November 2008 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

The extraction of iron involves heating a mixture of iron ore, limestone and coke (carbon) at high temperatures in a blast furnace.

The limestone and iron ore are extracted from large quarries, some of which are found in areas of outstanding natural beauty.

9A Some people are against the development of these large quarries.

One reason is that the quarries . . .

1 attract large numbers of tourists to visit the area.

2 make unsightly scars on the landscape.

3 are unnecessary because there are few uses for limestone.

4 create a dangerous habitat for wildlife.

9B Some people support the development of these quarries.

One reason is that the working quarries . . .

1 are always placed where the public cannot see them.

2 conserve resources.

3 provide employment for people who live in the area.

4 provide an area for leisure activities.

9C Iron is produced continuously, sometimes for several years without shutting down the blast furnace.

This is done . . .

1 because it is difficult to obtain large supplies of limestone.

2 because it takes several years to reach the required temperature in the furnace.

3 to minimise the energy costs.

4 to ensure that the iron is of the highest quality.

4.1.1.2 Mixtures

Question 22 · continued

9D Some iron is obtained by recycling scrap iron.

Why does it take less energy to make iron from scrap iron than to extract the iron from its ore?

1 Scrap iron is an alloy.

2 Scrap iron contains the element sulfur.

3 Scrap iron does **not** have to be reduced using carbon.

4 Corrosion of the scrap iron makes it easier to melt.

END OF TEST

4.1.1.2 Mixtures

Question 23

November 2008 | CHY1BP | Original Q4 | Legacy

QUESTION FOUR

This question is about extracting oil from olives.

Match processes, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A crushed

B pressed

C separated

D stirred

The olives are collected from the trees and . . . **1** . . . to split them open. This produces a paste.

Water is then added to this paste and the mixture is . . . **2** . . . for several minutes.
The mixture is allowed to stand.

To obtain oil and water, the mixture is . . . **3** . . . .

The olive oil and water are left to stand until they have . . . **4** . . . .

4.1.1.2 Mixtures

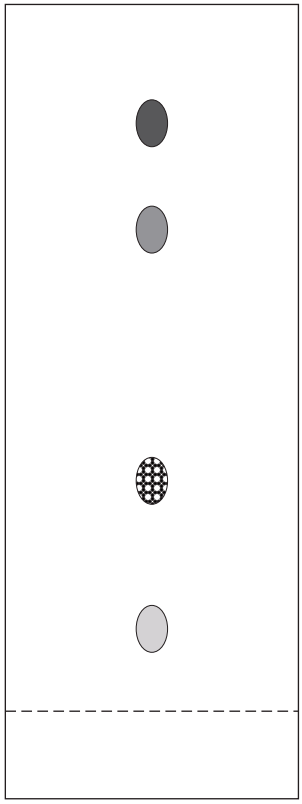
Question 24

November 2008 | CHY1BP | Original Q6 | Legacy

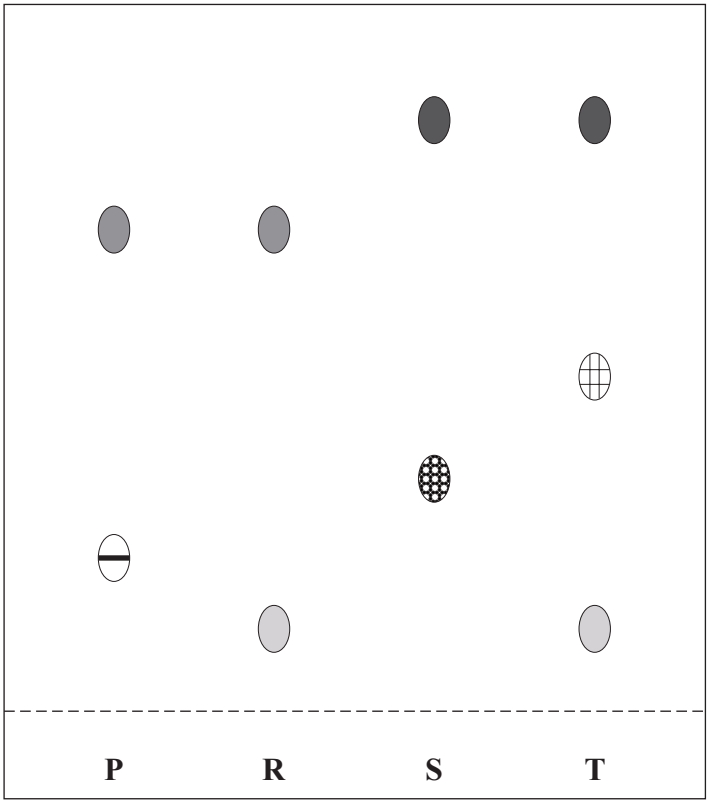
QUESTION SIX

The colour pigments in four fruit drinks, **P**, **R**, **S** and **T**, were examined using chromatography to see if the drinks were safe.

The results are shown below.



Safe colour pigments



Colours in the fruit drinks

6A Which fruit drink contains the greatest number of colour pigments?

1 **P**

2 **R**

3 **S**

4 **T**

4.1.1.2 Mixtures

Question 24 · continued

6B The chromatogram shows that . . .

1 all the fruit drinks are safe.

2 only fruit drink **R** is safe.

3 only fruit drinks **R** and **S** are safe.

4 only fruit drinks **P** and **T** are safe.

6C Manufacturers add colour pigments to fruit drinks to . . .

1 make the fruit drinks more attractive to consumers.

2 make sure that the fruit drinks contain additives with E-numbers.

3 increase the energy content of the fruit drinks.

4 make the fruit drinks more healthy.

6D A company is told that one of the fruit drinks it manufactures contains a colour pigment that is **not** safe.

What action should the company immediately take?

1 Order supplies of a safe colour pigment to use in its place in the fruit drink.

2 Tell all shops to stop selling the fruit drink and tell the public **not** to drink it.

3 Warn its employees to take precautions when handling the colour pigment.

4 Sack the manager of the factory that makes the fruit drink.

4.1.1.2 Mixtures

Question 25

March 2009 | CHY1BP | Original Q1 | Legacy

QUESTION ONE

This question is about gases.

Match gases, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A oxygen

B noble gas

C air

D water vapour

1	It condensed to form the Earth's oceans.
2	It is a mixture.
3	It makes up about 20 % of the Earth's atmosphere.
4	It is used in discharge tubes.

4.1.1.2 Mixtures

Question 26

June 2009 | CHY1BP | Original Q7 | Legacy

QUESTION SEVEN

A manufacturer of sugar-coated sweets stopped using the colour blue. This was because of concerns about the effect of artificial colours on children's health.

They replaced the blue colour with another dye extracted from plants.

7A The sweets are now labelled as 'free of all artificial colours and flavours'.

What information does this give the consumer?

1 Scientists have shown that the sweets are free of health risks.

2 It has been found that the sweets can be stored for a long time.

3 Naturally occurring chemicals have been used to make the sweets.

4 There has been no cruelty to animals in experiments to make the sweets.

7B Some of the ingredients in the sweets have an *E-number*.

What does this mean?

1 They are permitted additives.

2 They are natural ingredients.

3 They have been made from an emulsion.

4 They are eco-friendly.

7C Chromatography can be used to identify coloured ingredients.

Which statement about chromatography is true?

1 Chromatography works on any soluble colouring.

2 Chromatography works only on natural colouring.

3 Chromatography works only on artificial colouring.

4 Chromatography works on any insoluble colouring.

4.1.1.2 Mixtures

Question 26 · continued

7D What should scientists do to help to reduce the risks from food additives?

1 remove food containing additives from supermarkets

2 investigate the links between additives and health problems

3 advise food manufacturers about clear labelling

4 explain to people the risks of eating sugar-coated sweets

Turn over for the next question

4.1.1.2 Mixtures

Question 27

June 2009 | CHY1F | Original Q3 | Legacy

3 This is part of a food label.

> 'A diet low in fat, particularly saturated fat, could help to maintain a healthy heart.'
>
> *Nutritional information table*:
>
> | | Per 100 g |
> |---|---|
> | Total fat | 77.6 g |
> | of which: saturated | 11.2 g |
> | unsaturated | 66.4 g |
>
> Also contains colourings

3 (a) (i) Why is this food described as 'healthy'?

.....

.....

(1 mark)

3 (a) (ii) Draw a ring around the correct word in the box to complete the sentence.

Unsaturated fat can be detected by reacting it with

bromine.
hydrogen.
sulfur.

(1 mark)

3 (b) Liquid fats are called oils. Oil and water can be shaken together to make a mixture.

Draw a ring around the correct answer in the box to complete each sentence.

3 (b) (i) The mixture of oil and water can be prevented

from separating by adding

a colouring.
an emulsifier.
a preservative.

(1 mark)

3 (b) (ii) Compared with either oil or water the mixture has a better

shelf life.
smell.
texture.

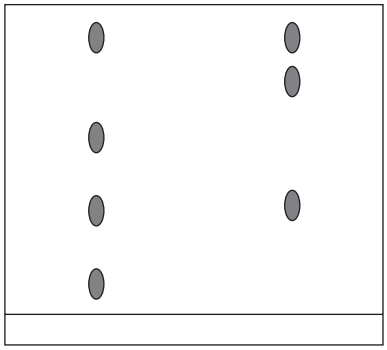
(1 mark)

4.1.1.2 Mixtures

Question 27 · continued

for mark

3 (c) The result of a process used to detect and identify the colours in two foods, **A** and **B**, is shown.



Food **A** Food **B**

3 (c) (i) Describe the differences between the colours used in food **A** and food **B**.

.....

.....

.....

.....

(2 marks)

3 (c) (ii) Tick (✓) the name of the process used to detect and identify colours in food.

Process	(✓)
chromatography	
extraction	
hardening	

(1 mark)

7

4.1.1.2 Mixtures

Question 28

June 2009 | CHY1F | Original Q7 | Legacy

7 (a) Limestone is a hard rock that is used as a building material.
Limestone was used by the Egyptians to make plaster.

Reaction 1 – calcium carbonate, $CaCO_3$, was decomposed by heating limestone

$$CaCO_3 \rightarrow CaO + CO_2$$

Reaction 2 – water was added to the solid produced to make slaked lime

$$CaO + H_2O \rightarrow Ca(OH)_2$$

Reaction 3 – a mixture of slaked lime and water was used as plaster. After the plaster had set it became even harder with age

$$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$$

7 (a) (i) Name the solid formed when calcium carbonate decomposed.

.....

(1 mark)

7 (a) (ii) Use the reactions to explain how the plaster became even harder with age.

.....

.....

.....

.....

.....

.....

.....

(3 marks)

4.1.1.2 Mixtures

Question 28 · continued

for mark

7 (b) A gardener wanted to make a step up to his greenhouse door. He decided to use a mixture of cement and sand to make mortar.

He experimented using mixtures with different cement to sand ratios.

- The mortar mixtures were put in the same sized mould.
- Each mortar mixture was allowed to set hard.
- He then dropped a metal ball from increasing heights until the set mortar cracked.
- He recorded his results in a table.

Volume of sand in cm^3	Volume of cement in cm^3	Height the metal ball dropped to crack the set mortar in cm
800	100	17
700	100	24
600	100	30
500	100	36
400	100	37
300	100	48
200	100	54

7 (b) (i) What is the relationship between the volume of sand and the strength of the mortar?

.....

.....

(1 mark)

7 (b) (ii) The gardener was not sure about some of his results.

Use the results to explain why.

.....

.....

.....

.....

.....

(2 marks)

7

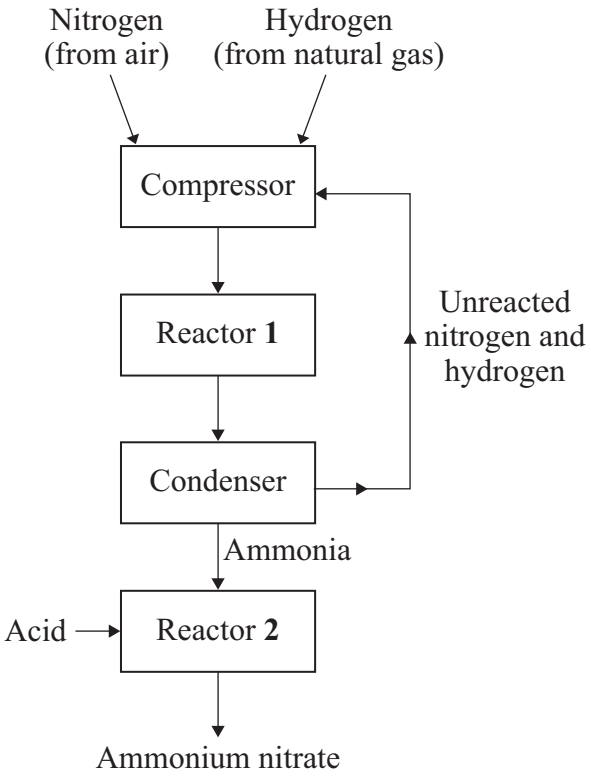
4.1.1.2 Mixtures

Question 29

June 2009 | CHY2F | Original Q3 | Legacy

3 Ammonium nitrate is an important chemical. The diagram shows the main stages in the manufacture of ammonium nitrate.

Study the diagram and then answer the questions.



Draw a ring around the correct answer in each box to complete the sentences.

3 (a) The compressor increases the [pressure / temperature / volume] to 200 atmospheres.

(1 mark)

3 (b) In reactor **1** ammonia is made by reacting [air / natural gas / nitrogen] with [air. / hydrogen. / natural gas.]

(2 marks)

4.1.1.2 Mixtures

Question 29 · continued

for mark

3 (c) In the condenser the mixture is [cooled / heated / reduced] and the ammonia is separated as a liquid. *(1 mark)*

3 (d) In reactor **2** ammonium nitrate is made by reacting ammonia with [hydrochloric / sulfuric / nitric] acid. *(1 mark)*

5

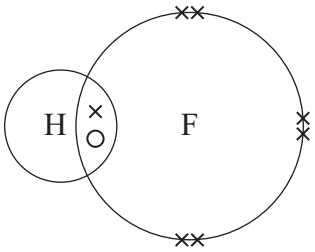
4.1.1.2 Mixtures

Question 30

June 2009 | CHY2F | Original Q4 | Legacy

4 This question is about fluorine and some of its compounds.

4 (a) The diagram represents a molecule of hydrogen fluoride.



Draw a ring around the type of bonding that holds the hydrogen and fluorine atoms together in this molecule.

covalent **ionic** **metallic**

(1 mark)

4 (b) Fluorine is made in industry by the electrolysis of a mixture of potassium fluoride and hydrogen fluoride.

4 (b) (i) Use **one** word from the box to complete the sentence.

gas	**liquid**	**solid**

To allow electrolysis to take place the mixture of potassium fluoride and hydrogen fluoride must be ..... . *(1 mark)*

4.1.1.2 Mixtures

Question 30 · continued

for mark

4 (b) (ii) The mixture of potassium fluoride and hydrogen fluoride contains fluoride ions (F^-), hydrogen ions (H^+) and potassium ions (K^+).

Use **one** word from the box to complete the sentence.

fluorine	**hydrogen**	**potassium**

During electrolysis the element formed at the **positive** electrode is

..... . *(1 mark)*

4 (c) Fluoride ions are sometimes added to drinking water. It is thought that these ions help to reduce tooth decay.

4 (c) (i) Tick (✓) **one** question that **cannot** be answered by scientific investigation alone.

Question	Tick (✓)
Do fluoride ions in drinking water reduce tooth decay?	
Are fluoride ions in drinking water harmful to health?	
Should fluoride ions be added to drinking water?	

(1 mark)

4 (c) (ii) Explain why you have chosen this question.

.....

.....

(1 mark)

5

4.1.1.2 Mixtures

Question 31

November 2009 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about metals.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A metal ore

B reactive metal

C transition metal

D metal alloy

1	a substance that contains enough metal to make it worth extracting
2	a mixture of metals
3	a metal that is found in the central block of the periodic table
4	a metal that cannot be extracted by reduction using carbon

4.1.1.2 Mixtures

Question 32

November 2009 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Duralumin is an alloy which contains copper and magnesium mixed with aluminium.

Aluminium is a low density metal but duralumin is used more often in making aeroplanes.

9A Aluminium, copper and magnesium are extracted from their naturally occurring compounds.

The method used for the extraction depends on . . .

1 the density of the metal.

2 the abundance of the metal compound in the Earth's crust.

3 the melting point of the metal compound.

4 the reactivity of the metal.

9B Copper can be extracted by strongly heating a mixture of the copper compound and carbon.

In this reaction, the copper compound is . . .

1 oxidised.

2 electrolysed.

3 reduced.

4 distilled.

9C Aluminium and magnesium are extracted by electrolysis.

One reason why this method is expensive is that . . .

1 the metals are resistant to corrosion.

2 the process requires a large amount of energy.

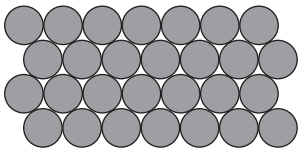
3 the metals are less reactive than carbon.

4 the metal ores are very abundant.

4.1.1.2 Mixtures

Question 32 · continued

9D The diagram shows the arrangement of the atoms in pure aluminium.



Which row in the table correctly shows how the structure and properties are different in duralumin?

	Structure	Properties
1	The layers of atoms are distorted.	The alloy is harder.
2	The copper atoms attach strongly to the aluminium atoms.	The alloy is softer.
3	The layers of atoms are distorted.	The alloy is softer.
4	The magnesium atoms attach strongly to the aluminium atoms.	The alloy is harder.

END OF TEST

4.1.1.2 Mixtures

Question 33

November 2009 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

This question is about extracting lavender oil from lavender plants.

Match processes, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A condenses

B boils

C evaporates

D floats

The crushed lavender plants are mixed with water in a distillation flask and heated until the mixture . . . **1** . . . .

The lavender oil and some water . . . **2** . . . .

The vapour is allowed to cool and it . . . **3** . . . .

The lavender oil rises to the surface of the water where it . . . **4** . . . .
The lavender oil is separated from the water and collected.

4.1.1.2 Mixtures

Question 34

January 2010 | CHY1F | Original Q2 | Legacy

2 Read the article about strawberry milkshakes.

'Strawberry milkshakes without strawberries!'



To make strawberry milkshakes at home, all you need is ice-cream, strawberries and milk.

Fast-food strawberry milkshakes could contain 60 additives but no strawberries.
The fast-food strawberry milkshakes:

- are cheap
- keep for a long time
- have an enhanced flavour. For example they may taste sweet.

2 (a) (i) Suggest **one** reason why the strawberry milkshakes made at home may also contain additives.

.....

.....

(1 mark)

2 (a) (ii) State **one** reason why some fast-food strawberry milkshakes do **not** contain strawberries.

.....

.....

(1 mark)

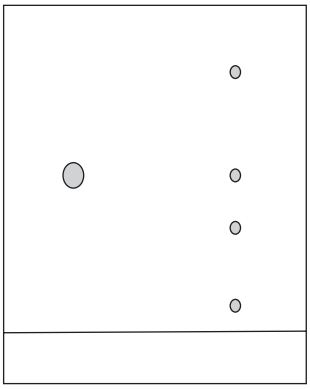
4.1.1.2 Mixtures

Question 34 · continued

for mark

2 (b) The additive E129, allura red, is often added to enhance the colour of strawberry milkshakes.

A student used chromatography to test if a strawberry milkshake contained E129. The result is shown.



2 (b) (i) How many colours are in this milkshake?

.....

(1 mark)

2 (b) (ii) The student concluded that the strawberry milkshake contained E129.

What evidence did the student use to make this conclusion?

.....

.....

(1 mark)

2 (b) (iii) Suggest why this conclusion may **not** be correct.

.....

.....

.....

(1 mark)

5

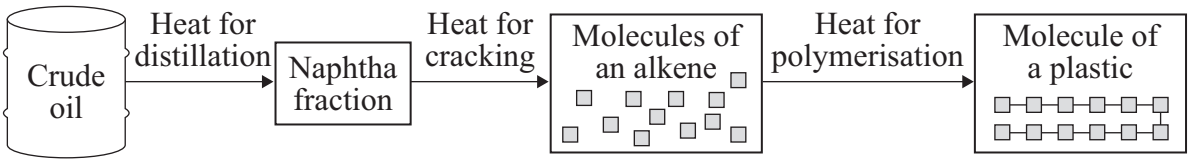
4.1.1.2 Mixtures

Question 35

January 2010 | CHY1F | Original Q5 | Legacy

5 Crude oil is used to make plastics.

5 (a) To make a plastic from crude oil involves many processes.



5 (a) (i) How do alkene molecules form a molecule of a plastic?

.....

.....

(1 mark)

5 (a) (ii) Suggest **one** of the main costs of making a plastic from crude oil.

.....

.....

(1 mark)

5 (a) (iii) Suggest **two** problems caused by the disposal of plastics in landfill sites.

1 .....

.....

2 .....

.....

(2 marks)

4.1.1.2 Mixtures

Question 35 · continued

for mark

5 (b) Some companies are using bio-plastics made from plants such as corn.
Less fossil fuel is used to make bio-plastics than is used to make plastics from crude oil.

Plastics made from plants would be more environmentally friendly than plastics made from crude oil.

Explain why.

.....

.....

.....

.....

(2 marks)

6

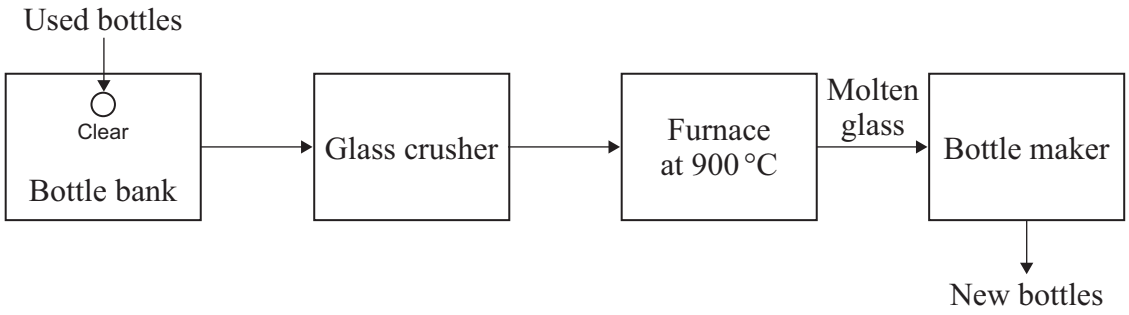
Turn over for the next question

4.1.1.2 Mixtures

Question 36

7 In recent years we have become more aware of the need to recycle glass.

7 (a) Used glass bottles can be recycled if they are put into bottle banks.



7 (a) (i) Suggest **one** reason why light bulbs should **not** be put into bottle banks.

.....

.....

(1 mark)

7 (a) (ii) Very few glass bottles are reused (used more than once).

Suggest **one** reason why.

.....

.....

(1 mark)

7 (a) (iii) New glass bottles can also be produced by heating, at 1700 °C, a mixture of the following raw materials:

sand (silicon dioxide), SiO_2
soda ash (sodium carbonate), Na_2CO_3
limestone (calcium carbonate), $CaCO_3$

Explain why the use of recycled glass to make glass bottles produces less carbon dioxide than making glass bottles from these raw materials.

.....

.....

.....

.....

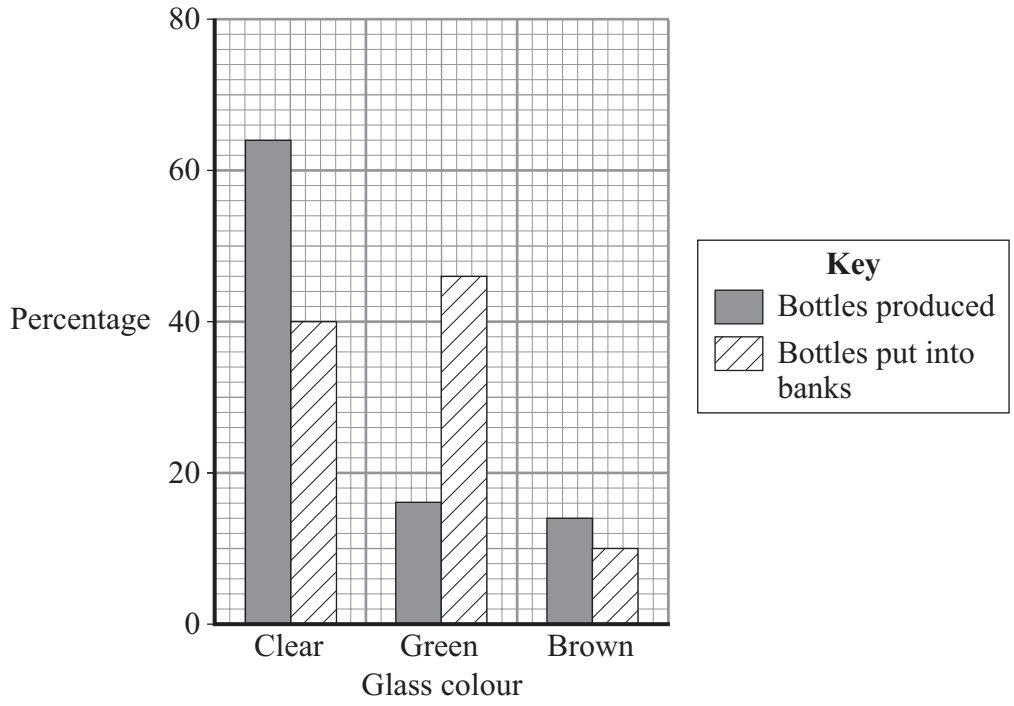
(2 marks)

4.1.1.2 Mixtures

Question 36 · continued

for mark

7 (b) The bar chart shows the percentages of glass bottles produced and the percentages of glass bottles put into bottle banks in the UK.



7 (b) (i) The percentage of green glass bottles produced is 16%.
What is the percentage of green glass bottles put into bottle banks?

Percentage = ... %

(1 mark)

7 (b) (ii) More green glass bottles are put into bottle banks than are made in the UK.
Suggest **one** reason why.

.....

.....

(1 mark)

7 (b) (iii) Suggest and explain **one** problem resulting from the percentage of clear glass bottles produced in the UK.

.....

.....

.....

.....

(2 marks)

8

4.1.1.2 Mixtures

Question 37

January 2010 | CHY2F | Original Q8 | Legacy

8 Read the article.

In the late eighteenth century the French scientist Nicolas Leblanc invented a process to change sodium chloride into sodium carbonate.

The main steps in the original process were:

Step 1. Sodium chloride was reacted with sulfuric acid to make sodium sulfate. Hydrogen chloride was formed and escaped into the atmosphere.
The hydrogen chloride damaged plants over a wide area around the factory.

Step 2. The sodium sulfate was heated with limestone and coal. A solid mixture was formed which contained sodium carbonate, calcium sulfide and unreacted coal.
The calcium sulfide gave off a very unpleasant smell.

Step 3. The sodium carbonate was dissolved in water and separated from the insoluble calcium sulfide and unreacted coal.

Step 4. Crystals of sodium carbonate were obtained from the solution of sodium carbonate.

The process was later improved.

- The hydrogen chloride produced in **Step 1** was changed into chlorine which was used to make bleach.
- The calcium sulfide produced in **Step 2** was converted into sulfur. This sulfur was used to make sulfuric acid.

8 (a) The symbol equation for the reaction in **Step 1** is shown below.

$$2NaCl(s) + H_2SO_4(l) \rightarrow Na_2SO_4(s) + 2HCl(g)$$

What property of hydrogen chloride allowed it to escape into the atmosphere?

.....

(1 mark)

4.1.1.2 Mixtures

Question 37 · continued

for mark

8 (b) The insoluble solids, calcium sulfide and unreacted coal were separated from the sodium carbonate solution in **Step 3**.

Suggest how this was done.

.....

.....

(1 mark)

8 (c) Sodium carbonate crystals were obtained from sodium carbonate solution in **Step 4**.

Suggest how this was done.

.....

.....

(1 mark)

8 (d) It has been stated that: 'the Chemical Industry can turn problems into profit'.

State **two** problems with the original process and explain how they were turned into profit.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

(4 marks)

7

4.1.1.2 Mixtures

Question 38

March 2010 | CHY1BP | Original Q2 | Legacy

QUESTION TWO

Many food additives are given E-numbers.

- Colourings have E-numbers from 100 to 199.
- Preservatives have E-numbers from 200 to 299.
- Substances to stop food from reacting with oxygen have E–numbers from 300 to 399.
- Emulsifying agents have E-numbers from 400 to 499.

Match E-numbers, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A E150

B E210

C E300

D E450

1	used to make gravy mixture brown in colour
2	used to stop salad dressing from separating
3	used to stop fruit from going brown in the air
4	used to increase the shelf-life of jam

4.1.1.2 Mixtures

Question 39

March 2010 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

This question is about the extraction and uses of soybean oil.

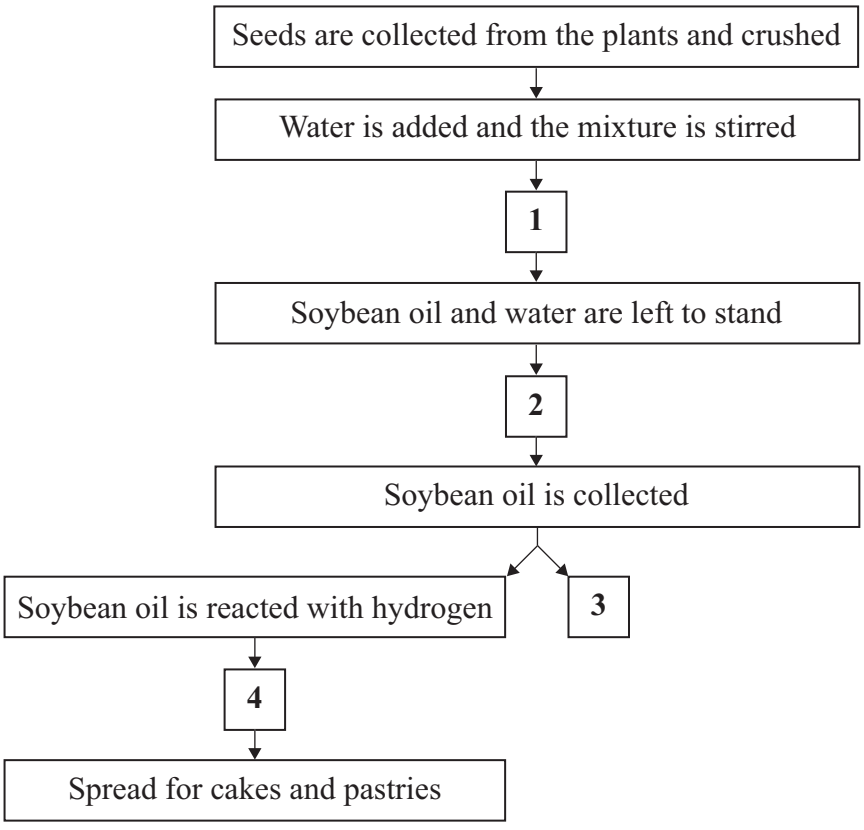
Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A The modified oil solidifies and additives are mixed in

B Soybean oil is used as biofuel in vehicles

C Soybean oil separates from the water

D Mixture of soybean seeds and water is pressed



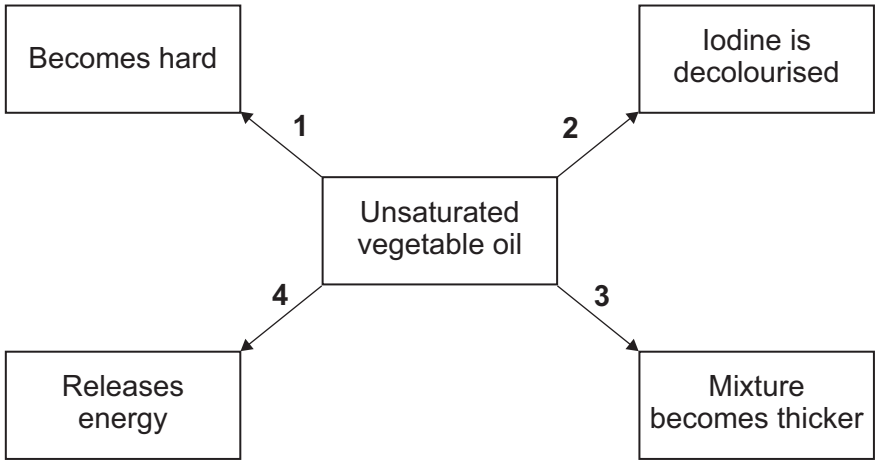
4.1.1.2 Mixtures

Question 40

June 2010 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows what happens to an unsaturated vegetable oil when it is treated in different ways.



Match processes, **A**, **B**, **C** and **D**, with the numbers **1–4** in the diagram.

A Burn in oxygen

B Test for unsaturation

C Add water and shake vigorously

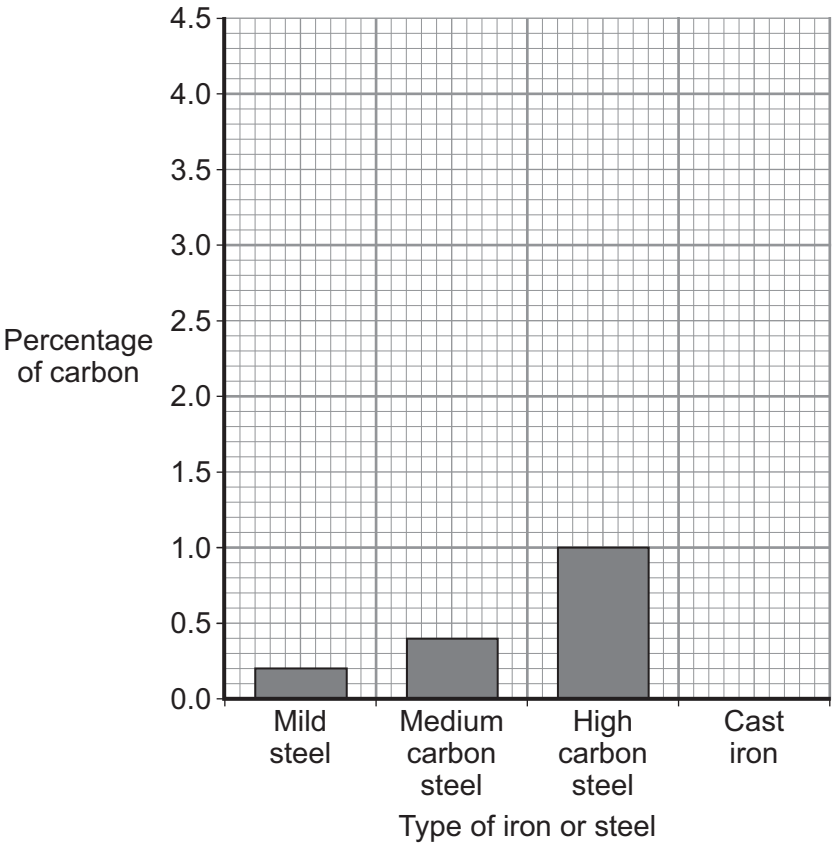
D React with hydrogen

4.1.1.2 Mixtures

Question 41

June 2010 | CHY1F | Original Q2 | Legacy

2 The bar chart shows the percentage of carbon in three types of steel.



2 (a) Draw a ring around the correct word in the box to complete the sentence.

Steel is the name used for | alloys / atoms / ores | of iron.

(1 mark)

2 (b) Cast iron contains 4% carbon.

Draw the bar for cast iron on the chart.

(1 mark)

2 (c) Cast iron is more brittle than these three types of steel.

Use the bar chart to suggest why.

.....

.....

(1 mark)

4.1.1.2 Mixtures

Question 41 · continued

2 (d) One type of stainless steel contains iron with 0.2% carbon to which 8% nickel and 18% chromium were added.

2 (d) (i) Tick (✓) the percentage of iron in this type of stainless steel.

Percentage (%) of iron	Tick (✓)
92.4	
88.6	
73.8	

(1 mark)

2 (d) (ii) Use the bar chart to name the type of steel that contains only 0.2% carbon.

.....

(1 mark)

2 (d) (iii) Draw a ring around the correct word in the box to complete the sentence.

Stainless steel is used for knives and forks because it is resistant to

corrosion.

decomposition.

distillation.

(1 mark)

6

4.1.1.2 Mixtures

Question 42

June 2010 | CHY1F | Original Q4 | Legacy

4 An article had the following headline.

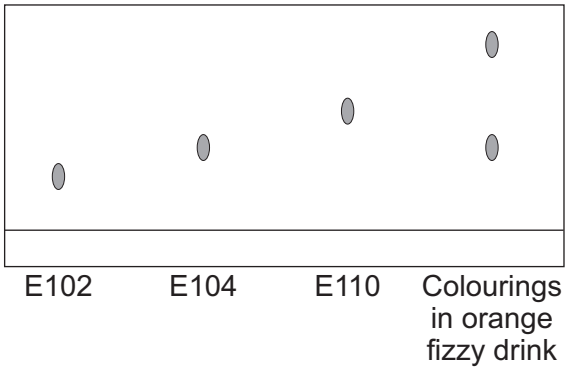
NEW FEAR OVER DRINK ADDITIVES

Some children get headaches and skin problems that are possibly caused by some types of fizzy orange drinks.

These fizzy drinks all contain water, carbon dioxide, artificial flavourings and colourings.

Three artificial colourings that have been used in fizzy orange drinks are tartrazine (E102), quinoline yellow (E104) and sunset yellow (E110).

4 (a) Colourings can be detected by chromatography.
The results of chromatography for the colourings in one fizzy orange drink are shown.



4(a) (i) How many colourings are there in the fizzy orange drink? .....

(1 mark)

4 (a) (ii) Which one of the colourings, E102, E104 or E110, does the fizzy orange drink contain?

Explain your answer.

E..... because .....

.....

.....

(2 marks)

4 (b) (i) Why are artificial colourings added to some fizzy orange drinks?

.....

.....

(1 mark)

4.1.1.2 Mixtures

Question 42 · continued

4 (b) (ii) Some people believe that artificial colourings cause headaches and skin problems.

Suggest **one** other substance in the fizzy orange drink that may cause these problems.

.....

(1 mark)

4 (c) Plastic bottles are often used as drink containers.

4 (c) (i) Draw a ring around the correct word in each box to complete the sentence.

The plastic is made by joining together many small molecules called

fractions
metals
monomers

to form very large molecules called

alloys.
polymers.
gases.

(2 marks)

4 (c) (ii) Used plastic bottles should **not** be dumped in landfill sites.

Give **two** reasons for this.

1 .....

.....

2 .....

.....

(2 marks)

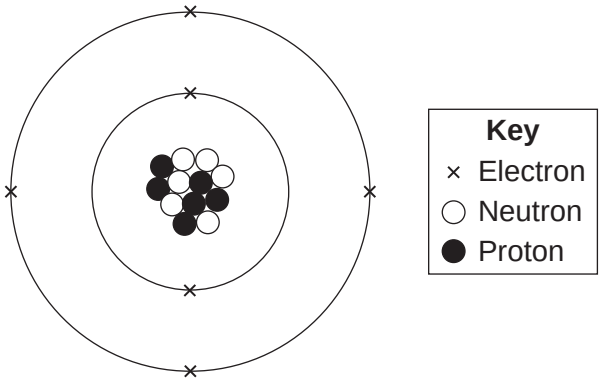
9

4.1.1.2 Mixtures

Question 43

June 2010 | CHY2F | Original Q2 | Legacy

2 The diagram represents a carbon atom.



2 (a) Use words from the box to answer the questions.

electron	**neutron**	**nucleus**	**proton**

2 (a) (i) What is the name of the central part of the atom?

.....

(1 mark)

2 (a) (ii) What is the name of the particle with no charge?

.....

(1 mark)

2 (a) (iii) What is the name of the particle with a negative charge?

.....

(1 mark)

2 (b) Use the diagram above to help you to answer these questions.

2 (b) (i) Draw a ring around the atomic (proton) number of this carbon atom.

6 **12** **18**

(1 mark)

2 (b) (ii) Draw a ring around the mass number of this carbon atom.

6 **12** **18**

(1 mark)

4.1.1.2 Mixtures

Question 43 · continued

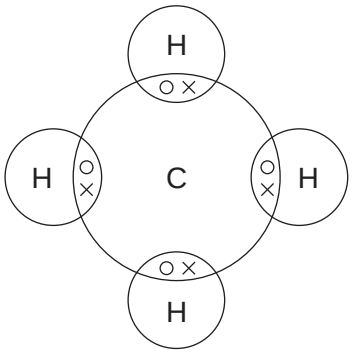
2 (c) A different carbon atom has 6 protons and 8 neutrons.

Draw a ring around the symbol that represents this atom.

$^{8}_{6}C$ $^{14}_{6}C$ $^{14}_{8}C$

(1 mark)

2 (d) The diagram shows the bonding in a methane molecule.



2 (d) (i) Draw a ring around the chemical formula of a methane molecule.

CH_4 **CH^4** **C_4H**

(1 mark)

2 (d) (ii) Draw a ring around the word that describes methane.

compound **element** **mixture**

(1 mark)

2 (d) (iii) Draw a ring around the type of bonding in a methane molecule.

covalent **ionic** **metallic**

(1 mark)

9

4.1.1.2 Mixtures

Question 44

June 2019 | CHY3F | Original Q1 | Legacy

1 The table shows some information about acids and alkalis.

Name of acid or alkali	Type	Ions produced in solution		pH	Effect on Universal Indicator
Hydrochloric acid	Strong acid	H^+	Cl^-	1	Goes red
Sodium hydroxide	Strong alkali	Na^+	OH^-	13	Goes purple

Use the information in the table to help you answer parts **(a)** and **(b)**.

1 (a) Draw a ring around the correct answer to complete each sentence.

1 (a) (i) Hydrochloric acid is acidic.

This is because it contains [Cl^- / H^+ / OH^-] ions.

(1 mark)

1 (a) (ii) Sodium hydroxide solution is alkaline.

This is because it contains [H^+ / Na^+ / OH^-] ions.

(1 mark)

1 (a) (iii) The pH of acids is [higher than / lower than / the same as] the pH of alkalis.

(1 mark)

4.1.1.2 Mixtures

Question 44 · continued

1 (b) Ethanoic acid is a weak acid.

Universal Indicator can be used to show that hydrochloric acid is a stronger acid than ethanoic acid of the same concentration.

Explain how.

.....

.....

.....

.....

(2 marks)

1 (c) Draw a ring around the correct answer to complete this sentence.

Strong acids and strong alkalis are [completely / not / partially] ionised in water.

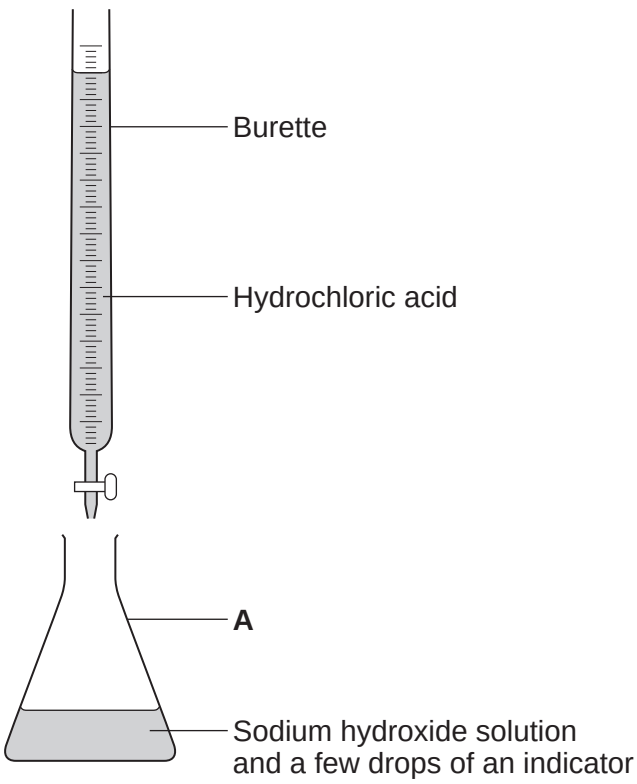
(1 mark)

Question 1 continues on the next page

4.1.1.2 Mixtures

Question 44 · continued

1 (d) The diagram shows the apparatus used to find the volume of hydrochloric acid that reacts with 25.0 cm^3 of sodium hydroxide solution.



1 (d) (i) Which **one** of the following is the correct name for **A**?

Draw a ring around your answer.

beaker **conical flask** **pipette**

(1 mark)

1 (d) (ii) Use the correct word from the box to complete the sentence.

distillation	**filtration**	**titration**

The method used to find the volume of acid that reacts with a known volume of alkali is ..... .

(1 mark)

1 (d) (iii) Suggest **one** way to make the results more reliable.

.....

(1 mark)

9

4.1.1.2 Mixtures

Question 45

November 2010 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

The substances that we get from the distillation of crude oil have a range of properties.

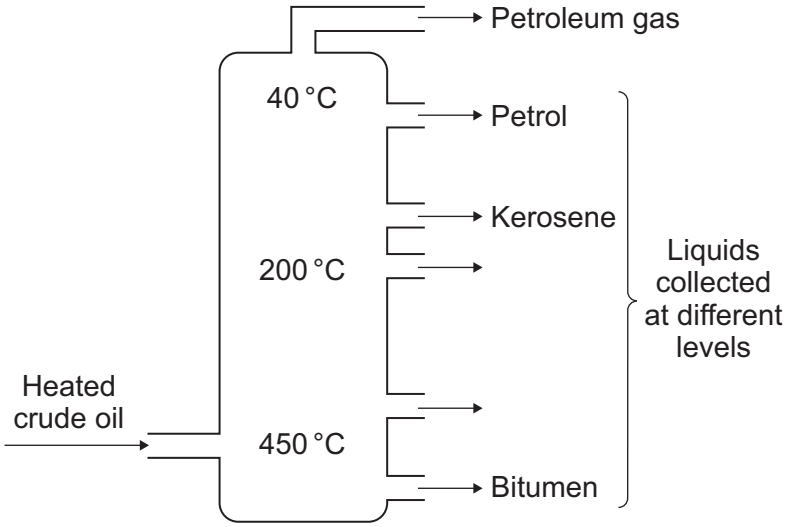
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A kerosene

B petroleum gas

C petrol

D bitumen



The substance with the lowest boiling point is . . . **1** . . . .

The substance collected at about 150 °C is . . . **2** . . . .

The most volatile liquid collected is . . . **3** . . . .

The most viscous substance collected is . . . **4** . . . .

4.1.1.2 Mixtures

Question 46

November 2010 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

This question is about how we obtain some metals.

Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A uses another metal

B does **not** use a chemical reaction

C could be done in a blast furnace

D is called electrolysis

1	Aluminium is made when an electric current passes through a molten aluminium compound.
2	Gold can be found at the bottom of some streams.
3	Titanium is made by reacting titanium chloride with magnesium.
4	Zinc is made when a mixture of zinc oxide and carbon is heated.

4.1.1.2 Mixtures

Question 47

November 2010 | CHY1BP | Original Q3 | Legacy

QUESTION THREE

We can get plant oils from crushed plants.

This is a two-stage process.

Stage 1

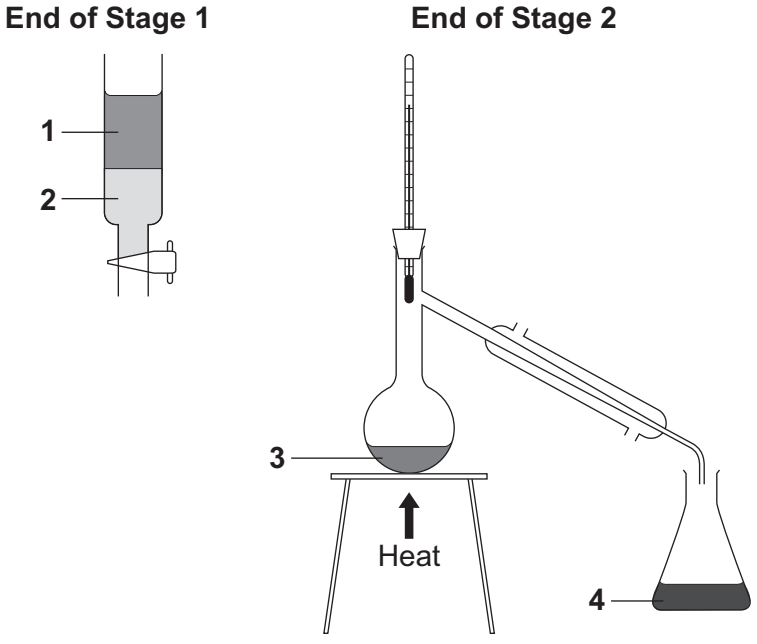
Shake up the crushed mixture with a solvent and water. This separates the oil from the crushed mixture.

- Only the oil dissolves in the solvent.
- The liquids are filtered from the solids.
- The oil and solvent mixture floats on water.

Stage 2

Use simple distillation to separate the oil from the solvent.

- The solvent has a lower boiling point than the oil.



Match words, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagrams.

A the oil and solvent mixture

B the plant oil

C the water

D the solvent

4.1.1.2 Mixtures

Question 48

November 2010 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

This question is about vegetable oils.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A chromatography

B combustion

C hydrogenation

D unsaturation

Vegetable oils are important foods and fuels.

Artificial colours in foods are usually detected by . . . **1** . . . .

Reacting oils with bromine will show the degree of . . . **2** . . . in the oil.

The melting points of vegetable oils can be increased by . . . **3** . . . .

Oils release heat energy by the process of . . . **4** . . . .

4.1.1.2 Mixtures

Question 49

November 2010 | CHY1BP | Original Q6 | Legacy

QUESTION SIX

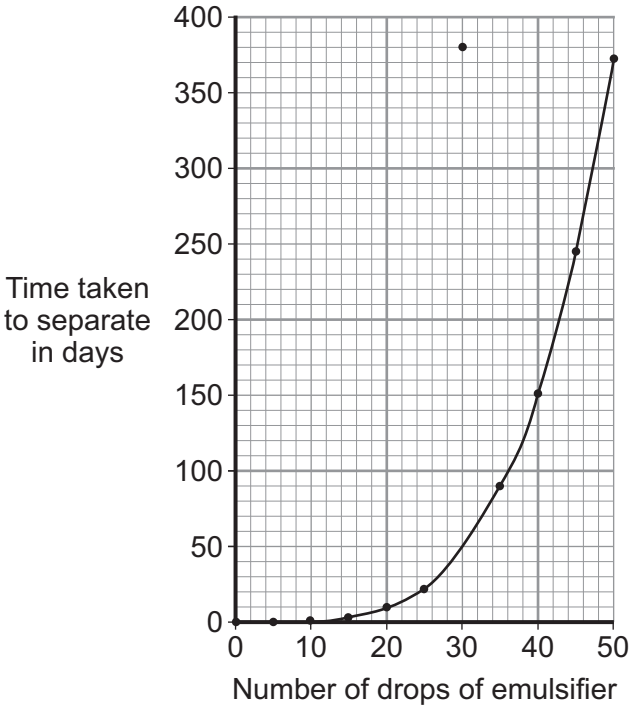
The water and oil used in making a salad dressing will separate if the salad dressing is left to stand.

A scientist at a food company wanted to know how much emulsifier she needed to add to prevent oil and water from separating.

- She mixed equal volumes of oil and water.
- Then she added drops of emulsifier.
- She shook the mixture and timed how long it took for the mixture to begin separating.

She recorded her results in a table and plotted a line graph.

Number of drops of emulsifier	0	5	10	15	20	25	30	35	40	45	50
Time taken to separate in days	0	0	1	3	10	23	380	90	152	244	372



4.1.1.2 Mixtures

Question 49 · continued

6A The scientist decided to ignore her result for 30 drops of emulsifier.

This was because . . .

1 380 is not on the 'Time taken to separate in days' axis on the graph.

2 the result does not fit the pattern.

3 the result was lower than expected.

4 380 days was the highest value recorded.

6B Using her graph, she decided that an accurate time of separation for 30 drops of emulsifier was . . .

1 27 days.

2 30 days.

3 50 days.

4 380 days.

6C To make all her results more reliable, she should . . .

1 repeat only the 30 drops of emulsifier experiment.

2 not use her first results and repeat the whole investigation.

3 repeat the whole investigation and compare both sets of results.

4 measure the drops of emulsifier more accurately.

6D The salad dressing has a shelf-life of 120 days.

The graph shows that the minimum amount of emulsifier needed to prevent the salad dressing from separating before 120 days is . . .

1 18 drops.

2 28 drops.

3 38 drops.

4 48 drops.

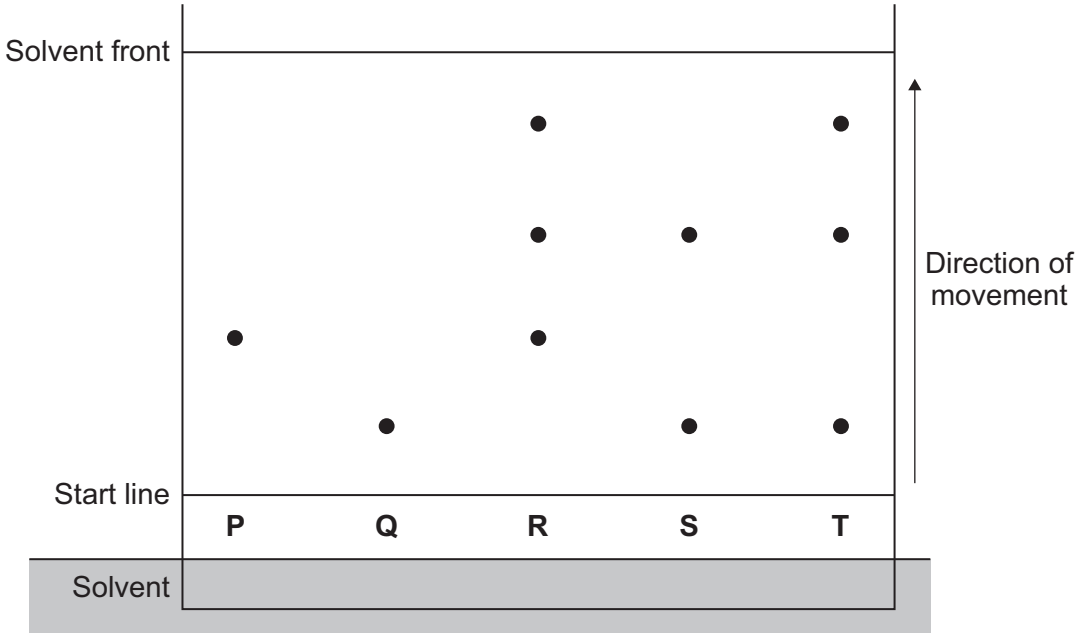
4.1.1.2 Mixtures

Question 50

November 2010 | CHY1BP | Original Q7 | Legacy

QUESTION SEVEN

Chromatography is used to identify and compare five food colourings, **P**, **Q**, **R**, **S** and **T**.
The five food colourings are used to coat chocolate sweets.



7A Which food colourings are mixtures of three colours?

1 **P** and **R**

2 **Q** and **S**

3 **R** and **T**

4 **S** and **P**

7B Food colouring **P** was analysed and was found to be toxic.

Which other food colouring is toxic?

1 **Q**

2 **R**

3 **S**

4 **T**

4.1.1.2 Mixtures

Question 50 · continued

7C Food colourings are used to coat chocolate sweets . . .

1 to make the sweets cost more.

2 to increase the shelf-life.

3 to make the sweets more attractive.

4 to increase the number of additives.

7D An E-number is used to identify a permitted food . . .

1 additive.

2 element.

3 mixture.

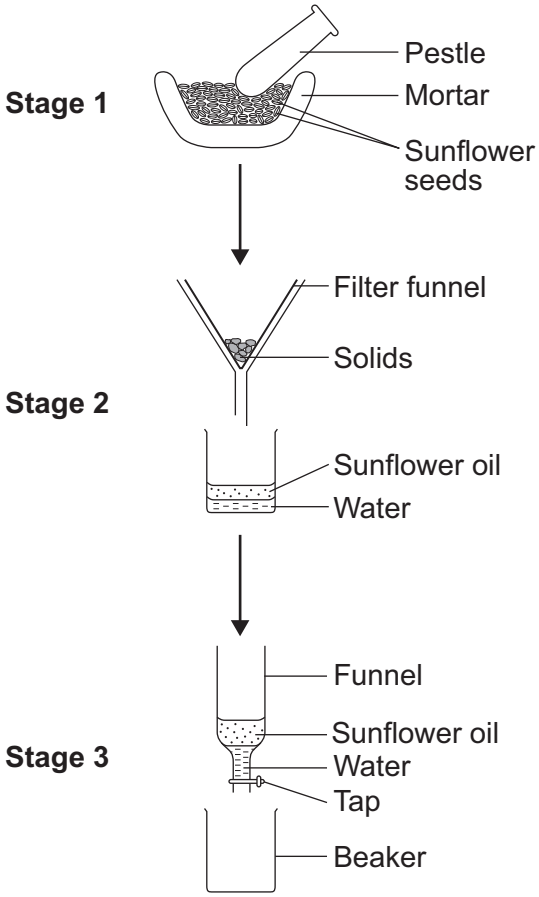
4 oil.

Turn over for the next question

4.1.1.2 Mixtures

Question 51

5 (a) The diagram shows how sunflower oil can be extracted from sunflower seeds in three stages.



5 (a) (i) Complete the sentences.

To release the oil and water in **stage 1** the sunflower seeds

are ..... .

To remove any solids in **stage 2** the mixture is ..... .

(2 marks)

4.1.1.2 Mixtures

Question 51 · continued

5 (a) (ii) Describe how the funnel with a tap in **stage 3** is used to separate the oil from the water.

.....

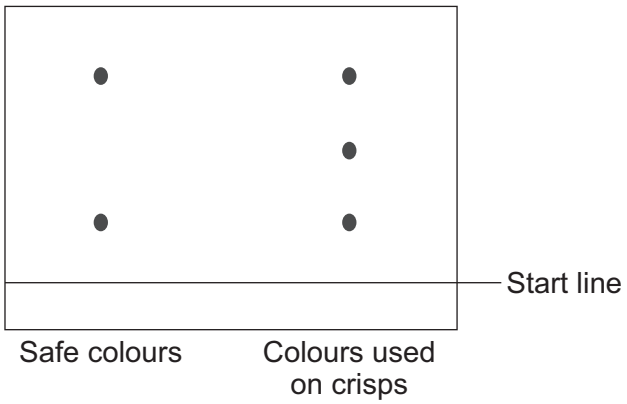
.....

.....

.....

(2 marks)

5 (b) Some crisps are made by frying thin slices of potato in sunflower oil.
Colours can be added to improve the appearance of the crisps.
Chromatography is used to check if these colours are safe to eat.
One result is shown below.



Use the results to help you to answer these questions.

5 (b) (i) How many colours were added to the crisps? .....

(1 mark)

5 (b) (ii) Are the crisps safe to eat? Explain your answer.

.....

.....

.....

(1 mark)

5 (b) (iii) Why would a manufacturer want to improve the appearance of their crisps?

.....

.....

(1 mark)

7

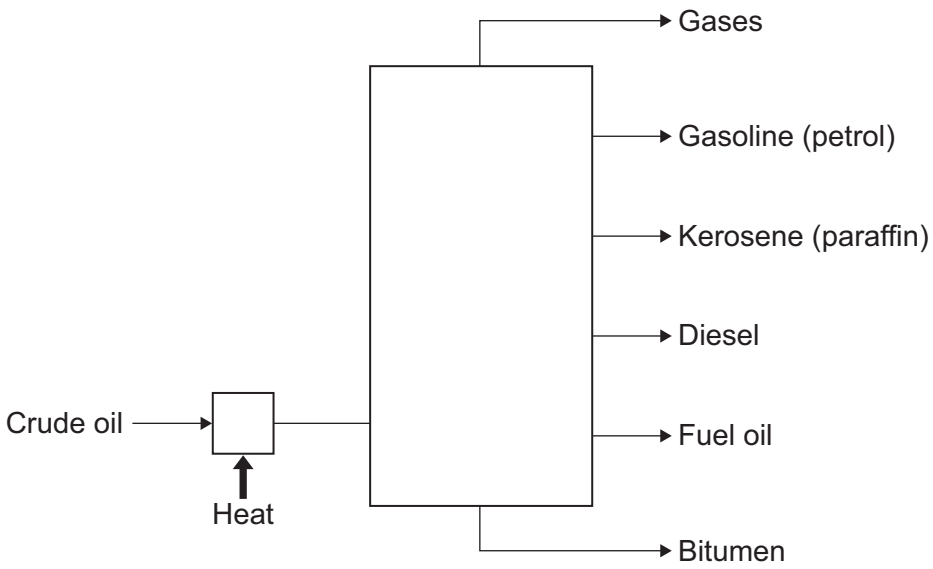
4.1.1.2 Mixtures

Question 52

January 2011 | CHY1F | Original Q7 | Legacy

7 Crude oil is used to produce many useful materials.

7 (a) The diagram shows some of the fractions produced from crude oil by fractional distillation.



Use the diagram to help you to explain how crude oil is separated into fractions.

You should use the words evaporated and condensed in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(3 marks)

4.1.1.2 Mixtures

Question 52 · continued

7 (b) The table shows some information about four of the fractions from crude oil that are used as fuels.

Fraction	Boiling point in °C	Number of carbon atoms found in the molecules
Gasoline (petrol)	20 – 200	5 – 10
Kerosene (paraffin)	180 – 260	10 – 16
Diesel	260 – 340	14 – 20
Fuel oil	370 – 600	20 – 70

Use the information in the table to help you to answer these questions.

7 (b) (i) How can you tell that each of the fractions is a mixture?

.....

.....

(1 mark)

7 (b) (ii) How does the number of carbon atoms in a molecule affect its boiling point?

.....

.....

(1 mark)

7 (c) Fuels are substances that release energy.

7 (c) (i) Name the reaction that releases energy from a fuel such as gasoline (petrol).

.....

(1 mark)

7 (c) (ii) Describe how fuel oil is broken down into smaller, more useful molecules such as gasoline (petrol).

.....

.....

.....

.....

(2 marks)

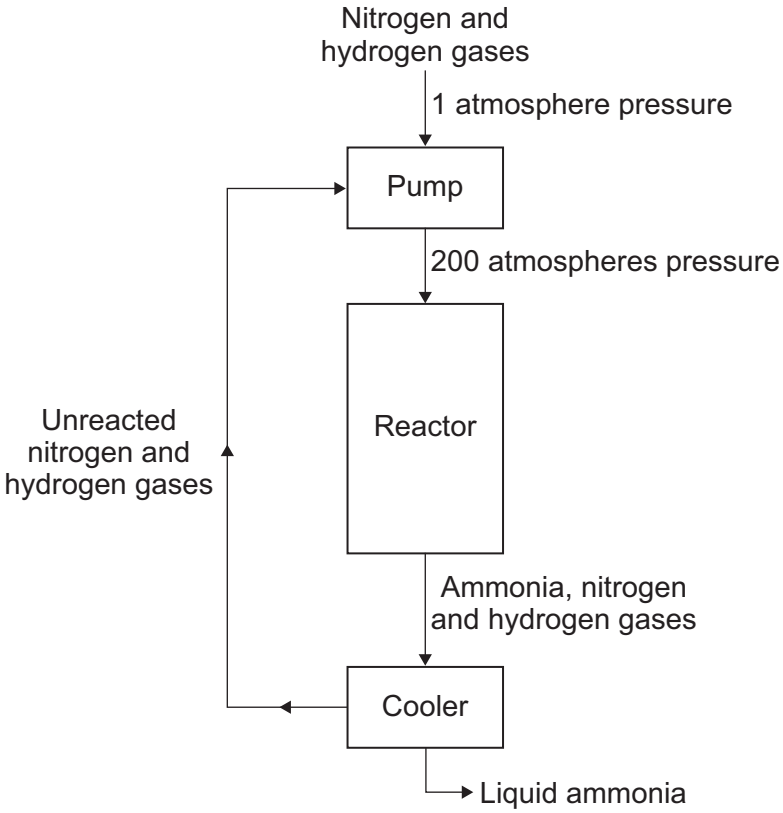
8

4.1.1.2 Mixtures

Question 53

January 2011 | CHY2F | Original Q1 | Legacy

1 The flow diagram shows how ammonia is made.



1 (a) What effect, if any, does the **pump** have on the pressure of the nitrogen and hydrogen?

Draw a ring around the correct answer to complete the sentence.

The pump | decreases / has no effect on / increases | the pressure.

(1 mark)

4.1.1.2 Mixtures

Question 53 · continued

1 (b) The word equation for making ammonia is:

nitrogen + hydrogen $\rightleftharpoons$ ammonia

In the **reactor** only a small amount of the nitrogen and hydrogen is changed into ammonia.

Tick (✓) the reason why.

Reason why	Tick (✓)
Ammonia is formed from two elements.	
Nitrogen and hydrogen are gases.	
The reaction is reversible.	

(1 mark)

1 (c) In the **cooler** the mixture of gases is cooled.

Draw a ring around the correct answer to complete the sentence.

The cooler turns the ammonia into

a liquid.

a solid.

an element.

(1 mark)

1 (d) What happens to the unreacted nitrogen and hydrogen from the **reactor**?

.....

.....

(1 mark)

4

4.1.1.2 Mixtures

Question 54

January 2011 | CHY3F | Original Q2 | Legacy

2 Read the information in the box and then answer the questions.

> Seidlitz Powder is a medicine.
>
> Seidlitz Powder comes as two powders. One powder is wrapped in white paper and contains tartaric acid. The other powder is wrapped in blue paper and contains sodium hydrogencarbonate.
>
> The contents of the blue paper are dissolved in water and the contents of the white paper are added. This causes a reaction that produces carbon dioxide gas. The mixture is safe to drink when the reaction stops.

2 (a) Suggest why Seidlitz Powder comes as two separate powders.

.....

(1 mark)

2 (b) The reaction produces carbon dioxide gas.

2 (b) (i) What would you see during the reaction?

.....

(1 mark)

2 (b) (ii) Which state symbol in a chemical equation shows that carbon dioxide is a gas?

Draw a ring around **one** answer.

(s) **(l)** **(aq)** **(g)**

(1 mark)

2 (b) (iii) Draw a ring around the correct answer to complete the sentence.

Carbon dioxide can be identified because it turns [limescale / limestone / limewater] milky.

(1 mark)

4.1.1.2 Mixtures

Question 54 · continued

2 (c) Sodium hydrogencarbonate contains sodium ions. Sodium ions can be identified by flame tests.

Draw a ring around the correct answer to complete the sentence.

Sodium ions give a [blue / red / yellow] flame.

(1 mark)

2 (d) Some Seidlitz Powder was bought on the Internet for £5. However, when tested, it was found to be only magnesium sulfate, worth a few pence.

Draw a ring around the correct answer to complete each sentence.

2 (d) (i) The test for sulfate ions uses [barium chloride / silver nitrate / sodium hydroxide] solution.

(1 mark)

2 (d) (ii) A positive test for sulfate ions produces a [blue / red / white] precipitate.

(1 mark)

2 (d) (iii) Suggest **one** disadvantage of buying medicines on the Internet.

.....

.....

(1 mark)

8

4.1.1.2 Mixtures

Question 55

January 2011 | CHY3F | Original Q3 | Legacy

3 This label was on a bottle of vinegar.



Vinegar contains ethanoic acid, which is a *weak* acid.

3 (a) Draw a ring around the correct answer to complete the sentences.

3 (a) (i) Ethanoic acid is an acid because it contains [hydrogen / hydroxide / oxide] ions.

(1 mark)

3 (a) (ii) Ethanoic acid is a *weak* acid because it is [completely / not / partially] ionised in water.

(1 mark)

3 (b) Magnesium ribbon can be used in a test to show that ethanoic acid is a weaker acid than hydrochloric acid.

3 (b) (i) State **one** way of making this test fair.

.....

.....

(1 mark)

3 (b) (ii) Give the results of this test.

.....

.....

.....

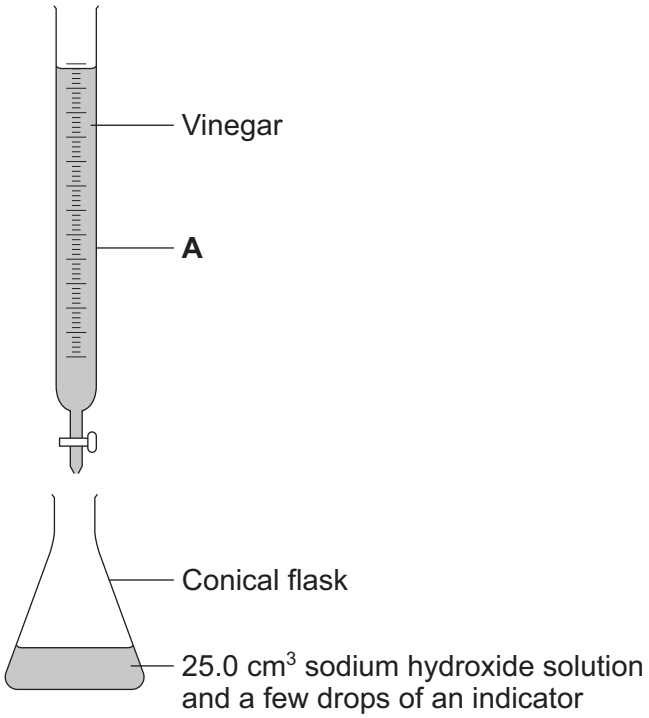
.....

(2 marks)

4.1.1.2 Mixtures

Question 55 · continued

3 (c) The diagram shows the apparatus a student used to find the volume of vinegar that reacts with 25.0 cm^3 of sodium hydroxide solution.



3 (c) (i) Choose the correct word from the box to complete the sentence.

filtration	**polymerisation**	**titration**

The name of this method is ..... .

(1 mark)

3 (c) (ii) Which **one** of the following is the correct name for apparatus **A**?

Draw a ring around **one** answer.

burette **measuring cylinder** **pipette**

(1 mark)

3 (c) (iii) State how the student knew when enough vinegar had been added.

.....

.....

(1 mark)

8

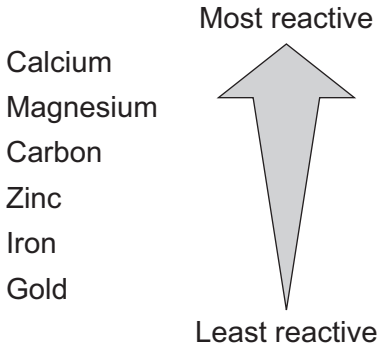
4.1.1.2 Mixtures

Question 56

March 2011 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This is the order of reactivity for some elements.



Match elements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A Carbon

B Gold

C Magnesium

D Zinc

1	It is a non-metal element.
2	It does not react with oxygen or water even at high temperatures.
3	It is more reactive than iron but **can** be extracted from its oxide by mixing with carbon and heating the mixture.
4	It is less reactive than calcium but **cannot** be extracted from its oxide by mixing with carbon and heating the mixture.

4.1.1.2 Mixtures

Question 57

March 2011 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

A man is going to make a concrete base for his garage.

He does an investigation to find out the ratio of sand to cement that will produce the strongest concrete:

- He makes several mixtures, changing the ratio of sand to cement.
- He measures the sand and cement quantities using a trowel.
- He makes a block of concrete with the same amount of each of the different mixtures.
- He makes the blocks exactly the same size.
- He drops a metal ball, from a measured height, onto each of the concrete blocks.
- He observes the concrete to see if it breaks.

The man starts by dropping the metal ball from a height of 10 cm onto one of the blocks. He gradually increases the height until the block breaks. He records this height.

He repeats this process with each of the concrete blocks.

The results are shown in the table below.

Trowels of sand	Trowels of cement	Height in cm
8	1	18
7	1	24
6	1	30
5	1	36
4	1	37
3	1	41
2	1	45

4.1.1.2 Mixtures

Question 57 · continued

March 2011 | CHY1AP | Original Q6 | Legacy

6A The independent variable in this test is the . . .

1 size of the concrete blocks.

2 ratio of sand to cement.

3 type of metal ball dropped.

4 height from which the metal ball is dropped.

6B The man is not confident that the height readings of 36 cm and 37 cm are correct.

What should he do?

1 repeat all the measurements using a heavier metal ball

2 repeat the measurement for the 5:1 ratio of sand to cement

3 repeat the measurement for the 4:1 ratio of sand to cement

4 repeat the measurements for the 5:1 and 4:1 ratios of sand to cement

6C The results in the table show a pattern.

The pattern is that . . .

1 as the ratio of sand to cement decreases, the strength of the concrete increases.

2 as the quantity of sand increases, the strength of the concrete increases.

3 as the quantity of sand decreases, the concrete breaks at a lower height.

4 the strength of the concrete is directly proportional to the quantity of sand added.

6D How could the man obtain results that are more reliable?

1 use different types of cement

2 weigh out the sand with a balance

3 repeat the test for all mixtures and calculate the mean

4 add stones to some of the concrete mixtures

4.1.1.2 Mixtures

Question 58

March 2011 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

During December 1952, many people died in London due to smog. Smog is a mixture of smoke and sulfur dioxide.

7A Sulfur dioxide is responsible for . . .

1 global dimming.

2 global warming.

3 the greenhouse effect.

4 acid rain.

The table shows the amount of sulfur dioxide in the air in three places in London in December 1952.

Location within London	Amount of sulfur dioxide in parts per million							
	Mean for the whole month of December 1952	Reading on each day in first week of December 1952						
		1st	2nd	3rd	4th	5th	6th	7th
Lambeth	0.22	0.16	0.24	0.34	0.75	0.86	1.34	0.47
Southwark	0.11	0.19	0.26	0.38	0.41	1.14	0.95	0.80
Westminster	0.16	0.15	–	0.24	0.48	0.63	0.99	0.89

7B Which of the following statements describes the pattern of the readings in the table?

1 The highest reading for sulfur dioxide is on the same day in each location.

2 The readings all rise and then fall in each location.

3 The sulfur dioxide readings are the same on the 6th December in each location.

4 The readings all rise and then stay the same in each location.

7C The most likely value for the missing reading on the 2nd December for Westminster is . . .

1 0.13

2 0.19

3 0.36

4 0.45

4.1.1.2 Mixtures

7D The mean value for the whole month of December for Southwark is lower than any of the readings for the first 7 days of December for Southwark.

This is because for Southwark, . . .

1 the mean of the readings for the first 7 days in December is 0.11

2 the readings for the other days in December were all zero.

3 after 7th December, the smog became thicker.

4 most of the readings for the other days in December were lower than 0.11

Turn over for the next question

4.1.1.2 Mixtures

Question 59

June 2011 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

A mixture of iron oxide and aluminium reacts when heated.

This is the balanced equation for the reaction:

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

Symbols	
Fe	Iron
O	Oxygen
Al	Aluminium

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A electrons

B bonds

C products

D elements

Iron oxide and aluminium are the reactants. Aluminium oxide and iron are the . . . **1** . . . .

Aluminium atoms and oxygen atoms combine by transferring . . . **2** . . . .

The particles (ions) in aluminium oxide are held together by . . . **3** . . . .

The equation is balanced because, in the reaction, there is no change in the total number of atoms of each of the . . . **4** . . . .

4.1.1.2 Mixtures

Question 60

June 2011 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Crude oil is a mixture made up mainly of alkanes.

9A The alkanes are a series of hydrocarbons . . .

1 all of which are gases at room temperature (20 °C).

2 that have the general formula C_nH_{2n}.

3 in which the molecules have a carbon : hydrogen ratio of 1 : 4.

4 that are saturated.

Crude oil can be separated into fractions by fractional distillation.

9B In the fractionating column, the crude oil separates into fractions because . . .

1 the crude oil changes from a liquid into a vapour.

2 the alkanes condense at different temperatures.

3 the crude oil decomposes when it is heated.

4 the alkanes have different densities.

9C The petrol fraction has a boiling range from 40 °C to 70 °C.

The fraction does not have a fixed boiling point because it . . .

1 contains only one alkane.

2 contains several alkanes.

3 collects near the top of the column.

4 decomposes at 40 °C.

9D The petrol fraction is used as a fuel. Ethanol (C_2H_5OH), made from plant material, can be used as a fuel instead of petrol.

One advantage of ethanol over petrol is that ethanol . . .

1 does not produce carbon dioxide when it burns.

2 is a renewable fuel.

3 produces only water when it burns.

4 is a compound, not a mixture.

END OF TEST

4.1.1.2 Mixtures

Question 61

June 2011 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

This question is about sunflower oil.

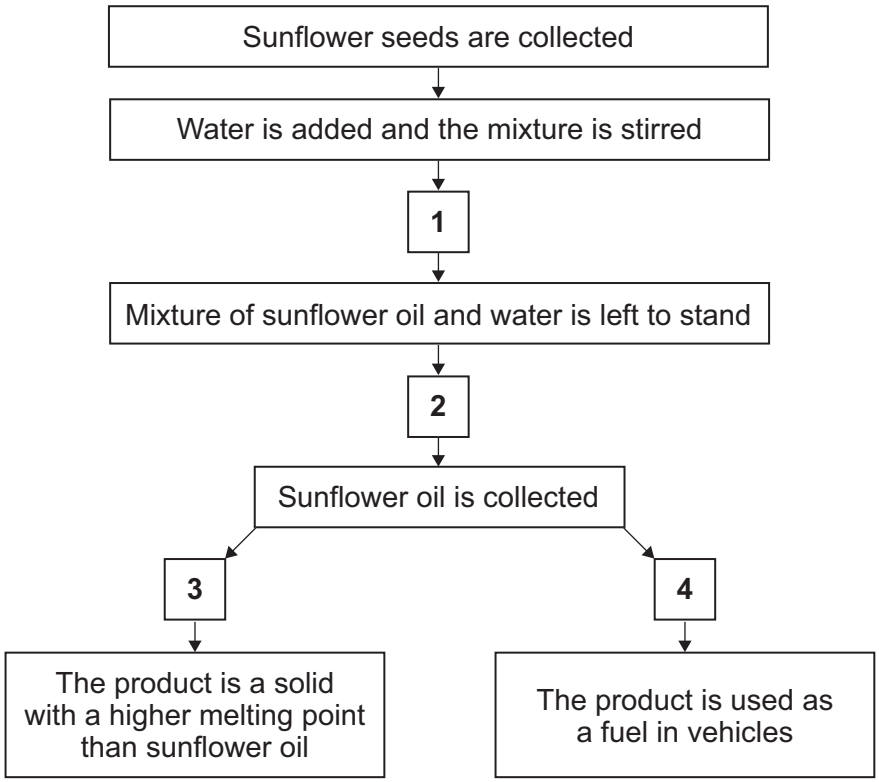
Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A Sunflower oil separates as a layer above the water.

B Sunflower oil is reacted with hydrogen at 60 °C.

C Sunflower oil is mixed with petroleum diesel.

D Mixture of sunflower seeds and water is pressed.



4.1.1.2 Mixtures

Question 62

June 2011 | CHY1BP | Original Q6 | Legacy

QUESTION SIX

This question is about unsaturated oils.

A student tested four oils, **K**, **L**, **M** and **N**, to find out which was the most unsaturated.

The student:

- used the same volume of each of the oils for all the tests.
- added bromine water from a burette to oil **K** and shook the mixture.
- continued until the bromine water was no longer decolourised.
- recorded the volume of bromine water added.
- repeated this two more times for oil **K**.

He then repeated the same procedure for oils **L**, **M** and **N**.

His results are given in the table.

Oil tested	Volume of bromine water added in cm^3		
	Test 1	Test 2	Test 3
K	20.1	20.2	20.2
L	42.2	44.2	46.2
M	25.6	26.3	27.0
N	15.8	16.5	14.3

6A The student used the burette to measure the volume of bromine water to the nearest . . .

1 $0.1\,cm^3$

2 $0.2\,cm^3$

3 $1.0\,cm^3$

4 $2.0\,cm^3$

4.1.1.2 Mixtures

Question 62 · continued

6B The student obtained the largest range of burette readings for oil . . .

1 **K**

2 **L**

3 **M**

4 **N**

6C The student obtained the most precise results for oil . . .

1 **K**

2 **L**

3 **M**

4 **N**

6D A valid conclusion from his experiment is that . . .

1 four oils were tested.

2 oil **N** was the most unsaturated.

3 all four of the oils were unsaturated.

4 all oils react with bromine.

4.1.1.2 Mixtures

Question 63

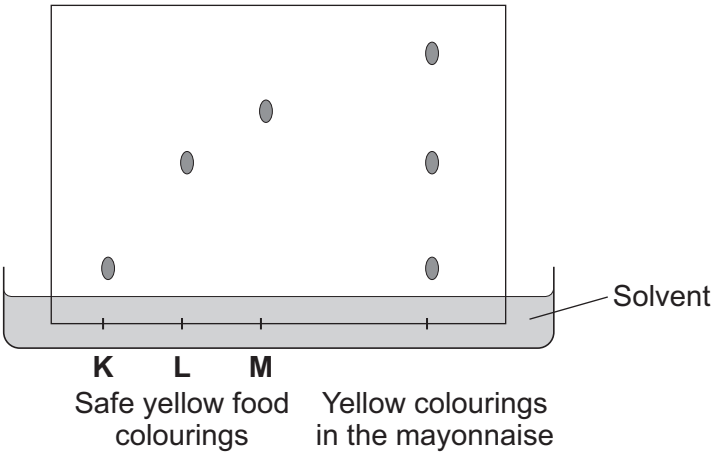
June 2011 | CHY1BP | Original Q9 | Legacy

QUESTION NINE

This ingredients list was on a jar of mayonnaise.

Ingredients
Water
Rapeseed oil
Sugar
Egg yolk
Cornflower
Vinegar
Colourings
Preservative E202

A test was used to find out if the yellow colourings in the mayonnaise were safe to eat.
The result of the test is shown below.



9A The test to detect and identify the colours is called . . .

1 distillation.

2 extraction.

3 vaporisation.

4 chromatography.

9B The test results show that in the mayonnaise . . .

1 none of the colourings is safe.

2 only one of the colourings is safe.

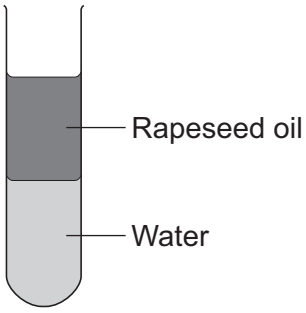
3 two of the colourings are safe.

4 all of the colourings are safe.

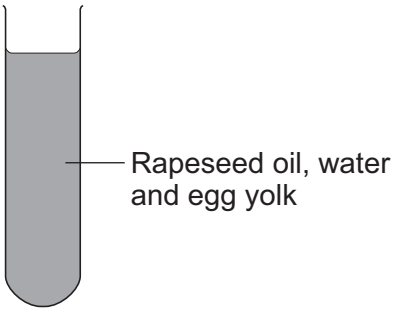
4.1.1.2 Mixtures

Question 63 · continued

9C The diagrams show an experiment using some of the ingredients in the mayonnaise.



Mixture of rapeseed oil and water, shaken then left to stand



Mixture of rapeseed oil, water and egg yolk, shaken then left to stand

The results of the experiment suggest that . . .

1 rapeseed oil dissolves in water.

2 rapeseed oil is unsuitable for use in mayonnaise.

3 egg yolk is an emulsifier.

4 egg yolk improves the colour of the mayonnaise.

9D The preservative in the mayonnaise has an E-number.

This means that this preservative . . .

1 is a natural ingredient.

2 adds to the flavour of the mayonnaise.

3 is a permitted additive.

4 improves the appearance of the mayonnaise.

END OF TEST

4.1.1.2 Mixtures

Question 64

June 2011 | CHY1F | Original Q4 | Legacy

4 An ore contains zinc carbonate ($ZnCO_3$).

4 (a) Complete the table to show the number of atoms of each element in the formula of zinc carbonate.

Zinc has been done for you.

Element	Number of atoms in the formula $ZnCO_3$
Zinc, Zn	1
Carbon, C	
Oxygen, O	

(2 marks)

4 (b) Draw a ring around the correct answer to complete the sentence and the word equation.

4 (b) (i) Zinc carbonate decomposes in a similar way to calcium carbonate

when [water is added. / cooled. / heated.]

(1 mark)

4 (b) (ii) zinc carbonate ⟶ zinc oxide + [carbon dioxide / hydrogen / oxygen]

(1 mark)

Question 4 continues on the next page

4.1.1.2 Mixtures

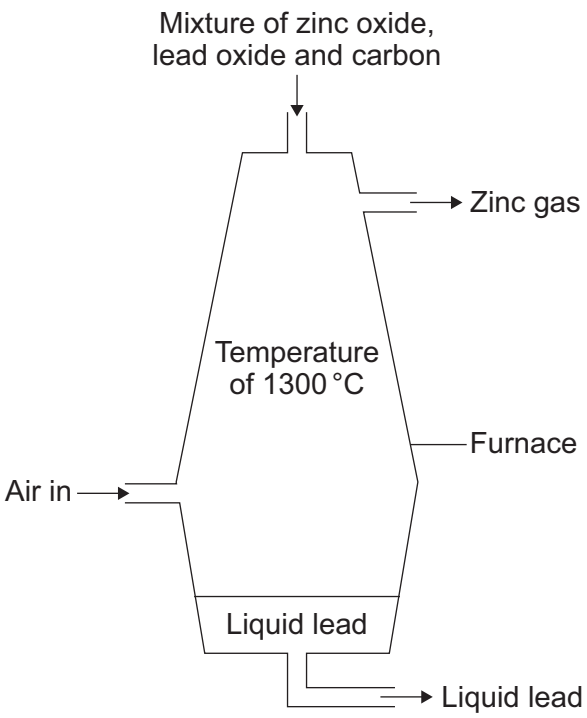
Question 64 · continued

4 (c) Another ore contains a mixture of zinc carbonate and lead carbonate.

The metals zinc and lead are produced from this ore in two stages:

Stage 1 decomposing the carbonates to produce a mixture of zinc oxide and lead oxide.

Stage 2 mixing the oxides with carbon and heating in a furnace.



Some of the reactions in the furnace are:

zinc oxide + carbon ⟶ zinc + carbon dioxide

lead oxide + carbon ⟶ lead + carbon dioxide

carbon + oxygen ⟶ carbon dioxide

4.1.1.2 Mixtures

Question 64 · continued

Use the information given to help you to answer these questions.

4 (c) (i) Draw a ring around the correct answer to complete the sentence.

The reaction between carbon and oxygen that heats the furnace is called

- combustion.
- decomposition.
- evaporation.

(1 mark)

4 (c) (ii) Tick (✓) **one** reason why carbon reacts with zinc oxide to produce zinc.

Reason	Tick (✓)
carbon is less reactive than zinc	
carbon is more reactive than zinc	
carbon is similar in reactivity to zinc	

(1 mark)

4 (c) (iii) In the furnace zinc is a gas but lead is a liquid.

Suggest why.

.....

.....

.....

.....

(2 marks)

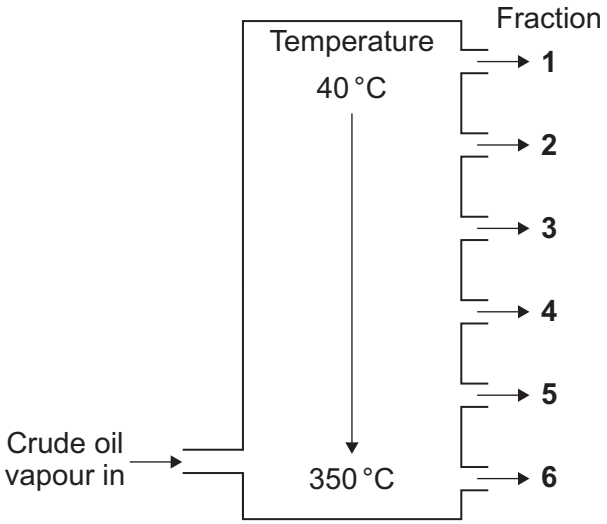
8

4.1.1.2 Mixtures

Question 65

June 2011 | CHY1F | Original Q5 | Legacy

5 Crude oil is a mixture of hydrocarbons.
Crude oil can be separated into fractions.



5 (a) (i) Complete the sentence.

The process used to separate the crude oil into fractions is called

fractional ..... .

(1 mark)

5 (a) (ii) Why do the fractions separate at different temperatures?

.....

.....

(1 mark)

4.1.1.2 Mixtures

Question 65 · continued

5 (b) Tick (✓) **two** properties of fraction **6**.

Property	Tick (✓)
contains hydrocarbons	
has a small number of carbon atoms in each molecule	
is easy to ignite	
has a high boiling point	

(2 marks)

5 (c) Fraction **1** contains hydrocarbons called alkanes.
The general formula of an alkane is: C_nH_{2n+2}

What is the formula of the alkane that has 5 carbon atoms in each molecule?

Draw a ring around the correct answer.

C_5H_9 **C_5H_{10}** **C_5H_{11}** **C_5H_{12}**

(1 mark)

5

4.1.1.2 Mixtures

Question 66

June 2011 | CHY3F | Original Q1 | Legacy

1 Use the periodic table on the Data Sheet to help you to answer these questions.

1 (a) The following is a list of symbols of some elements.

Sb	**Se**	**Si**	**Sn**	**Sr**

Choose your answers **only** from the symbols shown in the box above.

Which symbol represents

1 (a) (i) a Group 5 element ☐

(1 mark)

1 (a) (ii) the element in the same group as oxygen (O) ☐

(1 mark)

1 (a) (iii) the element with atomic (proton) number of 50 ☐

(1 mark)

1 (a) (iv) silicon? ☐

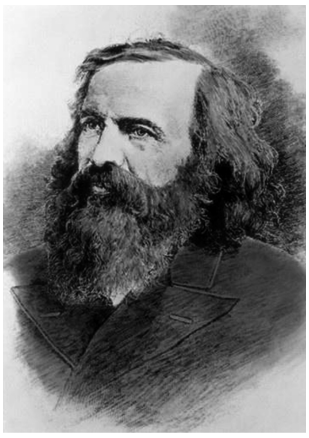
(1 mark)

Question 1 continues on the next page

4.1.1.2 Mixtures

Question 66 · continued

1 (b)



Mendeleev suggested his version of the periodic table in 1869.

Part of Mendeleev's table is shown below.

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca	#	Ti	V	Cr	Mn
Cu	Zn	#	#	As	Se	Br

4.1.1.2 Mixtures

Question 66 · continued

There are differences between Mendeleev's table and the periodic table on the Data Sheet.

Draw a ring around the correct answer to complete the sentences.

1 (b) (i) Mendeleev left gaps (shown by #) in his table.

Mendeleev left gaps for [compounds / elements / mixtures] that had not been discovered.

(1 mark)

1 (b) (ii) Mendeleev put copper (Cu) in the same box as [bromine (Br). / chromium (Cr). / potassium (K).]

(1 mark)

1 (b) (iii) Mendeleev did **not** have a Group [0. / 3. / 5.]

(1 mark)

7

4.1.1.2 Mixtures

Question 67

June 2011 | CHY3F | Original Q2 | Legacy

2 Hydrogen peroxide decomposes slowly to give water and oxygen.

The reaction is *exothermic.*

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

2 (a) In an *exothermic* reaction, energy is given out.

Draw a ring around the correct answer to complete the sentence.

In an *exothermic* reaction, the temperature

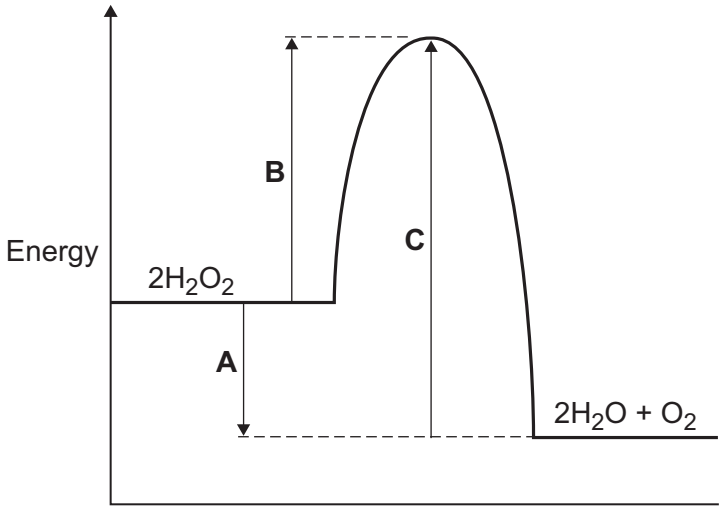
goes down.

goes up.

stays the same.

(1 mark)

2 (b) The energy level diagram for this reaction is shown below.



The energy changes, **A**, **B** and **C**, are shown on the diagram.

Use the diagram to help you answer these questions.

2 (b) (i) Which energy change, **A**, **B** or **C**, is the activation energy?

(1 mark)

2 (b) (ii) Which energy change, **A**, **B** or **C**, shows that this reaction is exothermic?

(1 mark)

4.1.1.2 Mixtures

Question 67 · continued

2 (b) (iii) Hydrogen peroxide decomposes quickly when a small amount of manganese(IV) oxide is added.

Draw a ring around the correct answer to complete each sentence.

Hydrogen peroxide decomposes quickly because

manganese(IV) oxide is

- a catalyst.
- an element.
- a solid.

The manganese(IV) oxide has lowered the

- activation energy.
- boiling point.
- temperature.

(2 marks)

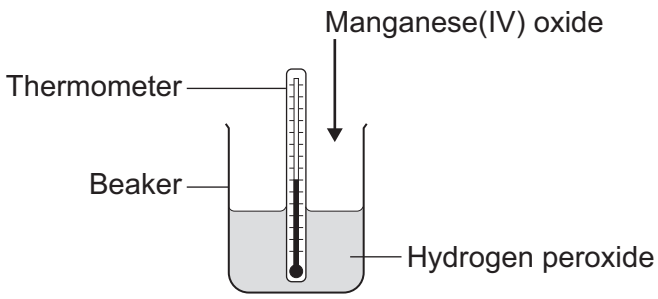
Question 2 continues on the next page

4.1.1.2 Mixtures

Question 67 · continued

2 (c) A student did an experiment to find the amount of energy produced when hydrogen peroxide solution is decomposed using manganese(IV) oxide.

The apparatus the student used is shown in the diagram.



The student first measured the temperature of the hydrogen peroxide. Then the student added the manganese(IV) oxide, stirred the mixture and recorded the highest temperature.

2 (c) (i) Suggest why the student stirred the mixture before recording the highest temperature.

.....

.....

(1 mark)

2 (c) (ii) The biggest error in this experiment is heat loss.

Suggest how the student could change the apparatus so that less heat is lost.

.....

.....

(1 mark)

7

4.1.1.2 Mixtures

Question 68

January 2012 | CH1FP | Original Q3 | Legacy

3 (a) Crude oil is a mixture of compounds.
These compounds are made up of hydrogen and carbon atoms only.

3 (a) (i) Draw a ring around the correct answer to complete the sentence.

Compounds made up of carbon and hydrogen atoms only are called

alcohols.
hydrocarbons.
vegetable oils.

(1 mark)

3 (a) (ii) The table shows five of these compounds.

Compound	State at room temperature (20 °C)	Boiling point in °C
ethane, C_2H_6	gas	−89
butane, C_4H_{10}	gas	0
hexane, C_6H_{14}	liquid	+69
pentadecane, $C_{15}H_{32}$	liquid	+270
heptadecane, $C_{17}H_{36}$	solid	+302

Tick (✓) **two** correct statements about the five compounds.

Statement	Tick (✓)
ethane has the smallest molecules	
hexane and pentadecane are liquid at 100 °C	
heptadecane has the highest boiling point	
butane boils at 100 °C	

(2 marks)

3 (a) (iii) Draw a ring around the correct answer to complete each sentence.

Fractional distillation is used to separate the compounds in crude oil.

The first step in fractional distillation is

cracking
displacing
evaporating

the crude oil.

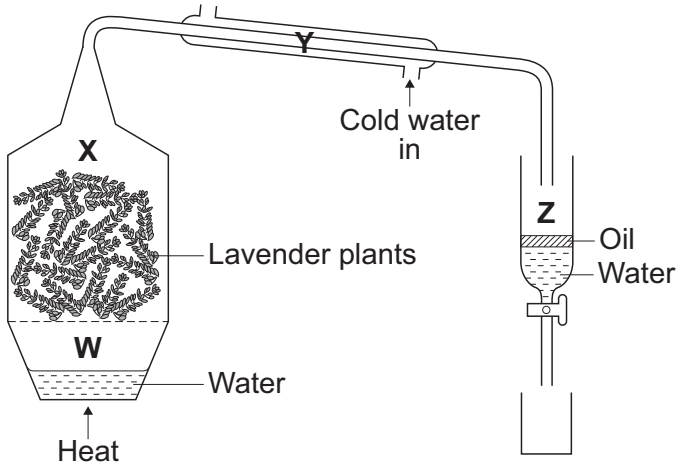
4.1.1.2 Mixtures

Question 68 · continued

During fractional distillation the compounds [burn / condense / decompose] at different temperatures.

(2 marks)

3 (b) Steam distillation is used to separate oils from plants.
The diagram shows some apparatus that can be used to separate oil from lavender plants. Four parts of the apparatus are labelled **W**, **X**, **Y** and **Z**.



3 (b) (i) In which part, **W**, **X**, **Y** or **Z**, of the apparatus:

is steam produced ☐

are steam and oil condensed? ☐

(2 marks)

3 (b) (ii) Use the correct word from the box to complete the sentence.

dissolves	floats	sinks

When the oil separates from the water, the oil ..... .

(1 mark)

3 (b) (iii) Describe how part **Z** of the apparatus can be used to remove the water from the oil.

.....

.....

.....

.....

(2 marks)

10

4.1.1.2 Mixtures

Question 69

January 2012 | CH1FP | Original Q5 | Legacy

5 Cement is made by heating a mixture of clay and limestone in a kiln.

5 (a) Many kilns are heated by burning natural gas (methane) in air.

A chemical equation for the burning of methane is:

$$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$$

Describe this reaction in words.

Give the names of the molecules **and** the numbers of each molecule in this chemical equation.

.....

.....

.....

.....

(2 marks)

5 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Limestone contains calcium carbonate.
There is a large deposit of limestone under an area of natural beauty.
A company wants to quarry this limestone and build a kiln near to the quarry to make cement.

Area of natural beauty



A quarry



Explosives will be used to extract the limestone out of the ground.

Heavy machinery will be used to lift and crush the limestone.

Lorries will be used to transport the limestone to the kiln to make cement.

The lorries and the heavy machinery will use diesel fuel.

4.1.1.2 Mixtures

Question 69 · continued

Quarrying limestone and making cement will have an impact on everything near the area.

Describe the positive and the negative impacts of quarrying limestone and making cement.

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(6 marks)

8

4.1.1.2 Mixtures

Question 70

January 2012 | CH1FP | Original Q6 | Legacy

6 A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol	
Alkane	**Formula**
hexane	C_6H_{14}
heptane	
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$

Air	
Gas	**Percentage (%)**
nitrogen	78
oxygen	21
carbon dioxide	0.035
Small amounts of other gases and water vapour	

6 (a) Use the information above to answer these questions.

6 (a) (i) Give the formula for heptane.

.....

(1 mark)

6 (a) (ii) Complete the general formula of alkanes.
n = number of carbon atoms

$$C_nH$$

(1 mark)

6 (b) Alkanes in petrol burn in air.
The equations represent two reactions of hexane burning in air.

Reaction 1 $2C_6H_{14} + 19O_2 \rightarrow 12CO_2 + 14H_2O$

Reaction 2 $2C_6H_{14} + 13O_2 \rightarrow 12CO + 14H_2O$

Reaction 2 produces a different carbon compound to **Reaction 1**.

6 (b) (i) Name the carbon compound produced in **Reaction 2**.

.....

(1 mark)

6 (b) (ii) Give a reason why the carbon compounds produced are different.

.....

.....

(1 mark)

Question 6 continues on the next page

4.1.1.2 Mixtures

Question 70 · continued

6 (c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

6 (c) (i) What is the percentage of the other gases in the table?

.....

(1 mark)

6 (c) (ii) What is the name of the compound that makes up most of the other gases?

.....

(1 mark)

6 (c) (iii) Give a reason why sulfur dioxide is produced in a petrol engine.

.....

.....

(1 mark)

6 (c) (iv) State how nitrogen oxides are produced in a petrol engine.

.....

.....

.....

.....

(2 marks)

4.1.1.2 Mixtures

Question 70 · continued

6 (d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

.....

.....

.....

.....

(2 marks)

11

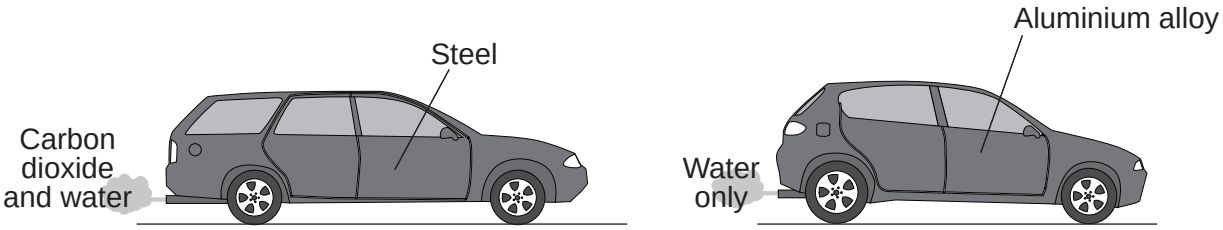
Turn over for the next question

4.1.1.2 Mixtures

Question 71

June 2012 | CH1FP | Original Q3 | Legacy

3 The picture shows two different cars.



3 (a) Some properties of aluminium are given below.

Tick (✓) **two** reasons why aluminium is better than steel for car bodies.

Reason	Tick (✓)
Aluminium is not a transition metal.	
Aluminium has a low density.	
Aluminium is expensive to extract.	
Aluminium is resistant to corrosion.	

(2 marks)

3 (b) Each car body is made from an *alloy*.

3 (b) (i) What is an *alloy*?

.....

.....

(1 mark)

3 (b) (ii) An alloy is used to make a car body. A pure metal is **not** used to make a car body.

Suggest why.

.....

.....

(1 mark)

4.1.1.2 Mixtures

Question 71 · continued

3 (c) The car with a steel body uses petrol for fuel.

Draw a ring around the correct answer to complete each sentence.

3 (c) (i) Petrol is made from

air.
crude oil.
metal ores.

(1 mark)

3 (c) (ii) Petrol is a mixture of

carbonates
hydrocarbons
polymers

including C_8H_{18}

(1 mark)

3 (c) (iii) In the car engine petrol reacts with

argon
nitrogen
oxygen

to produce carbon dioxide and water.

(1 mark)

3 (d) Look at the substances coming out of each car's exhaust.

3 (d) (i) Suggest the name of the fuel used in the car with the aluminium alloy body.

Name of fuel .....

(1 mark)

3 (d) (ii) Why is the fuel burned in the car with the aluminium alloy body better for the environment than petrol?

.....

.....

(1 mark)

9

4.1.1.2 Mixtures

Question 72

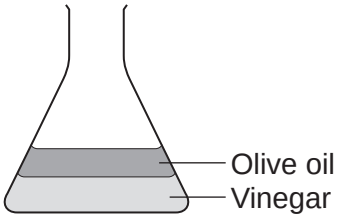
June 2012 | CH1FP | Original Q5 | Legacy

5 Olive oil is used to make salad dressings and margarine.

5 (a) Vinegar is often used in salad dressings.
Vinegar contains 95% water and 5% ethanoic acid.

5 (a) (i) To make a simple salad dressing add olive oil to vinegar and shake.
After a few minutes the mixture separates.

Simple salad dressing



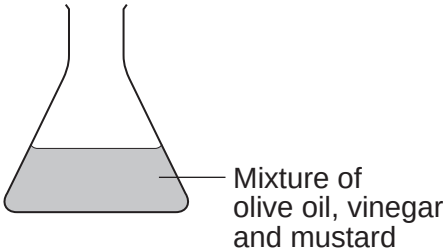
Tick (✓) **one** reason why the olive oil separates above the vinegar.

Reason	Tick (✓)
Olive oil does not dissolve in vinegar.	
Olive oil has a higher density than vinegar.	
Olive oil has a higher boiling point than vinegar.	

(1 mark)

5 (a) (ii) To make a French salad dressing add mustard to the olive oil and vinegar and shake.
After several minutes the mixture does **not** separate.

French salad dressing



The olive oil, vinegar and mustard mixture does **not** separate.
Give **one** reason why.

.....

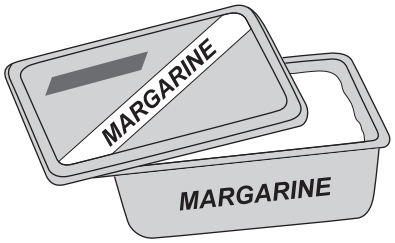
.....

(1 mark)

4.1.1.2 Mixtures

Question 72 · continued

5 (b) Olive oil contains *unsaturated* compounds. Olive oil can be hardened to make margarine.



5 (b) (i) Draw a ring around the correct answer to complete the sentence.

Unsaturated compounds contain | double | ionic | metallic | carbon-carbon bonds.

(1 mark)

5 (b) (ii) Draw **one** line from the test that would detect unsaturated compounds to the result of the test.

Test	Result of test
Add bromine water	Turns cloudy
Add limewater	Turns colourless
Add water	Turns orange

(1 mark)

5 (c) Olives grow on trees.
When olive oil is burned it produces carbon dioxide.

5 (c) (i) Burning olive oil as a fuel is said to be 'carbon neutral'.
Suggest why.

.....

.....

(1 mark)

5 (c) (ii) Olive oil is too expensive to use as biodiesel fuel.
Suggest another reason why olive oil should **not** be used as a fuel.

.....

.....

(1 mark)

6

4.1.1.2 Mixtures

Question 73

June 2012 | CH1FP | Original Q6 | Legacy

6 Ethanol (C_2H_5OH) can be made from ethene or from sugar.

6 (a) Complete the table which shows the number of atoms of each element in the formula of ethanol.

Use the Chemistry Data Sheet to help you to complete the table.

Element	Symbol	Number of atoms in the formula C_2H_5OH
Carbon	C	2
Hydrogen	H	.....
.....	O	1

(2 marks)

6 (b) Ethene (C_2H_4) is produced when hydrocarbons are cracked.

6 (b) (i) Tick (✓) **two** conditions needed to crack a hydrocarbon.

Condition	Tick (✓)
The presence of an emulsifier.	
Heating the hydrocarbon to a high temperature.	
Adding oxygen to the hydrocarbon.	
The presence of a catalyst.	

(2 marks)

6 (b) (ii) Draw the missing bonds to complete the displayed structure of ethene.

H H

C C

H H

(1 mark)

6 (b) (iii) Name the substance added to ethene (C_2H_4) to produce ethanol (C_2H_5OH).

.....

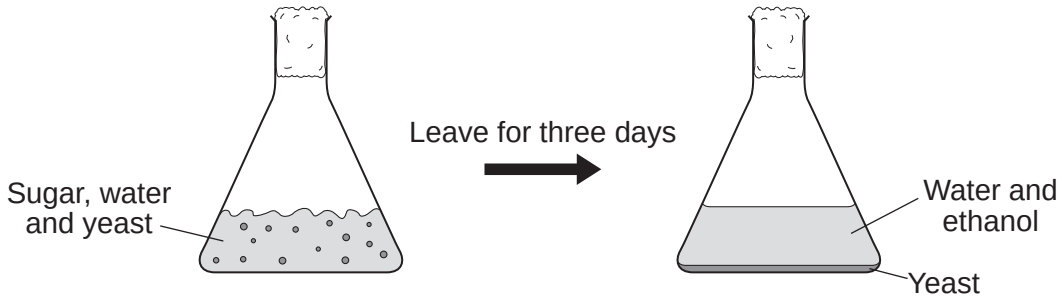
(1 mark)

4.1.1.2 Mixtures

Question 73 · continued

6 (c) The diagram shows how a solution of ethanol is made from sugar dissolved in water.

The boiling point of ethanol is 78°C and the boiling point of water is 100°C.



6 (c) (i) Name the gas produced during this reaction.

.....

(1 mark)

6 (c) (ii) What are the main steps needed to obtain pure ethanol from the mixture produced after three days?

.....

.....

.....

.....

(2 marks)

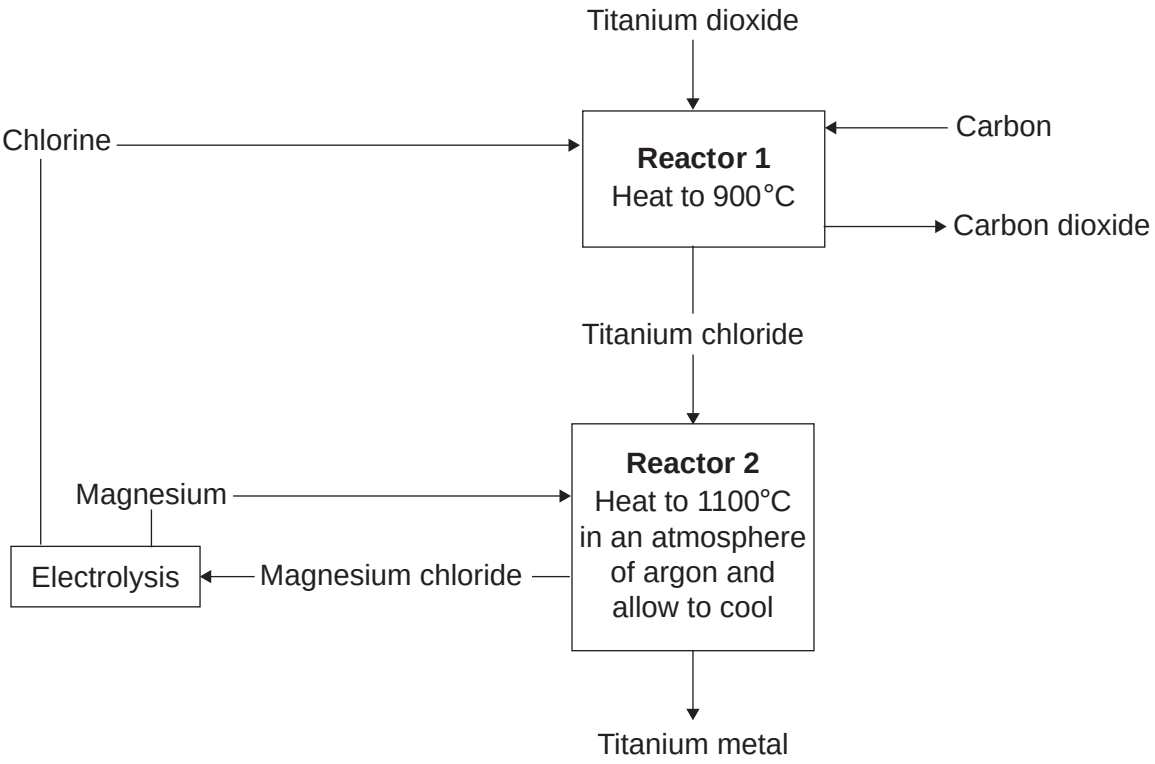
9

4.1.1.2 Mixtures

Question 74

June 2012 | CH1FP | Original Q7 | Legacy

7 Rutile is an ore of titanium. Rutile contains titanium dioxide.
The flow chart shows how titanium metal is extracted from titanium dioxide.



7 (a) Titanium is much more expensive than iron.

Give **one** reason why.

.....

.....

(1 mark)

7 (b) Name the only waste product shown on the flow chart.

.....

(1 mark)

4.1.1.2 Mixtures

Question 74 · continued

7 (c) Describe the example of recycling shown on the flow chart.

.....

.....

.....

.....

(2 marks)

7 (d) The air is removed from **Reactor 2**. An atmosphere of argon is used for the reaction between titanium chloride and magnesium metal.

Explain why.

.....

.....

.....

.....

(2 marks)

Question 7 continues on the next page

4.1.1.2 Mixtures

Question 74 · continued

7 (e) Titanium metal is produced by reacting titanium chloride with magnesium.

950 kg of titanium chloride was mixed with 240 kg of magnesium metal. The mixture was heated and produced 950 kg of magnesium chloride.

Calculate the mass of titanium metal produced.

.....

Mass = ... kg

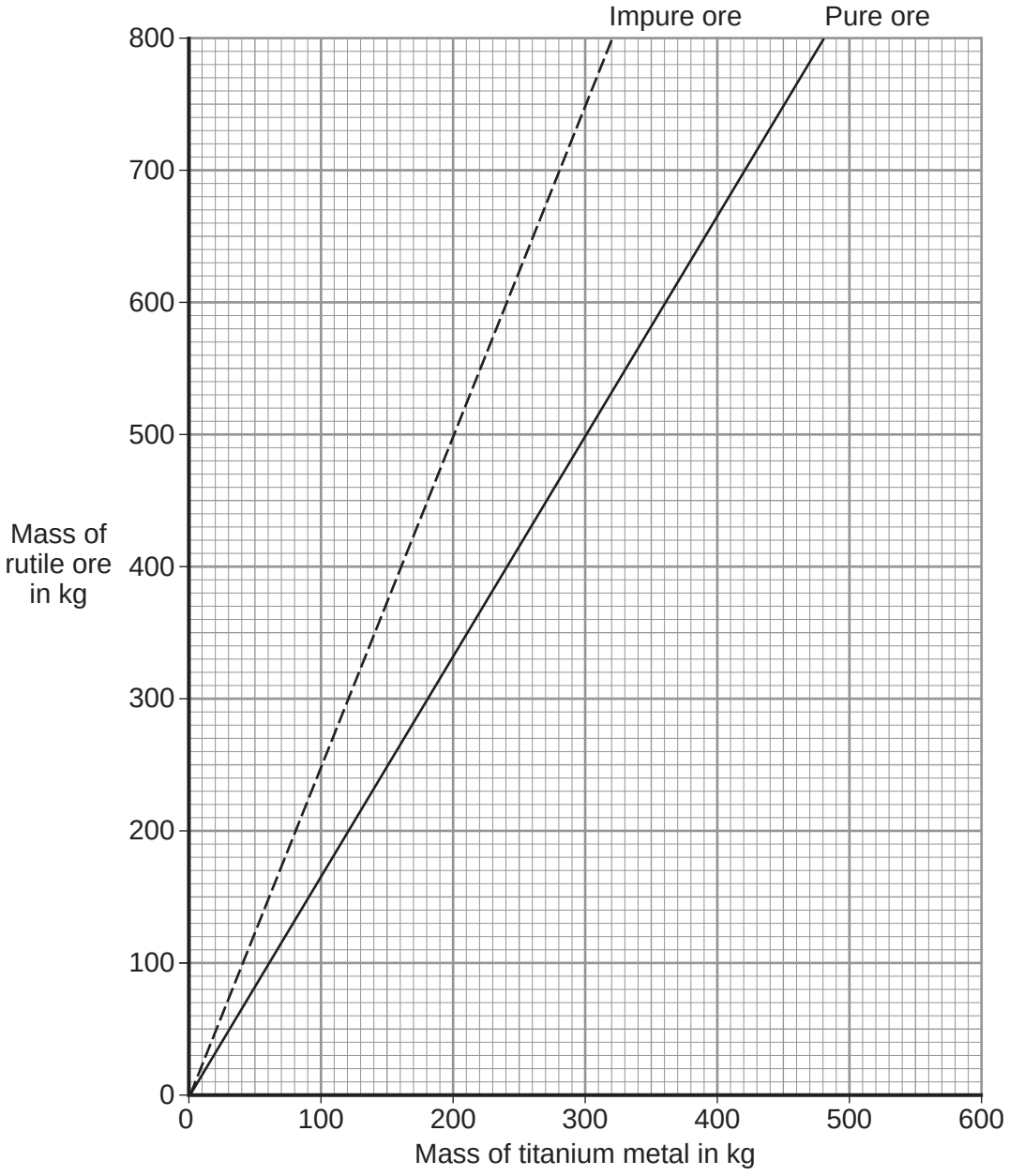
(1 mark)

4.1.1.2 Mixtures

Question 74 · continued

June 2012 | CH1FP | Original Q7 | Legacy

7 (f) The graph shows the mass of titanium metal produced from a pure rutile ore and from an impure rutile ore.



The difference between the two lines represents the amount of waste rock in the impure ore.

300 kg of titanium metal was produced from the impure ore.

Calculate the mass of waste rock in the impure ore.

.....

Mass = ... kg

(1 mark)

8

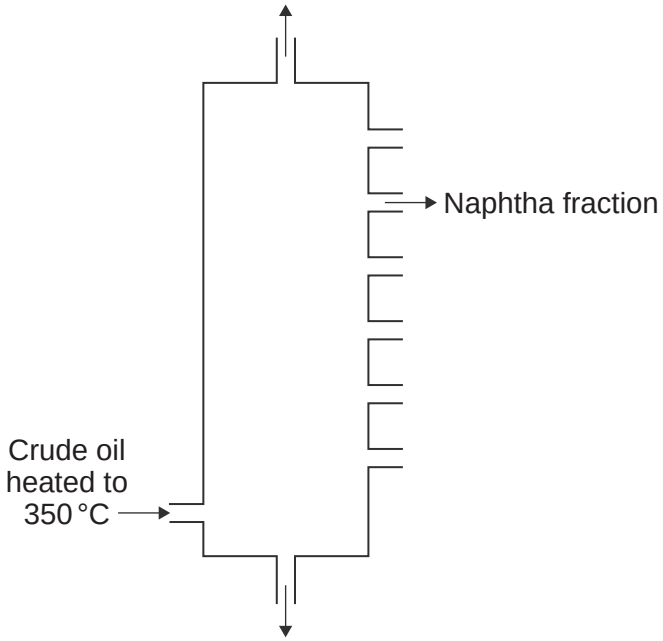
4.1.1.2 Mixtures

Question 75

June 2012 | CH1FP | Original Q8 | Legacy

8 Crude oil is used to produce poly(ethene).

8 (a) Fractional distillation is used to separate crude oil into fractions.



8 (a) (i) Write a number, **2**, **3**, **4** or **5**, next to each stage so that the description of fractional distillation is in the correct order. Numbers **1** and **6** have been done for you.

Number	Stage
1	The crude oil is heated to 350 °C.
	When a fraction in the vapours cools to its boiling point, the fraction condenses.
	Any liquids flow down to the bottom of the column and the hot vapours rise up the column.
6	The condensed fraction is separated and flows out through a pipe.
	When the hot vapours rise up the column, the vapours cool.
	Most of the compounds in the crude oil evaporate.

(2 marks)

8 (a) (ii) The naphtha fraction is cracked to produce ethene (C_2H_4).
Ethene is used to make the polymer called poly(ethene).

Name **two** substances produced when poly(ethene) burns in air.

1 .....

2 .....

(2 marks)

4.1.1.2 Mixtures

Question 75 · continued

8 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Each year in the UK, billions of plastic bags are given free to shoppers. These bags are made from poly(ethene) and are often used only once.
After being used many of these plastic bags are either thrown away as litter or buried in landfill sites.

In 2006 over 10 billion of these plastic bags were given free to shoppers.
In 2009 the number of plastic bags given to shoppers had decreased to 6.1 billion.
One reason for the decrease was because some supermarkets made people pay for their plastic bags.

From 2011 a new type of plastic shopping bag made mainly from poly(ethene) had a use-by date of only one year printed on the bag.

Use the information above and your knowledge and understanding to describe advantages and disadvantages of using plastic shopping bags made from poly(ethene).

.....

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(6 marks)

10

4.1.1.2 Mixtures

Question 76

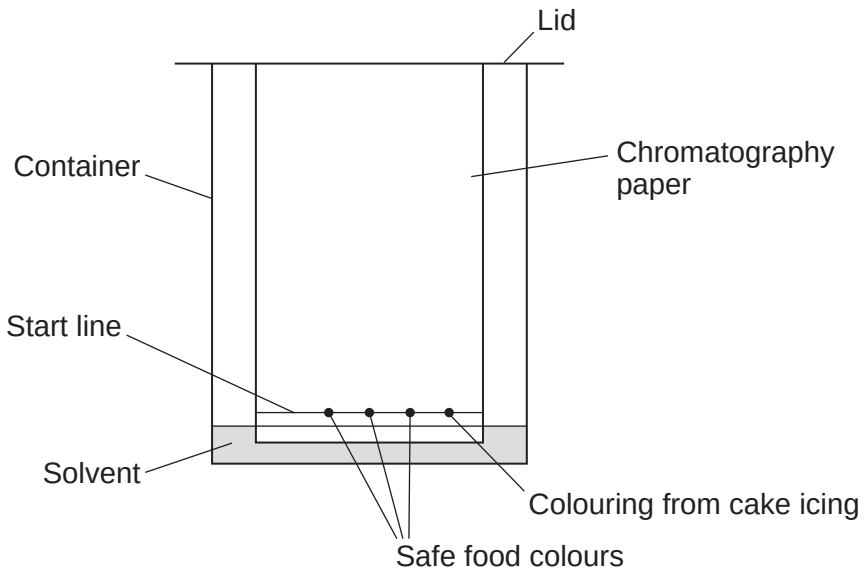
June 2012 | CH2FP | Original Q6 | Legacy

6 Icing on cakes is tested to check that safe colours were used when they were made.



Paper chromatography is one method of testing which colours are in cake icing.

6 (a) The diagram shows an experiment a student did.



6 (a) (i) Suggest why there is a lid on the container.

.....

.....

(1 mark)

6 (a) (ii) The start line should be drawn in pencil **not** in ink.
Suggest why.

.....

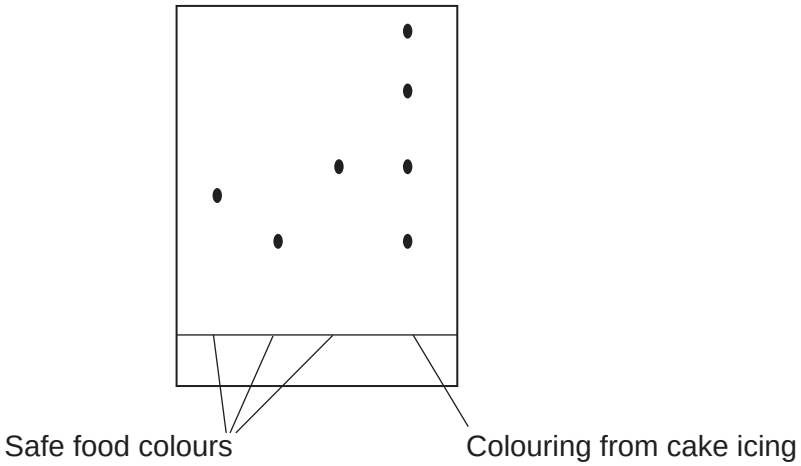
.....

(1 mark)

4.1.1.2 Mixtures

Question 76 · continued

6 (b) The diagram shows the results of the paper chromatography experiment.



6 (b) (i) How many different food colours were used in the colouring from the cake icing?

.....

(1 mark)

6 (b) (ii) Is the cake icing safe to eat?

Give a reason for your answer.

.....

.....

(1 mark)

Question 6 continues on the next page

4.1.1.2 Mixtures

Question 76 · continued

6 (c) Gas chromatography linked to mass spectroscopy is an example of an instrumental method. This method was used on a mixture of solvents.

6 (c) (i) Give **two** advantages of gas chromatography compared with paper chromatography.

.....

.....

.....

.....

(2 marks)

6 (c) (ii) What does gas chromatography do to the mixture of solvents?

.....

.....

(1 mark)

6 (c) (iii) What information does mass spectroscopy give?

.....

.....

(1 mark)

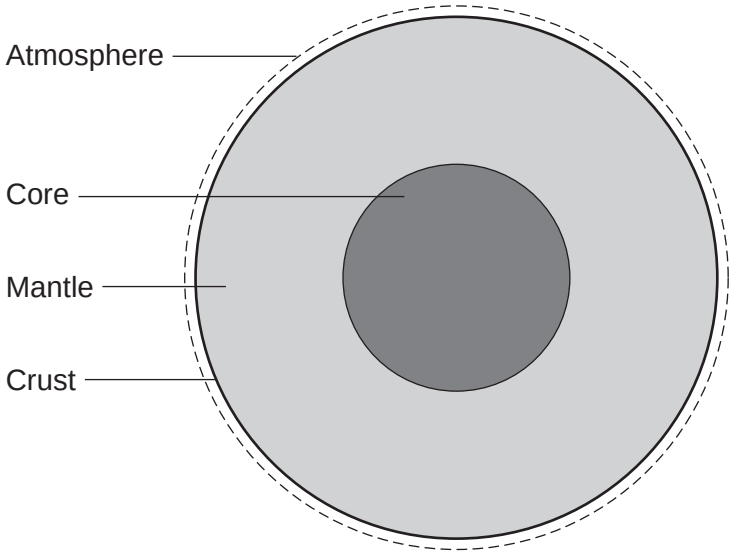
8

4.1.1.2 Mixtures

Question 77

January 2013 | CH1FP | Original Q2 | Legacy

2 The diagram shows the layers in and around the Earth.



2 (a) Use the diagram above to help you to answer this question.

Draw **one** line from each statement to its correct layer.

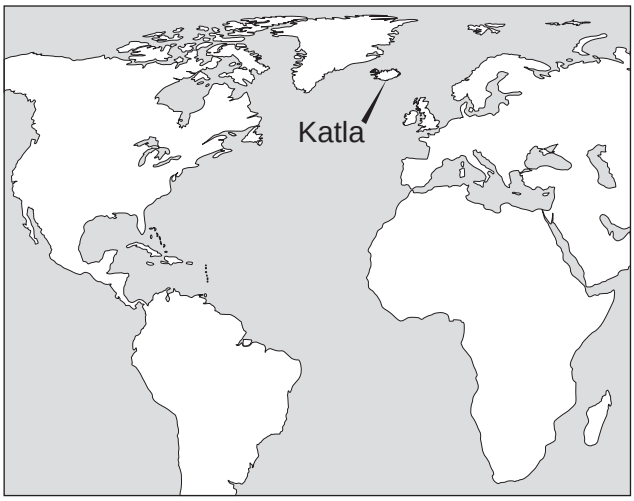
Statement	Layer
There are mountain ranges.	atmosphere
There are convection currents that cause earthquakes.	core
There is a mixture of gases.	crust
	mantle

(3 marks)

4.1.1.2 Mixtures

Question 77 · continued

2 (b) Iceland has many volcanoes.
Scientists are monitoring a volcano in Iceland, called Katla.



There has been an increase in the number of small earthquakes (tremors) around Katla.

2 (b) (i) Draw a ring around the correct answer to complete the sentence.

Iceland has volcanoes because it

- has low temperatures.
- is an island.
- is on a tectonic plate boundary.

(1 mark)

2 (b) (ii) People do not know when Katla will next erupt.

Tick (✓) the correct reason why.

Reason	Tick (✓)
Small earthquakes (tremors) near the volcano are happening more often.	
The last two eruptions happened a long time ago in October 1918 and in May 1860.	
Scientists cannot accurately predict when volcanic eruptions will occur.	

(1 mark)

Question 2 continues on the next page

4.1.1.2 Mixtures

Question 77 · continued

2 (c) Previous eruptions of Katla produced large amounts of solid ash particles and sulfur dioxide.

Use the correct answer to complete each sentence.

acid rain	**earthquakes**	**global dimming**	**global warming**

An environmental impact caused by solid ash particles is ..... .

An environmental impact caused by sulfur dioxide is ..... .

(2 marks)

7

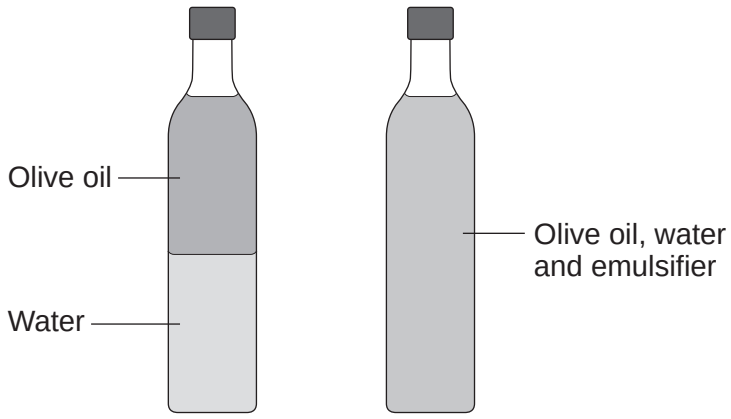
4.1.1.2 Mixtures

Question 78

January 2013 | CH1FP | Original Q3 | Legacy

3 Olive oil has a high content of healthy, unsaturated fats.

3 (a) Olive oil and water do not mix.
A salad dressing is made by shaking olive oil and water with an emulsifier.



3 (a) (i) Complete the sentence.

The salad dressing of olive oil, water and emulsifier is a mixture

called an ..... .

(1 mark)

3 (a) (ii) Give **one** benefit of using emulsifiers in food.

.....

.....

(1 mark)

3 (b) Olive oil has a boiling point of 300 °C.

3 (b) (i) Complete the sentence.

The boiling point of olive oil compared to the boiling point of water

is ..... .

(1 mark)

3 (b) (ii) Apart from colour, state **two** ways in which a food cooked in olive oil will be different to a food cooked in water.

.....

.....

.....

.....

(2 marks)

5

4.1.1.2 Mixtures

Question 79

January 2013 | CH1FP | Original Q5 | Legacy

5 This question is about compounds produced from crude oil.

The table below shows four of these compounds.

Compound	Melting point in °C	Boiling point in °C
methane (CH_4)	–183	–164
ethene (C_2H_4)	–169	–104
decane ($C_{10}H_{22}$)	–30	+174
icosane ($C_{20}H_{42}$)	+37	+343

5 (a) Tick (✓) **two** correct statements about the four compounds.

Statement	Tick (✓)
Methane has the lowest melting point and icosane has the highest boiling point.	
Ethene and methane are alkanes.	
Methane and decane are gases at room temperature (20 °C).	
Decane and icosane are liquid at 100 °C.	

(2 marks)

5 (b) Petrol contains a mixture of compounds, including octane (C_8H_{18}).

Complete the word equation for the complete combustion of octane.

octane + oxygen → ..... + ...

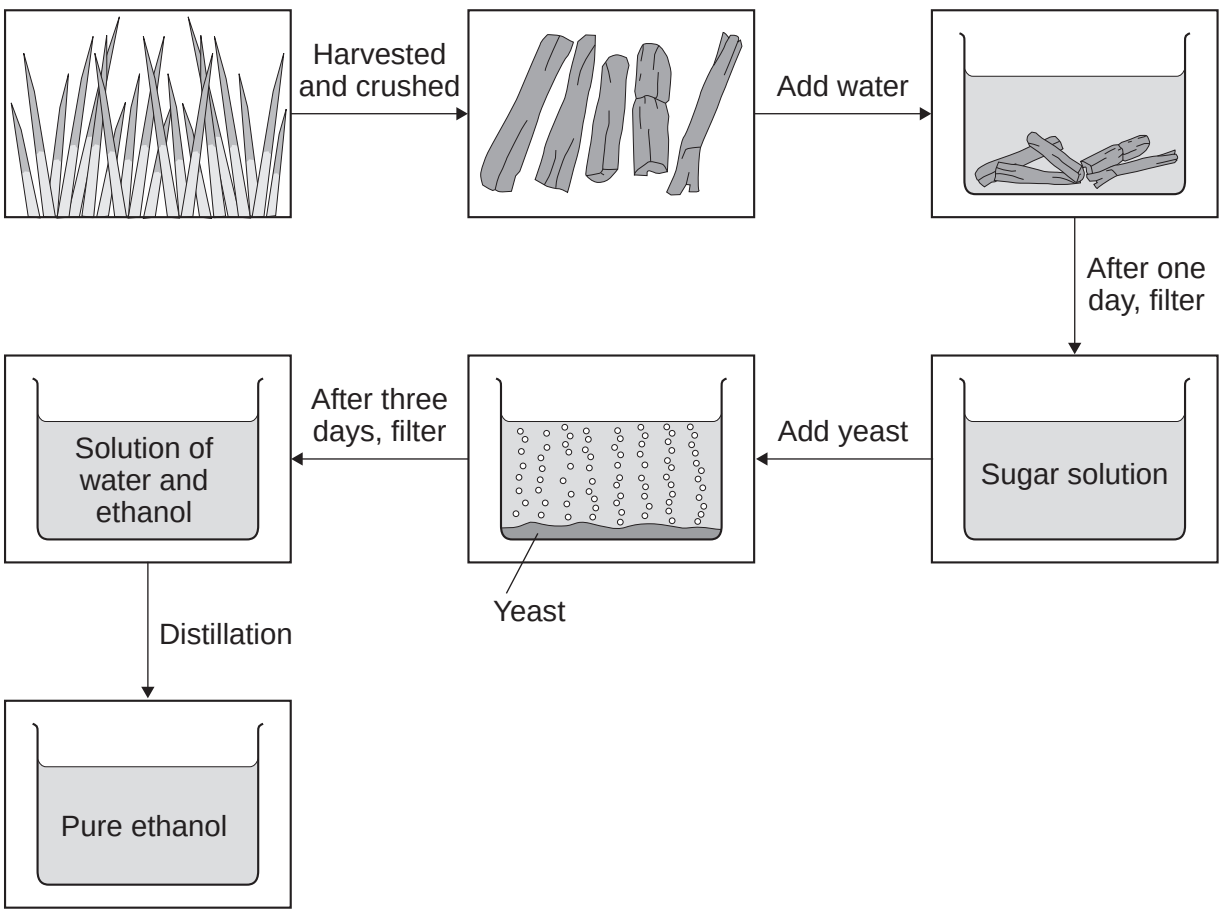
(2 marks)

Question 5 continues on the next page

4.1.1.2 Mixtures

Question 79 · continued

5 (c) Most petrol used in cars contains about 5% ethanol (C_2H_5OH).
Ethanol can be produced from sugar cane.



5 (c) (i) Draw a ring around the correct answer to complete the sentence.

The reaction to produce ethanol from sugar solution is

combustion.

displacement.

fermentation.

(1 mark)

4.1.1.2 Mixtures

Question 79 · continued

5 (c) (ii) Some people say that increasing the production of ethanol from sugar cane will be **good** for the environment.

Suggest **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

5 (c) (iii) Other people say that increasing the production of ethanol from sugar cane will be **bad** for the environment.

Suggest **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

9

4.1.1.2 Mixtures

Question 80

January 2013 | CH1FP | Original Q7 | Legacy

7 This question is about oil reserves.

7 (a) Diesel is separated from crude oil by fractional distillation.

Describe the steps involved in the fractional distillation of crude oil.

.....

.....

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.....

.....

.....

.....

.....

(3 marks)

7 (b) Diesel is a mixture of lots of different *alkanes.*

What are *alkanes*?

.....

.....

.....

.....

.....

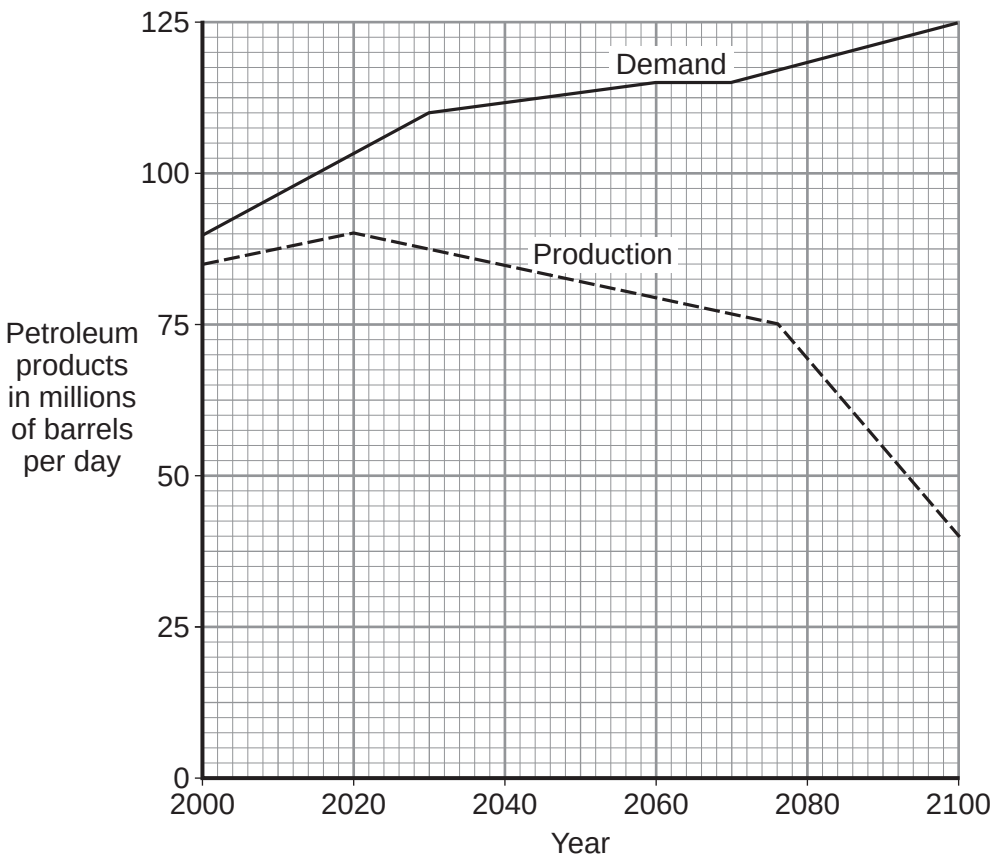
(2 marks)

Question 7 continues on the next page

Question 80 · continued

7 (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Petroleum products, such as petrol, are produced from crude oil.
The graph shows the possible future production of petroleum products from crude oil and the expected demand for petroleum products.



Canada's oil sands hold about 20% of the world's known crude oil reserves.

The oil sands contain between 10 to 15% of crude oil. This crude oil is mainly bitumen.

In Canada the oil sands are found in the ground underneath a very large area of forest. The trees are removed. Then large diggers and trucks remove 30 metres depth of soil and rock to reach the oil sands. The oil sands are quarried. Boiling water is mixed with the quarried oil sands to separate the bitumen from the sand. Methane (natural gas) is burned to heat the water.

The mixture can be separated because bitumen floats on water and the sand sinks to the bottom of the water. The bitumen is cracked and the products are separated by fractional distillation.

4.1.1.2 Mixtures

Question 80 · continued

Use the information on page 18 and your knowledge and understanding to suggest the advantages and disadvantages of extracting petroleum products from oil sands.

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(6 marks)

11

4.1.1.2 Mixtures

Question 81

January 2013 | CH2FP | Original Q1 | Legacy

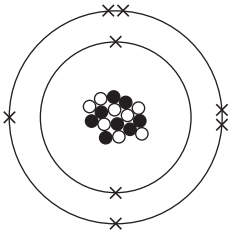
1 This question is about atoms and molecules.

1 (a) Complete the table to show the relative masses of the particles in atoms.

Name of particle	Relative mass
Proton	.....
Neutron	1
Electron	.....

(2 marks)

1 (b) The diagram shows an oxygen atom.



Key
- ● Proton
- ○ Neutron
- × Electron

Use the correct number to complete each sentence.

8	16	18	24

The atomic (proton) number of the oxygen atom shown above is ..... .

The mass number of the oxygen atom shown above is ..... .

(2 marks)

1 (c) (i) Draw a ring around the correct answer to complete the sentence.

Oxygen atoms with different numbers of neutrons are called

isotopes.

molecules.

polymers.

(1 mark)

4.1.1.2 Mixtures

Question 81 · continued

1 (c) (ii) An oxygen atom with a different number of neutrons has 10 neutrons.

Draw a ring around the symbol which represents this atom.

$^{16}_{8}O$ $^{18}_{10}O$ $^{18}_{8}O$

(1 mark)

1 (d) A water molecule contains hydrogen and oxygen atoms.

1 (d) (i) Use the correct answer to complete the sentence.

a compound	an element	a mixture

Water is ..... .

(1 mark)

1 (d) (ii) Draw a ring around the correct structure of a water molecule.

H — O — H **O — H — H** **O — H — O**

(1 mark)

1 (d) (iii) Draw a ring around the type of bonding in a water molecule.

covalent **ionic** **metallic**

(1 mark)

1 (d) (iv) Draw a ring around the correct answer to complete the sentence.

The bonds in a water molecule are formed by [gaining / losing / sharing] electrons.

(1 mark)

10

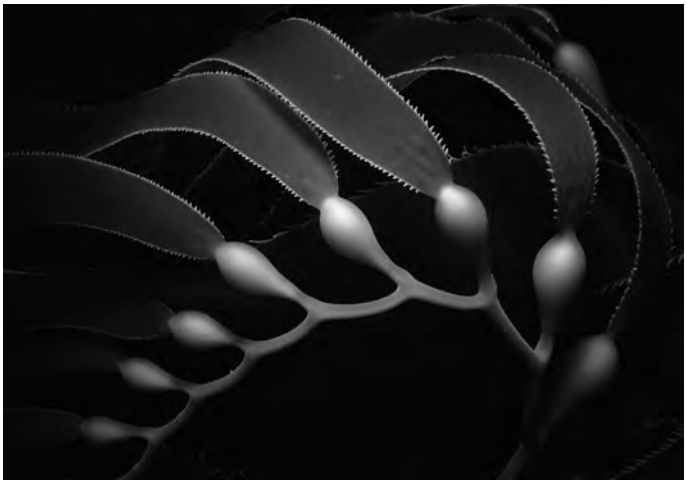
4.1.1.2 Mixtures

Question 82

January 2013 | CH2FP | Original Q3 | Legacy

3 Kelp is a seaweed.

Kelp can be burned to give out energy.



3 (a) Draw a ring around the correct answer to complete the sentence.

Reactions which give out energy are

endothermic.

exothermic.

reversible.

(1 mark)

3 (b) Which **two** of the following questions **cannot** be answered by scientific experiments alone?

Tick (✓) **two** boxes.

Question	Tick (✓)
How much carbon dioxide is produced when 100 g of kelp is burned?	
Does kelp give out more heat energy than coal when burned?	
Should people use kelp instead of oil as an energy source?	
Will kelp be more popular than coal in the next 10 years?	

(2 marks)

4.1.1.2 Mixtures

Question 82 · continued

3 (c) Potassium iodide can be produced from kelp.

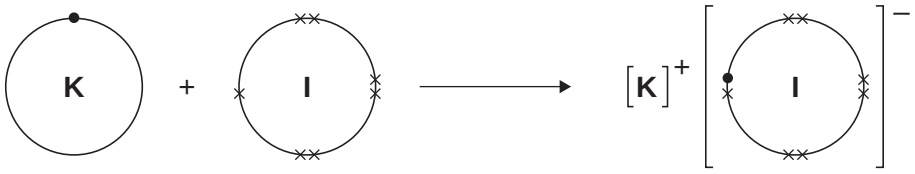
3 (c) (i) Potassium can be reacted with iodine to produce potassium iodide.

potassium + iodine → potassium iodide

The diagram shows how this happens.

Only the outer electrons are shown.

The dots (●) and crosses (×) are used to represent electrons.



Use the diagram to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with iodine to produce potassium iodide.

To get full marks you should use the words atom, electron and ion in your answer.

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(4 marks)

Question 3 continues on the next page

4.1.1.2 Mixtures

Question 82 · continued

3 (c) (ii) Potassium iodide reacts with lead nitrate.

$$2\,KI(aq) + Pb(NO_3)_2(aq) \rightarrow 2\,KNO_3(aq) + PbI_2(s)$$

Why is this reaction a precipitation?

.....

.....

(1 mark)

3 (c) (iii) How can the precipitate be removed from the reaction mixture?

.....

.....

(1 mark)

9

4.1.1.2 Mixtures

Question 83

January 2013 | CH2FP | Original Q4 | Legacy

4 Thermosoftening polymers can be used to make plastic bottles and food packaging.

4 (a) Why are thermosoftening polymers **not** suitable for storing very hot food?

.....

.....

(1 mark)

4 (b) The reaction to produce the polymers uses a catalyst.

Why are catalysts used in chemical reactions?

.....

.....

(1 mark)

4 (c) Compounds from food packaging must not get into food.

Gas chromatography can be used to separate compounds in food.

The output from the gas chromatography column can be linked to an instrument which can identify the compounds.

4 (c) (i) Name the instrument used to identify the compounds.

.....

.....

(1 mark)

4 (c) (ii) Give **one** reason why instrumental methods of analysis are used to identify the compounds.

.....

.....

(1 mark)

4 (d) Poly(ethene) is a thermosoftening polymer.

Poly(ethene) can be made with different properties. The properties depend on the conditions used when poly(ethene) is made.

Suggest **two** conditions which could be changed when poly(ethene) is made.

.....

.....

(2 marks)

6

4.1.1.2 Mixtures

Question 84

January 2013 | CH2FP | Original Q6 | Legacy

6 Printed pictures can be made using etchings.



An etching can be made when a sheet of brass reacts with iron chloride solution.

6 (a) Brass is a mixture of two metals, copper and zinc.

6 (a) (i) A mixture of two metals is called ..... .

(1 mark)

6 (a) (ii) Draw a ring around the correct answer to complete the sentence.

Copper and zinc atoms are different sizes.

This makes brass | harder | more flexible | softer | than the pure metals.

(1 mark)

4.1.1.2 Mixtures

Question 84 · continued

6 (b) Iron chloride has the formula $FeCl_3$

Relative atomic masses (A_r): Cl = 35.5; Fe = 56.

6 (b) (i) Calculate the relative formula mass (M_r) of iron chloride ($FeCl_3$).

.....

.....

.....

Relative formula mass (M_r) of iron chloride = ...

(2 marks)

6 (b) (ii) Calculate the percentage of iron in iron chloride ($FeCl_3$).

.....

.....

.....

Percentage of iron in iron chloride = ...%

(2 marks)

6

4.1.1.2 Mixtures

Question 85

June 2013 | CH1FP | Original Q1 | Legacy

1 Magnesium burns in oxygen.



1 (a) Use the Chemistry Data Sheet to help you to answer this question.

The word equation for magnesium burning is:

magnesium + oxygen ⟶ magnesium oxide

Draw **one** line from each substance to its correct description.

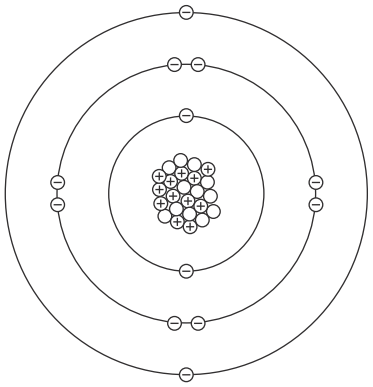
Substance	Description
magnesium	compound
magnesium oxide	metal
oxygen	mixture
	non-metal

(3 marks)

4.1.1.2 Mixtures

Question 85 · continued

1 (b) The diagram represents a magnesium atom.



Complete the table to show the name of each particle and the charge of each particle in the magnesium atom.

Name of particle	Charge
proton	+1
neutron	.....
.....	–1

(2 marks)

1 (c) Use the Chemistry Data Sheet to help you to answer these questions.

Draw a ring around the correct answer to complete each sentence.

1 (c) (i) In a magnesium atom, the protons and neutrons are in the

core.
nucleus.
shell.

(1 mark)

1 (c) (ii) The number of protons in a magnesium atom is the

atomic number.
mass number.
group number.

(1 mark)

1 (c) (iii) The sum of the protons and neutrons in a magnesium atom is the

atomic number.
mass number.
group number.

(1 mark)

8

4.1.1.2 Mixtures

Question 86

June 2013 | CH1FP | Original Q8 | Legacy

8 Crude oil is a mixture of many different chemical compounds.

8 (a) Fuels, such as petrol (gasoline), can be produced from crude oil.

8 (a) (i) Fuels react with oxygen to release energy.

Name the type of reaction that releases energy from a fuel.

.....

(1 mark)

8 (a) (ii) Fuels react with oxygen to produce carbon dioxide.
The reaction of a fuel with oxygen can produce a different oxide of carbon.

Name this different oxide of carbon and explain why it is produced.

.....

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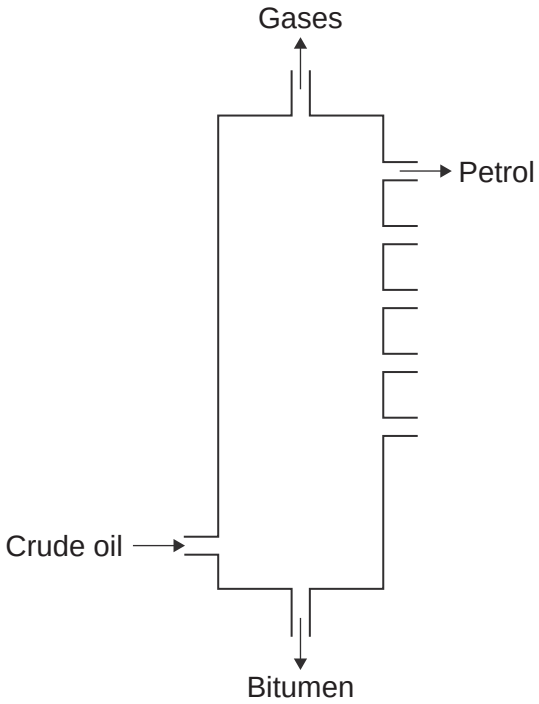
(2 marks)

8 (b) Most of the compounds in crude oil are hydrocarbons.
Hydrocarbons with the smallest molecules are very volatile.



4.1.1.2 Mixtures

Question 86 · continued

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe and explain how **petrol** is separated from the mixture of hydrocarbons in crude oil.

Use the diagram and your knowledge to answer this question.

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(6 marks)

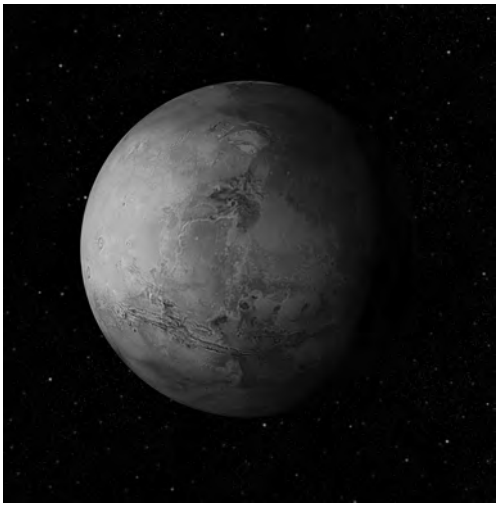
9

4.1.1.2 Mixtures

Question 87

June 2013 | CH2FP | Original Q5 | Legacy

5 This question is about the planet Mars.



5 (a) Mars is a red colour in the sky at night.

The red colour of Mars is because of iron oxide.

Iron oxide is an ionic compound.

Draw a ring around the correct answer to complete the sentence.

Ionic compounds are made of

- giant lattices.
- polymer chains.
- simple molecules.

(1 mark)

5 (b) Many spacecraft have been sent to Mars. Parts of these spacecraft are made from polymers.

5 (b) (i) Polymers that behave like shape memory alloys are used in spacecraft.

The shape memory polymers are cooled and compressed. These polymers are stored on the spacecraft until needed.

Suggest how the polymers could be made to return to their original shape.

.....

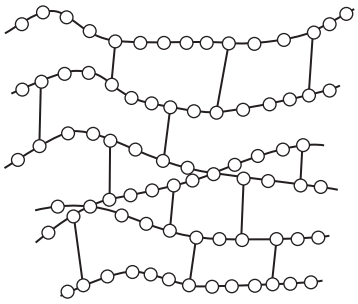
(1 mark)

4.1.1.2 Mixtures

Question 87 · continued

5 (b) (ii) Thermosetting polymers are used for the tiles on the outside of spacecraft.

The diagram shows the structure of a thermosetting polymer.



Explain, in terms of structure, why some polymers are thermosetting.

.....

.....

.....

.....

(2 marks)

5 (c) Instrumental methods such as GC–MS are used to analyse substances found on Mars.

In GC–MS, gas chromatography columns are linked to mass spectrometers.

5 (c) (i) What does gas chromatography do to the substances?

.....

.....

(1 mark)

5 (c) (ii) Give **two** reasons for using instrumental methods for analysis.

1 .....

.....

2 .....

.....

(2 marks)

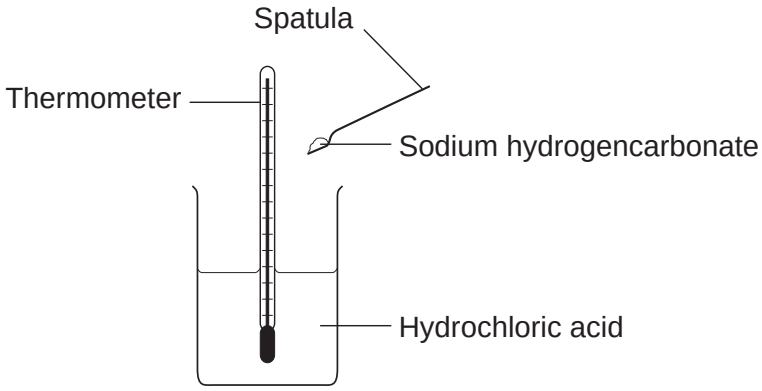
7

4.1.1.2 Mixtures

Question 88

June 2013 | CH2FP | Original Q7 | Legacy

7 (a) Some students did an experiment to find the temperature change when hydrochloric acid reacts with sodium hydrogencarbonate.



The results are in the table.

Number of spatula measures of sodium hydrogencarbonate	Start temperature in °C	Final temperature in °C	Change in temperature in °C
2	20	16	4
4	20	14	6
6	19	11	8
8	20	10	10
10	19	9	10
12	20	10	10

4.1.1.2 Mixtures

Question 88 · continued

7 (a) (i) Describe, as fully as you can, the trends shown in the students' results.

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(3 marks)

7 (a) (ii) State the type of energy transfer for this reaction.

.....

.....

(1 mark)

Question 7 continues on the next page

4.1.1.2 Mixtures

Question 88 · continued

7 (b) Sodium hydrogencarbonate is used as baking powder for making cakes.

When the cake mixture is baked the sodium hydrogencarbonate decomposes.

The equation for the reaction is:

$$2\,NaHCO_3(s) \xrightarrow{\text{Heat}} Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

7 (b) (i) The cake mixture rises when baked.



Use the equation to suggest why.

.....

.....

(1 mark)

7 (b) (ii) The same reaction can be reversed to produce sodium hydrogencarbonate from sodium carbonate.

$$Na_2CO_3 + H_2O + CO_2 \longrightarrow 2\,NaHCO_3$$

Do the reactants need to be heated?

Give a reason for your answer.

.....

.....

(1 mark)

4.1.1.2 Mixtures

Question 88 · continued

7 (c) (i) Calculate the relative formula mass of sodium hydrogencarbonate ($NaHCO_3$).

Relative atomic masses (A_r): H=1; C=12; O=16; Na=23

.....

.....

.....

Relative formula mass (M_r) = ...

(2 marks)

7 (c) (ii) Calculate the percentage by mass of carbon in sodium hydrogencarbonate.

.....

.....

Percentage of carbon = ... %

(1 mark)

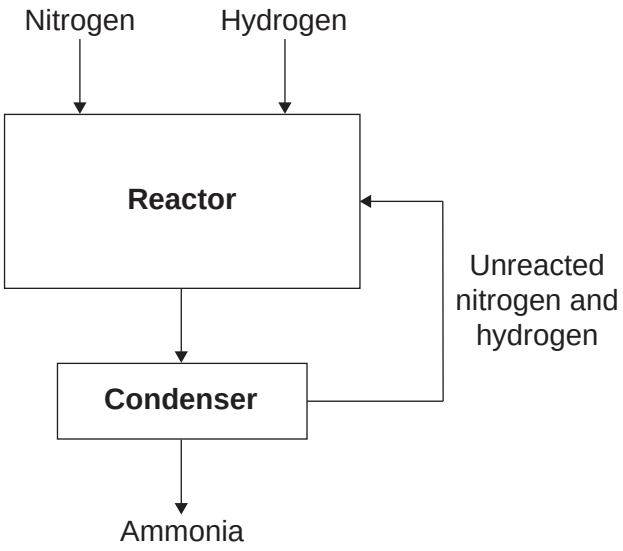
9

4.1.1.2 Mixtures

Question 89

June 2013 | CH3FP | Original Q1 | Legacy

1 The flow diagram shows the Haber process. In the Haber process ammonia is produced from nitrogen and hydrogen.



1 (a) The word equation for the production of ammonia is:

nitrogen + hydrogen $\rightleftharpoons$ ammonia

Draw a ring around the correct answer to complete the sentence.

The symbol $\rightleftharpoons$ in the word equation shows the reaction is

exothermic.
reversible.
slow.

(1 mark)

4.1.1.2 Mixtures

Question 89 · continued

1 (b) The reactor contains iron.

Complete the sentence.

The iron speeds up the reaction because it is a ..... .

(1 mark)

1 (c) What happens to the unreacted nitrogen and hydrogen?

.....

.....

(1 mark)

1 (d) The sentences describe how ammonia is produced in the Haber process.

The sentences are in the wrong order.

P Ammonia is separated as a liquid.

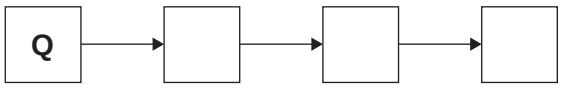
Q Nitrogen and hydrogen are mixed together.

R A mixture of gases enters the condenser.

S Nitrogen and hydrogen react to produce ammonia.

Complete the boxes below to show the correct order of the sentences.

The first box has been done for you.



(2 marks)

5

4.1.1.2 Mixtures

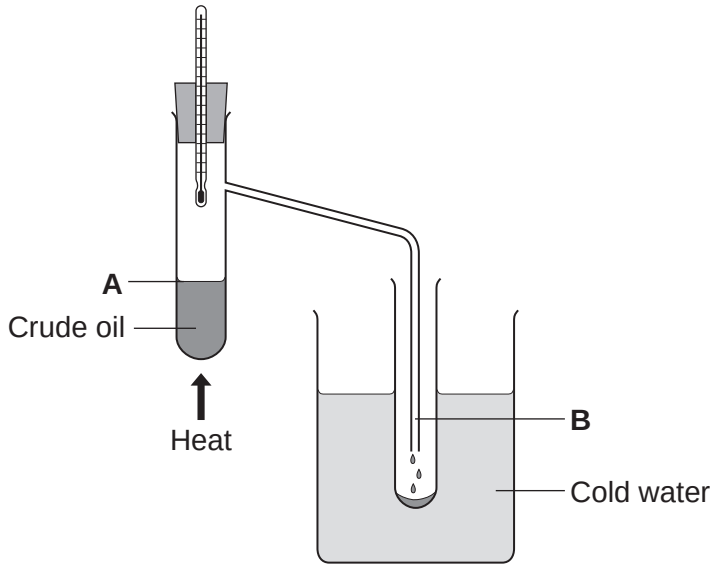
Question 90

June 2014 | CH1FP | Original Q4 | Legacy

4 Crude oil is a mixture of a very large number of compounds.

Figure 4 shows a laboratory experiment to separate crude oil.

Figure 4



4 (a) Complete the sentence.

[1 mark]

The name for compounds that contain only hydrogen and carbon is ..... .

4 (b) Use the correct word from the box to complete each sentence.

condensation	**decomposition**	**distillation**
evaporation	**reduction**	

4 (b) (i) The process of separating crude oil is fractional ..... .

[1 mark]

4 (b) (ii) The process taking place at **A** is ..... .

[1 mark]

4 (b) (iii) The process taking place at **B** is ..... .

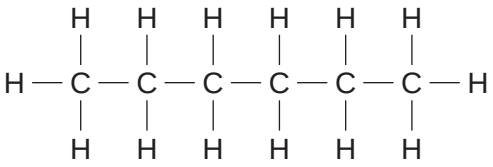
[1 mark]

4.1.1.2 Mixtures

Question 90 · continued

4 (c) One of the compounds in crude oil is hexane. The displayed structure of hexane is shown in **Figure 5**.

Figure 5



Complete the sentences.

4 (c) (i) Each line between the atoms in hexane represents a covalent ..... .

[1 mark]

4 (c) (ii) Complete the chemical formula for hexane.

[1 mark]

C_6H.....

4 (c) (iii) Hexane can be broken down into smaller molecules by a process called ..... .

[1 mark]

4 (d) Small molecules, called alkenes, are used to make polymers.

4 (d) (i) Name the polymer made from butene.

[1 mark]

.....

4 (d) (ii) Incinerators are used to burn waste polymers, such as plastic bags.

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of burning plastic bags.

[2 marks]

	Advantage Tick (✓)	Disadvantage Tick (✓)
Energy is released.		
More recycling is needed.		
Carbon dioxide is produced.		

10

4.1.1.2 Mixtures

Question 91

June 2014 | CH1FP | Original Q7 | Legacy

7 Ethanol and vegetable oil are used as fuels.

7 (a) There are two different ways to produce ethanol:

- using ethene from crude oil
- using sugar from plants.

7 (a) (i) Ethanol is produced from ethene by **hydration** in the presence of a catalyst.

What is **hydration**?

[1 mark]

.....

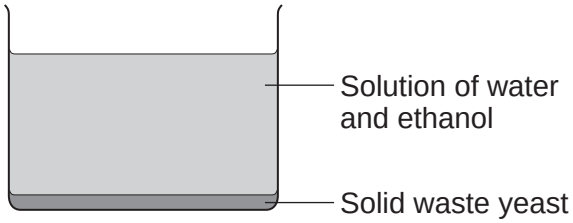
.....

7 (a) (ii) Fermentation is used to produce ethanol from sugar by:

- dissolving the sugar in water
- adding yeast to the sugar solution
- leaving the mixture for three days.

Figure 8 shows the substances after three days.

Figure 8



Suggest:

- how the solid waste yeast is removed
- how ethanol is obtained from the solution.

[2 marks]

.....

.....

.....

.....

4.1.1.2 Mixtures

Question 91 · continued

7 (b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Crude oil is separated to produce the fraction petroleum diesel.

Worries about low supplies of crude oil have led to the growing of large areas of crops to produce vegetable oil.

Vegetable oils are used to produce biodiesel.

There are economic, ethical and environmental issues about the use of biodiesel.

Biodiesel and petroleum diesel are used as a fuel for cars. In a car engine the fuel burns and releases waste products through the car exhaust system.

Table 4 shows the amount of waste products formed by biodiesel compared with the amount of waste products formed by petroleum diesel.

(Note that ppm is parts per million.)

Table 4

	Carbon dioxide in ppm	Nitrogen oxides in ppm	Sulfur dioxide in ppm	Particulates in g per m^3
Biodiesel	20 000	760	0	0.3
Petroleum diesel	80 000	700	300	0.6

Use this information and your knowledge and understanding to give advantages and disadvantages of using biodiesel instead of petroleum diesel.

[6 marks]

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4.1.1.2 Mixtures

Question 92

June 2014 | CH2FP | Original Q2 | Legacy

2 Dental braces are made from nitinol wires. Nitinol is a mixture of metals.



2 (a) Nitinol can return to its original shape after being deformed.

Draw a ring around the correct answer to complete the sentence.

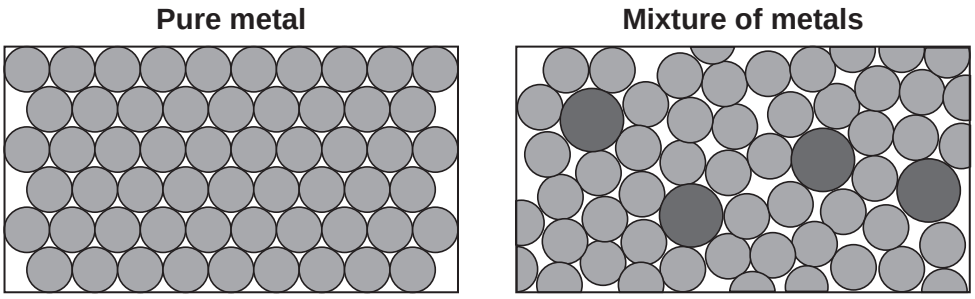
[1 mark]

Nitinol is a shape memory

alloy.
catalyst.
polymer.

2 (b) **Figure 2** shows the arrangement of atoms in a pure metal and in a mixture of metals.

Figure 2



The mixture of metals is harder than the pure metal.

Use **Figure 2** to explain why.

[2 marks]

.....

.....

.....

.....

4.1.1.2 Mixtures

Question 92 · continued

2 (c) Gold and stainless steel are also used for dental braces.

Suggest **two** factors to consider when choosing which metal to use for dental braces.

[2 marks]

.....

.....

.....

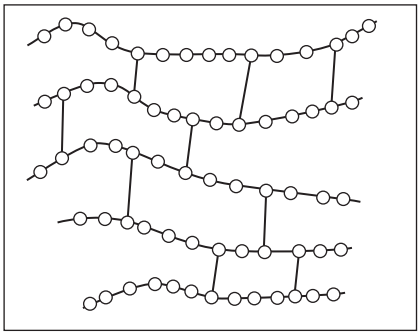
.....

2 (d) A thermosetting polymer is used to hold dental braces on the teeth.

Figure 3 shows the structure of a thermosetting polymer.

Figure 3

Thermosetting polymer



How can you tell from **Figure 3** that the polymer is thermosetting?

[1 mark]

.....

.....

6

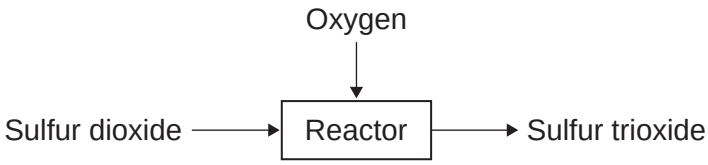
4.1.1.2 Mixtures

Question 93

June 2014 | CH2FP | Original Q3 | Legacy

3 **Figure 4** represents the reaction of sulfur dioxide with oxygen.

Figure 4



3 (a) (i) Complete the word equation for the reaction of sulfur dioxide with oxygen.

[1 mark]

sulfur dioxide + ... → .....

3 (a) (ii) Draw a ring around the correct answer to complete the sentence.

[1 mark]

Sulfur dioxide (SO_2) is

- a compound.
- an element.
- a mixture.

3 (b) The reactants are gases.

When the pressure of the gases is increased, the reaction gets faster.

Complete the sentence.

[1 mark]

When the pressure of the gases is increased,

the frequency of the collisions ..... .

4.1.1.2 Mixtures

Question 93 · continued

3 (c) The particles need energy to react.

Complete the sentence.

[1 mark]

The minimum amount of energy that particles need to react is called

the ..... energy.

3 (d) Give **one** way of increasing the rate of the reaction other than changing the pressure.

[1 mark]

.....

.....

5

Turn over for the next question

4.1.1.2 Mixtures

Question 94

June 2014 | CH2FP | Original Q4 | Legacy

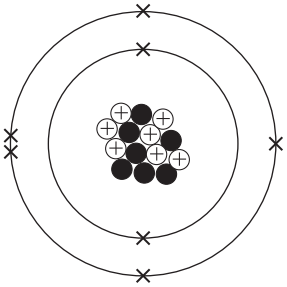
4 Fertilisers contain elements that plants need.

AQAGROW
Plant Fertiliser

Contains:
- Nitrogen
- Phosphorus
- Potassium

4 (a) **Figure 5** represents a nitrogen atom.

Figure 5



Complete each sentence.

4 (a) (i) The mass number of this nitrogen atom is ..... .

[1 mark]

4 (a) (ii) Atoms of nitrogen with different numbers of neutrons are called ..... .

[1 mark]

4 (a) (iii) Compared with a proton, the mass of an electron is ..... .

[1 mark]

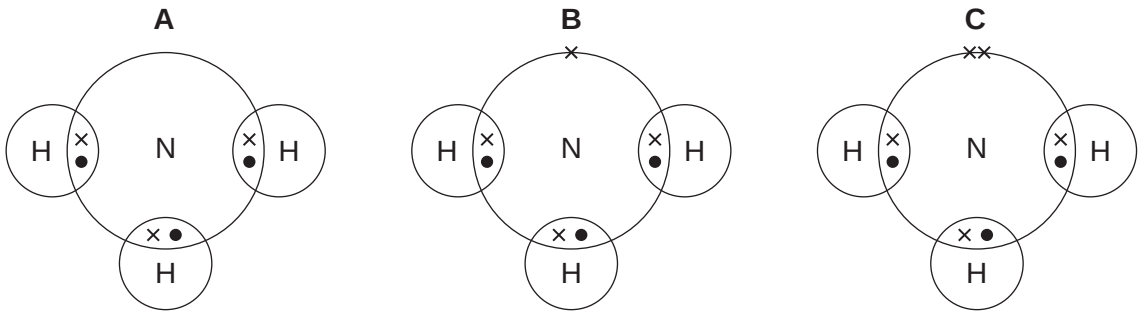
4.1.1.2 Mixtures

Question 94 · continued

4 (b) Fertilisers can be made from ammonia.

4 (b) (i) Which diagram, **A**, **B**, or **C**, represents the electronic structure of an ammonia molecule?

[1 mark]



The electronic structure of an ammonia molecule is shown in diagram ☐

4 (b) (ii) What is the correct formula of ammonia?

Draw a ring around the correct answer.

[1 mark]

N_3H NH_3 NH^3

Question 4 continues on the next page

4.1.1.2 Mixtures

Question 94 · continued

4 (c) A student made ammonium nitrate by reacting ammonia solution with an acid.

4 (c) (i) Name the acid used to make ammonium nitrate.

[1 mark]

.....

4 (c) (ii) Complete the sentence.

[1 mark]

The student added a few drops of ....., which changed colour when the ammonia solution had neutralised the acid.

4 (c) (iii) The student added charcoal and filtered the mixture.

This produced a colourless solution of ammonium nitrate.

How is solid ammonium nitrate obtained from the solution?

[1 mark]

.....

4 (c) (iv) A farmer put ammonium nitrate fertiliser onto a field of grass.

Suggest what would happen to the grass.

[1 mark]

.....

.....

4.1.1.2 Mixtures

Question 94 · continued

4 (d) Some fertilisers contain potassium chloride.

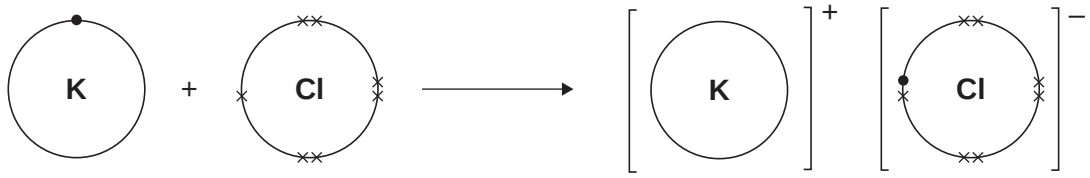
Potassium reacts with chlorine to produce potassium chloride.

Figure 6 shows how this happens.

The dots (•) and crosses (x) represent electrons.

Only the outer shell is shown.

Figure 6



Use **Figure 6** to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with chlorine to produce potassium chloride.

[4 marks]

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13

4.1.1.2 Mixtures

Question 95

June 2014 | CH2FP | Original Q6 | Legacy

6 The label shows the ingredients in a drink called Cola.

Cola

Ingredients:

Carbonated water
Sugar
Colouring
Phosphoric acid
Flavouring
Caffeine

6 (a) (i) The pH of carbonated water is 4.5.

The pH of Cola is 2.9.

Name the ingredient on the label that lowers the pH of Cola to 2.9.

[1 mark]

.....

6 (a) (ii) Which ion causes the pH to be 2.9?

[1 mark]

.....

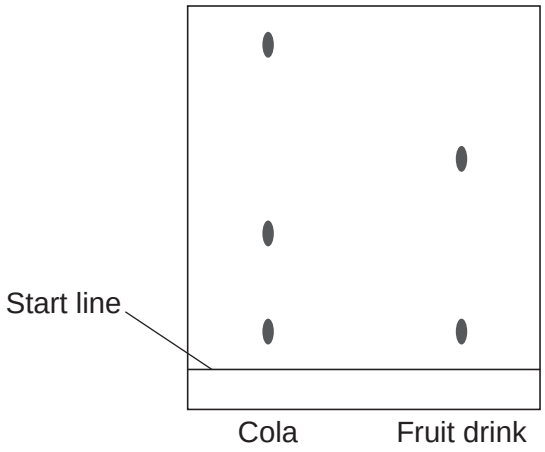
4.1.1.2 Mixtures

Question 95 · continued

6 (b) A student investigated the food colouring in Cola and in a fruit drink using paper chromatography.

The chromatogram in **Figure 8** shows the student's results.

Figure 8



6 (b) (i) Complete the sentence.

The start line should be drawn with a ruler and ..... .

Give a reason for your answer.

[2 marks]

.....

.....

6 (b) (ii) Suggest **three** conclusions you can make from the student's results.

[3 marks]

.....

.....

.....

.....

.....

.....

4.1.1.2 Mixtures

Question 95 · continued

6 (c) Caffeine can be separated from the other compounds in the drink by gas chromatography.

Why do different compounds separate in a gas chromatography column?

[1 mark]

.....

.....

6 (d) Caffeine is a stimulant.

Large amounts of caffeine can be harmful.

6 (d) (i) Only **one** of the questions in the table **can** be answered by science alone.

Tick (✓) **one** question.

[1 mark]

Question	Tick (✓)
Should caffeine be an ingredient in drinks?	
Is there caffeine in a certain brand of drink?	
How much caffeine should people drink?	

6 (d) (ii) Give **two** reasons why the other questions **cannot** be answered by science alone.

[2 marks]

Reason 1 .....

.....

Reason 2 .....

.....

11

4.1.1.2 Mixtures

Question 96

June 2014 | CH3FP | Original Q7 | Legacy

7 Water in Britain is taken from reservoirs to use as drinking water.

Figure 9



7 (a) What are the **two** main steps used to treat water from reservoirs?

Give **one** reason for each step.

[4 marks]

.....

.....

.....

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.....

4.1.1.2 Mixtures

Question 96 · continued

7 (b) Some people use water filters to treat water before drinking it.

7 (b) (i) Water filters remove hardness from hard water.

What is in water filters that removes hardness from water?

[1 mark]

.....

.....

7 (b) (ii) Suggest why water filters used in the home contain particles of silver.

[1 mark]

.....

.....

7 (c) Pure water can be produced by distillation.

Why is distillation **not** usually an economic method of treating water for drinking?

[1 mark]

.....

.....

7 (d) Drinking hard water has health benefits.

State **one** health benefit of drinking hard water.

[1 mark]

.....

.....

8

4.1.1.2 Mixtures

Question 97

June 2015 | CH1FP | Original Q3 | Legacy

3 Crude oil is a fossil fuel.

3 (a) To make crude oil more useful it is separated into fractions.

Use the correct word from the box to complete each sentence.

boiling	**compound**	**decomposition**	**distillation**
filtration	**mixture**	**molecule**	

3 (a) (i) Crude oil is a ..... of different substances.

[1 mark]

3 (a) (ii) The substances in crude oil have different ..... points.

[1 mark]

3 (a) (iii) Crude oil is separated by fractional ..... .

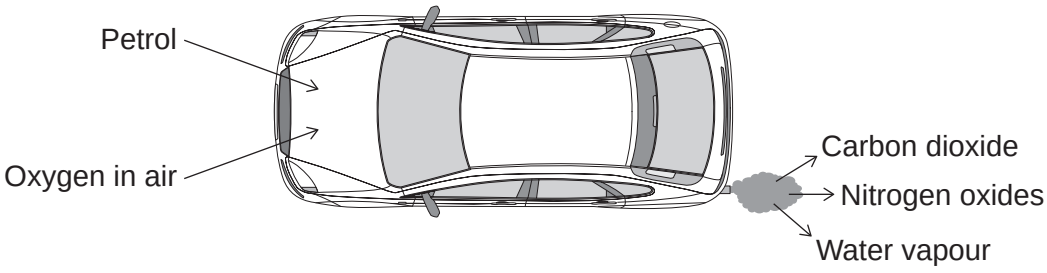
[1 mark]

3 (b) Petrol is one of the fractions produced from crude oil.

Car engines use a mixture of petrol and air.

Figure 5 shows some of the gases produced.

Figure 5



4.1.1.2 Mixtures

Question 97 · continued

3 (b) (i) What type of reaction happens to petrol in a car engine?

[1 mark]

Tick (✓) **one** box.

combustion ☐

decomposition ☐

neutralisation ☐

3 (b) (ii) Petrol contains octane (C_8H_{18}).

Complete the word equation for the reaction of octane with oxygen.

[2 marks]

octane + ... ⟶ ..... + ...

3 (b) (iii) Cars use sulfur-free petrol as a fuel.

Describe why sulfur should be removed from petrol.

[2 marks]

.....

.....

.....

.....

Question 3 continues on the next page

4.1.1.2 Mixtures

Question 97 · continued

3 (c) Some fractions from crude oil contain large hydrocarbon molecules.

These molecules can be cracked to produce smaller, more useful molecules.

An equation for cracking decane is:

$$\underset{\text{decane}}{C_{10}H_{22}} \longrightarrow \underset{\text{propane}}{C_3H_8} + \underset{\text{ethene}}{C_2H_4} + \underset{\text{pentene}}{C_5H_{10}}$$

3 (c) (i) Why is propane useful?

[1 mark]

Tick (✓) **one** box.

Propane is a polymer. ☐

Propane is an alloy. ☐

Propane is a fuel. ☐

3 (c) (ii) Draw bonds to complete the displayed structure of ethene.

[1 mark]



4.1.1.2 Mixtures

Question 97 · continued

3 (c) (iii) What is the colour change when bromine water reacts with ethene?

[1 mark]

Tick (✓) **one** box.

Orange to colourless ☐

Orange to green ☐

Orange to red ☐

3 (c) (iv) Complete the sentence.

[1 mark]

Pentene is useful because many pentene molecules can join together to form ..... .

12

4.1.1.2 Mixtures

Question 98

June 2015 | CH1FP | Original Q5 | Legacy

5 Limestone is used to make many different materials.

5 (a) Heating limestone produces calcium oxide and carbon dioxide.

Complete the sentences.

5 (a) (i) The main compound in limestone is calcium ..... .

[1 mark]

5 (a) (ii) The reaction to produce calcium oxide from limestone is thermal ..... .

[1 mark]

5 (a) (iii) Calcium hydroxide is produced when calcium oxide reacts with ..... .

[1 mark]

5 (a) (iv) Calcium hydroxide is used to neutralise acids because it is an ..... .

[1 mark]

Question 5 continues on the next page

Question 98 · continued

5 (b) Cement is made from limestone and clay.

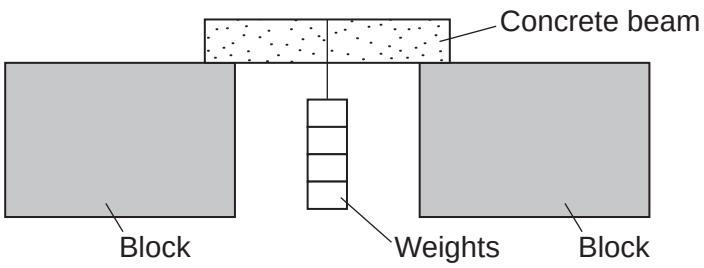
Concrete is made by mixing cement with water, sand and aggregate (small pieces of rock).

A group of students did an investigation on the amount of aggregate needed to make the strongest concrete beam.

The students used this method:

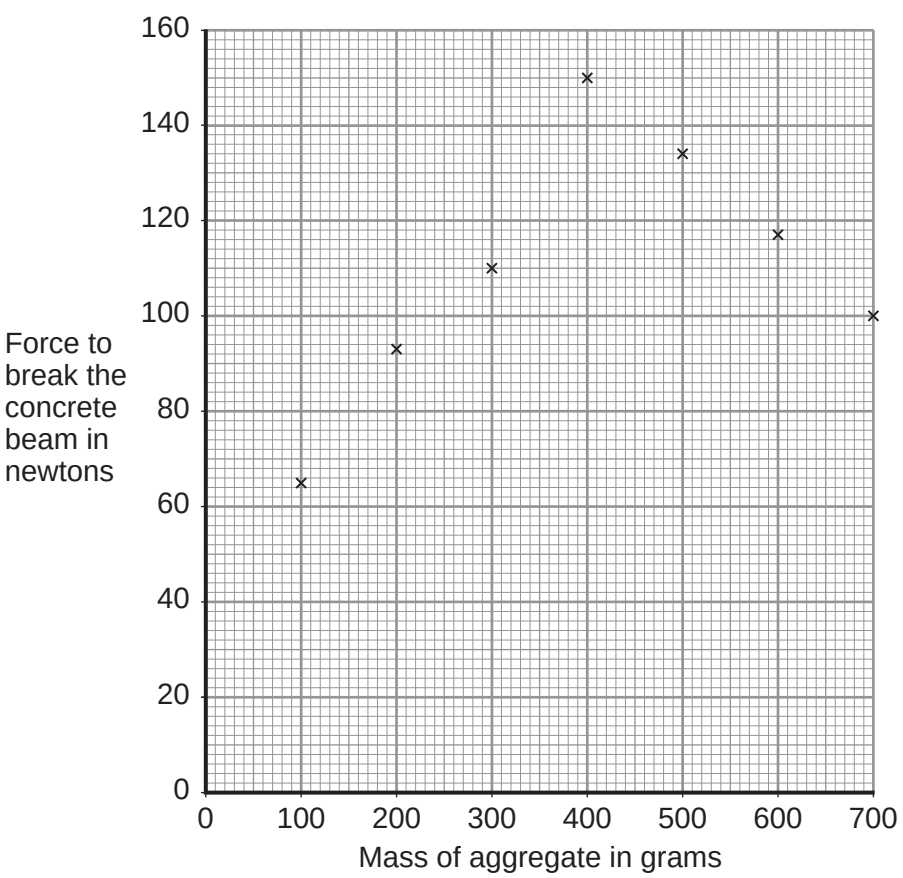
- use the same mass of cement and the same mass of sand but change the mass of aggregate to make seven different concrete mixtures
- use the different concrete mixtures to make beams of the same size
- add weights, as shown in **Figure 7**, until the concrete beam breaks.

Figure 7



The students' results are plotted on the graph in **Figure 8**.

Figure 8



4.1.1.2 Mixtures

Question 98 · continued

5 (b) (i) One of the points is anomalous.

Complete the graph in **Figure 8** by drawing **two** straight lines of best fit.

[2 marks]

5 (b) (ii) Describe **one** way the students could improve the method so that their results are more accurate for each graph point.

[2 marks]

.....

.....

.....

.....

5 (b) (iii) What force is needed to break a concrete beam containing no aggregate?

Show your working on the graph.

[2 marks]

Force = ... newtons

5 (b) (iv) One of the students concluded that:

'The force needed to break a concrete beam increases as the mass of aggregate increases.'

The student's conclusion is **not completely** correct. Use values from the graph to explain why.

[3 marks]

.....

.....

.....

.....

.....

.....

13

4.1.1.2 Mixtures

Question 99

June 2015 | CH2FP | Original Q3 | Legacy

3 Lead iodide is an insoluble salt.

3 (a) What type of substance is lead iodide?

[1 mark]

Tick (✓) **one** box.

An element ☐

A mixture ☐

A compound ☐

3 (b) A student produced lead iodide by a precipitation reaction.

Use the correct answers from the box to complete the word equation.

[2 marks]

lead bromide	**lead nitrate**	**potassium bromide**	**potassium iodide**

..... + ... ⟶ lead iodide + potassium nitrate

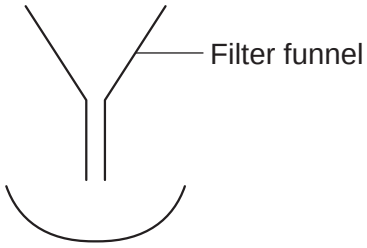
4.1.1.2 Mixtures

Question 99 · continued

3 (c) The student wanted to separate the precipitate of lead iodide from the solution by using filtration.

The student used the apparatus shown in **Figure 3**.

Figure 3



Explain why the apparatus in **Figure 3** would **not** separate the lead iodide from the mixture.

[2 marks]

.....

.....

.....

.....

3 (d) The student expected to get 5 g of lead iodide but only got 3 g.

3 (d) (i) The student did this calculation.

$\frac{3}{5} \times 100$

Use the correct answer from the box to complete the sentence.

[1 mark]

mass of one mole	**percentage yield**	**relative formula mass**

The student calculated the ..... .

3 (d) (ii) Give **one** reason why the mass the student got was less than expected.

[1 mark]

.....

.....

7

4.1.1.2 Mixtures

Question 100

June 2015 | CH2FP | Original Q4 | Legacy

4 This question is about electrolysis.

4 (a) Metal spoons can be coated with silver.
This is called electroplating.

Suggest **one** reason why spoons are electroplated.

[1 mark]

.....

.....

4 (b) When sodium chloride solution is electrolysed the products are hydrogen and chlorine.

4 (b) (i) What is made from chlorine?

[1 mark]

Tick (✓) **one** box.

Bleach ☐

Fertiliser ☐

Soap ☐

4 (b) (ii) Sodium chloride solution contains two types of positive ions, hydrogen ions (H^+) and sodium ions (Na^+).

Why is hydrogen produced at the negative electrode and **not** sodium?

[1 mark]

Tick (✓) **one** box.

Hydrogen is a gas. ☐

Hydrogen is less reactive than sodium. ☐

Hydrogen ions move faster than sodium ions. ☐

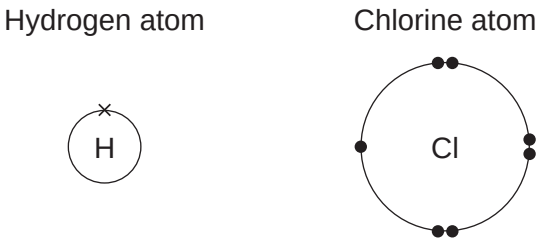
4.1.1.2 Mixtures

Question 100 · continued

4 (b) (iii) Hydrogen and chlorine can be used to produce hydrogen chloride.

The diagrams in **Figure 4** show how the outer electrons are arranged in an atom of hydrogen and an atom of chlorine.

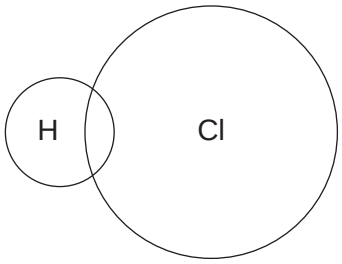
Figure 4



Complete **Figure 5** to show how the outer electrons are arranged in a molecule of hydrogen chloride (HCl).

[1 mark]

Figure 5



4 (b) (iv) What is the type of bond in a molecule of hydrogen chloride?

[1 mark]

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

Question 4 continues on the next page

4.1.1.2 Mixtures

Question 100 · continued

4 (b) (v) Why is hydrogen chloride a gas at room temperature (20 °C)?

[2 marks]

Tick (✓) **two** boxes.

Hydrogen chloride has a low boiling point. ☐

Hydrogen chloride has a high melting point. ☐

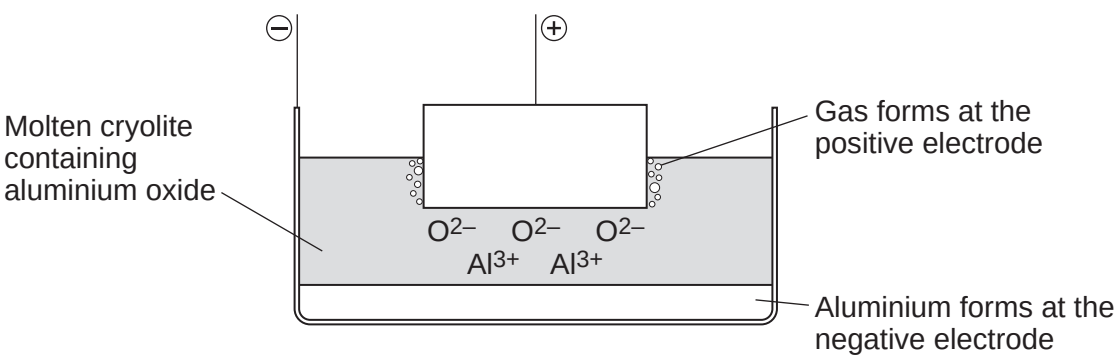
Hydrogen chloride is made of simple molecules. ☐

Hydrogen chloride does not conduct electricity. ☐

Hydrogen chloride has a giant structure. ☐

4 (c) Aluminium is produced by electrolysis of a molten mixture of aluminium oxide and cryolite.
This is shown in **Figure 6**.

Figure 6



4 (c) (i) Name a gas produced at the positive electrode.

[1 mark]

.....

4.1.1.2 Mixtures

Question 100 · continued

4 (c) (ii) Aluminium ions move to the negative electrode.

Explain why.

[2 marks]

.....

.....

.....

.....

4 (c) (iii) At the negative electrode, the aluminium ions gain electrons to produce aluminium.

What is this type of reaction called?

[1 mark]

Tick (✓) **one** box.

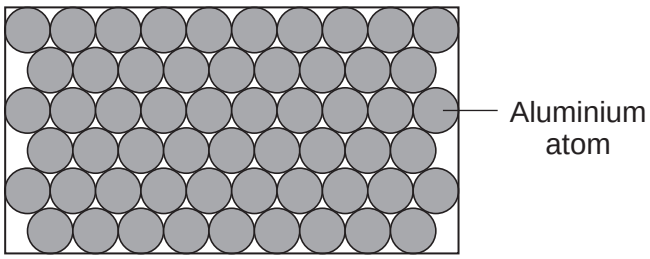
Combustion ☐

Oxidation ☐

Reduction ☐

4 (c) (iv) Aluminium has layers of atoms, as shown in **Figure 7**.

Figure 7



Complete the sentence.

[1 mark]

Metals can be bent and shaped because the layers of atoms can ..... .

Question 4 continues on the next page

4.1.1.2 Mixtures

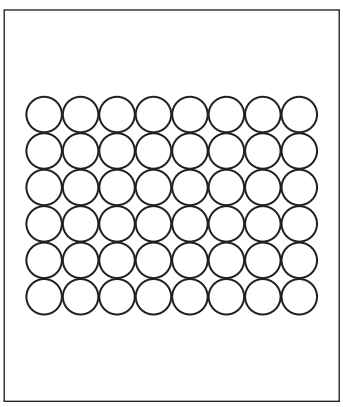
Question 100 · continued

4 (d) Electrodes used in the production of aluminium are made from graphite.

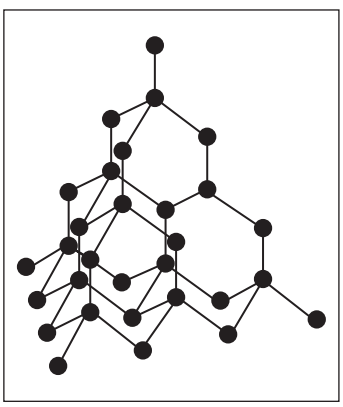
4 (d) (i) Which diagram, **A**, **B** or **C**, shows the structure of graphite?

[1 mark]

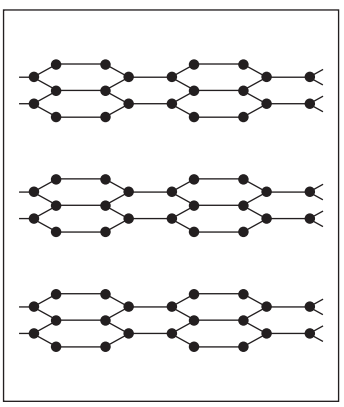
A



B



C



The structure of graphite is shown in diagram ☐.

4 (d) (ii) The temperature for the electrolysis is 950 °C.

Use the correct answer from the box to complete the sentence.

[1 mark]

cross links	**a giant ionic lattice**	**strong covalent bonds**

The graphite does not melt at 950 °C because

graphite has ..... .

14

4.1.1.2 Mixtures

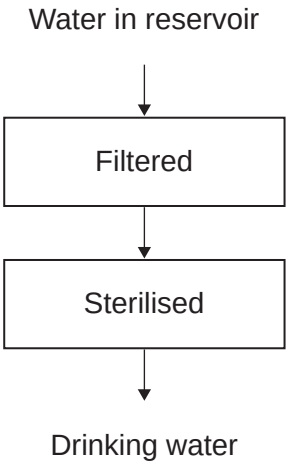
Question 101

June 2015 | CH3FP | Original Q1 | Legacy

1 This question is about drinking water.

1 (a) The flow diagram in **Figure 1** shows how water is made suitable for drinking.

Figure 1



1 (a) (i) What is removed when the water is filtered?

[1 mark]

Tick (✓) **one** box.

Gases ☐

Liquids ☐

Solids ☐

4.1.1.2 Mixtures

Question 101 · continued

1 (a) (ii) What is used to sterilise the water?

[1 mark]

Tick (✓) **one** box.

Carbon ☐

Chlorine ☐

Sodium chloride ☐

1 (a) (iii) Why is the water sterilised?

[1 mark]

.....

.....

1 (b) Water can be purified by distillation.

Drinking water is **not** usually purified by distillation because distillation is expensive.

Complete the sentence.

[1 mark]

Distillation is expensive because it requires a lot of ..... .

1 (c) Why do some water companies add fluoride to drinking water?

[1 mark]

.....

.....

5

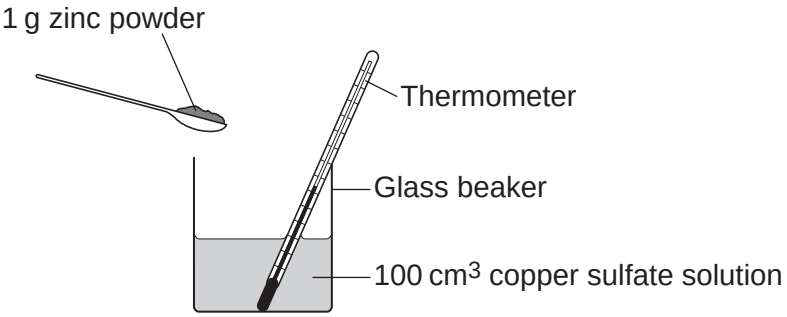
4.1.1.2 Mixtures

Question 102

June 2015 | CH3FP | Original Q3 | Legacy

3 A student investigates the energy released when zinc powder reacts with copper sulfate solution. The student uses the apparatus shown in **Figure 3**.

Figure 3



The student:

- measures 100 cm^3 copper sulfate solution into a beaker
- measures the temperature of the copper sulfate solution
- puts 1 g zinc powder into the beaker
- stirs the mixture with a thermometer
- measures the highest temperature.

The student's results were:

Starting temperature = 21 °C
Highest temperature = 32 °C

3 (a) (i) Calculate the change in temperature.

[1 mark]

.....

Change in temperature = ... °C

3 (a) (ii) Calculate the energy released in the reaction.

Use the equation

$$\text{energy released in J} = \text{volume of solution in } cm^3 \times 4.2 \times \text{temperature change in °C}$$

[2 marks]

.....

.....

Energy released = ... J

4.1.1.2 Mixtures

Question 102 · continued

3 (b) The reaction of zinc with copper sulfate is exothermic.

How can you tell from the student's results that the reaction is exothermic?

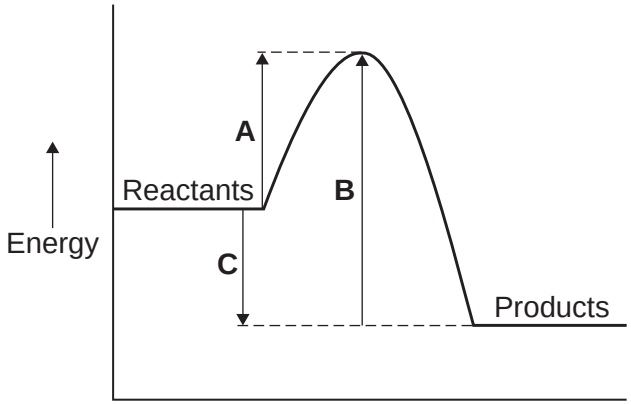
[1 mark]

.....

.....

3 (c) The energy diagram for the reaction is shown in **Figure 4**.

Figure 4



3 (c) (i) How can you tell from the energy diagram that the reaction is exothermic?

[1 mark]

.....

.....

3 (c) (ii) Which arrow shows the activation energy in **Figure 4**?

[1 mark]

Tick (✓) **one** box.

A ☐

B ☐

C ☐

6

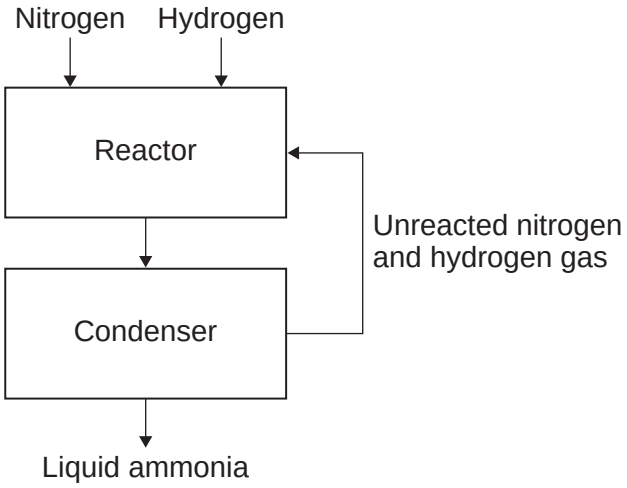
4.1.1.2 Mixtures

Question 103

June 2015 | CH3FP | Original Q4 | Legacy

4 **Figure 5** shows a flow diagram of the Haber process.
The Haber process produces ammonia from nitrogen and hydrogen.

Figure 5



4 (a) Use the correct answer from the box to complete the sentence.

[1 mark]

air	limestone	natural gas

Hydrogen is obtained from ..... .

4 (b) In the reactor, nitrogen and hydrogen at a high pressure are heated and passed over a catalyst.

4 (b) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

25	100	450

The temperature in the reactor is ..... °C

4 (b) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

copper	iron	nickel

The catalyst used in the reactor is ..... .

4.1.1.2 Mixtures

Question 103 · continued

4 (b) (iii) How does a catalyst speed up a reaction?

[1 mark]

Tick (✓) **one** box.

The catalyst lowers the activation energy. ☐

The catalyst gives the reactants extra energy. ☐

The catalyst increases the pressure in the reactor. ☐

4 (c) A mixture of gases leaves the reactor.

The mixture contains ammonia, nitrogen and hydrogen.

Describe what happens to this mixture of gases in the condenser.

Use **Figure 5** to help you.

[3 marks]

.....

.....

.....

.....

.....

.....

7

4.1.1.2 Mixtures

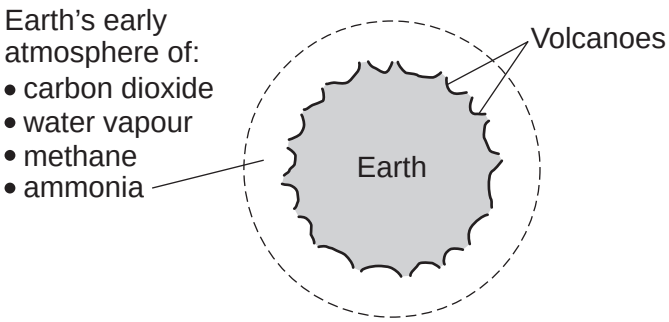
Question 104

June 2016 | CH1FP | Original Q2 | Legacy

2 This question is about the Earth and its atmosphere.

2 (a) **Figure 4** shows the Earth and its atmosphere billions of years ago.

Figure 4



2 (a) (i) The boiling point of water is 100 °C.

Suggest **one** reason why there was no liquid water on the Earth's surface billions of years ago.

[1 mark]

_____

_____

2 (a) (ii) Complete the sentence.

[1 mark]

On the Earth today, volcanic eruptions happen at the boundaries between

tectonic _____ .

Question 2 continues on the next page

4.1.1.2 Mixtures

Question 104 · continued

2 (b) The Earth's atmosphere today contains nitrogen, oxygen, argon, carbon dioxide and other gases.

2 (b) (i) Draw **one** line from each substance to a description of the substance.

[3 marks]

Substance	Description of the substance
air	compound
carbon dioxide	element
argon	hydrocarbon
	metal
	mixture

2 (b) (ii) Which gas in the Earth's atmosphere is used when hydrocarbons burn?

[1 mark]

Tick (✓) **one** box.

- carbon dioxide ☐
- nitrogen ☐
- oxygen ☐

2 (b) (iii) What percentage of the Earth's atmosphere is nitrogen?

[1 mark]

Tick (✓) **one** box.

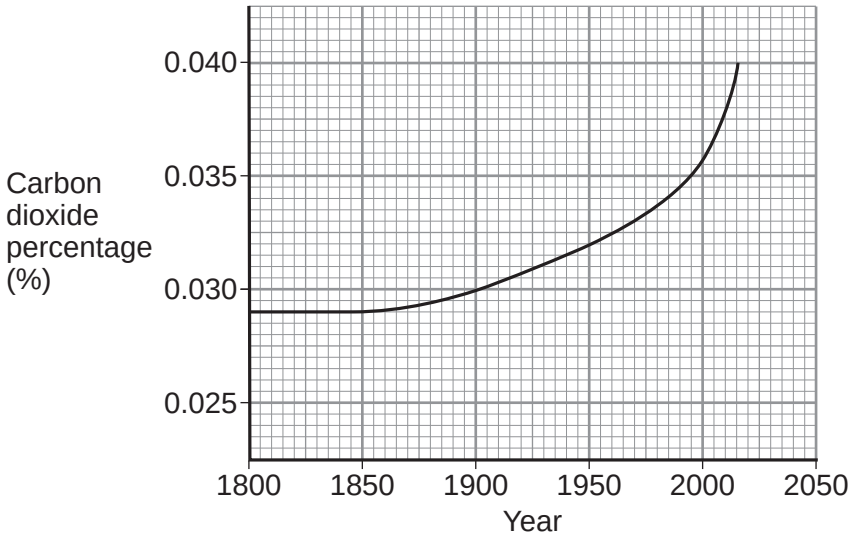
- about 40% ☐
- about 60% ☐
- about 80% ☐

4.1.1.2 Mixtures

Question 104 · continued

2 (c) **Figure 5** shows the carbon dioxide percentage (%) in the Earth's atmosphere since the year 1800.

Figure 5



2 (c) (i) What was the carbon dioxide percentage in 1900?

[1 mark]

_____ %

2 (c) (ii) Describe, in detail, how the carbon dioxide percentage changed from 1900 to 2015.

[2 marks]

_____

_____

_____

_____

2 (c) (iii) Suggest **two** reasons for the change in the carbon dioxide percentage from 1900 to 2015.

[2 marks]

1 _____

_____

2 _____

_____

12

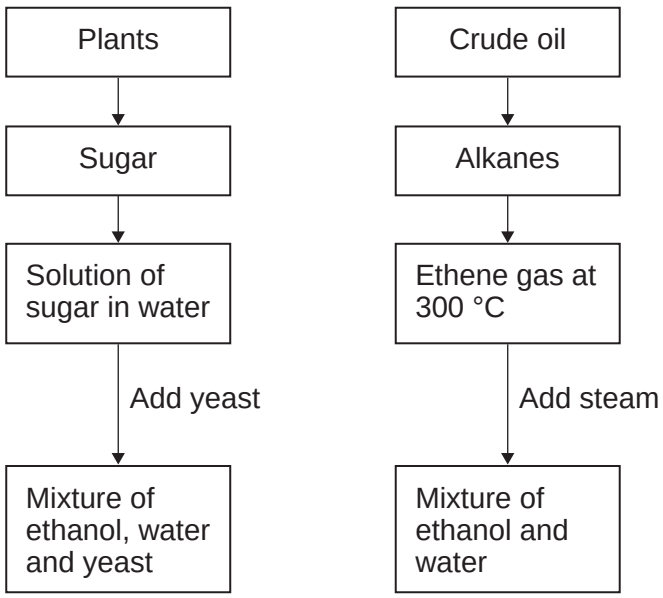
4.1.1.2 Mixtures

Question 105

June 2016 | CH1FP | Original Q4 | Legacy

4 **Figure 8** shows how ethanol is made from plants and from crude oil.

Figure 8



4 (a) (i) What is the name of the reaction to produce ethanol from sugar?

[1 mark]

Tick (✓) **one** box.

- fermentation ☐
- polymerisation ☐
- reduction ☐

4 (a) (ii) What is the name of the reaction to produce ethanol from ethene?

[1 mark]

Tick (✓) **one** box.

- bioleaching ☐
- displacement ☐
- hydration ☐

4.1.1.2 Mixtures

Question 105 · continued

4 (a) (iii) A lot of the ethanol produced is used as a fuel for cars.

What are **two** reasons why most of this ethanol is made from plants and **not** from crude oil?

[2 marks]

Tick (✓) **two** boxes.

- Resources of crude oil are non-renewable. ☐
- Ethanol from plants is more flammable. ☐
- Producing ethanol from plants is not sustainable. ☐
- Ethanol from plants has a different formula. ☐
- Producing ethanol from plants uses less energy. ☐

Question 4 continues on the next page

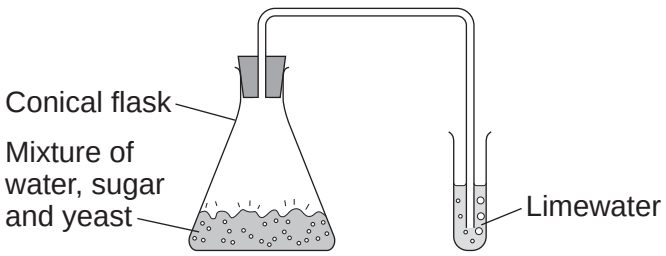
4.1.1.2 Mixtures

Question 105 · continued

4 (b) A student made ethanol from sugar.

Figure 9 shows the apparatus used.

Figure 9



4 (b) (i) What change is seen in the limewater?

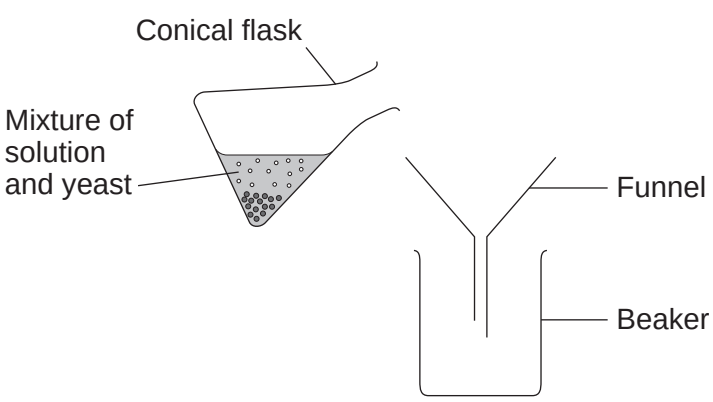
Give a reason for your answer.

[2 marks]

4 (b) (ii) The student wanted to separate the solid yeast from the solution.

Figure 10 shows the apparatus used.

Figure 10



What is missing from the apparatus in **Figure 10**?

[1 mark]

4.1.1.2 Mixtures

Question 105 · continued

4 (c) Vegetable oils are made from plants.

4 (c) (i) Which statement is correct?

[1 mark]

Tick (✓) **one** box.

Vegetable oils have lower boiling points than water. ☐

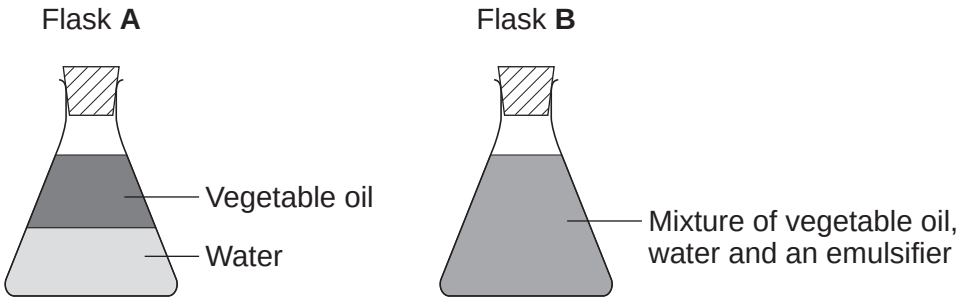
Vegetable oils cook foods at higher temperatures than boiling water. ☐

Cooking in vegetable oils decreases the energy content of the food. ☐

4 (c) (ii) A student puts different mixtures into two flasks, **A** and **B**. The student shakes the flasks.

Figure 11 shows the two flasks after they have been shaken and left to stand for one minute.

Figure 11



Complete the sentences.

[2 marks]

The mixture in flask **A** separates because _____

_____

The mixture in flask **B** does not separate because _____

_____

10

4.1.1.2 Mixtures

Question 106

June 2016 | CH1FP | Original Q5 | Legacy

5 This question is about hydrocarbons.

5 (a) Most of the hydrocarbons in crude oil are alkanes.

5 (a) (i) Large alkane molecules can be cracked to produce more useful molecules.

The equation shows the cracking of dodecane.

$$\underset{\text{dodecane}}{C_{12}H_{26}} \longrightarrow \underset{\text{butane}}{C_4H_{10}} + \underset{\text{hexene}}{C_6H_{12}} + \underset{\text{ethene}}{C_2H_4}$$

Give **two** conditions used to crack large alkane molecules.

[2 marks]

1 _____

2 _____

5 (a) (ii) The products hexene and ethene are alkenes.

Complete the sentence.

[1 mark]

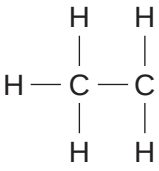
When alkenes react with bromine water the colour changes

from orange to _____ .

5 (a) (iii) Butane (C_4H_{10}) is an alkane.

Complete the displayed structure of butane.

[1 mark]



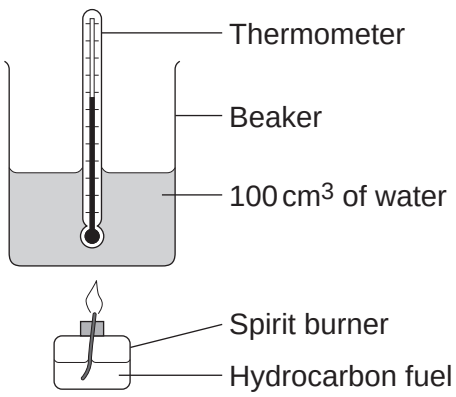
Question 5 continues on the next page

Question 106 · continued

5 (b) A group of students investigated the energy released by the combustion of four hydrocarbon fuels.

Figure 12 shows the apparatus used.

Figure 12



Each hydrocarbon fuel was burned for two minutes.

Table 2 shows the students' results.

Table 2

	After two minutes				
Name and formula of hydrocarbon fuel	**Mass of fuel used in g**	**Temperature increase of water in °C**	**Energy released by fuel in kJ**	**Energy released by 1.0 g of fuel in kJ**	**Relative amount of smoke in the flame**
Hexane, C_6H_{14}	0.81	40	16.80	20.74	very little smoke
Octane, C_8H_{18}	1.10	54	22.68	20.62	some smoke
Decane, $C_{10}H_{22}$	1.20	58	24.36		smoky
Dodecane, $C_{12}H_{26}$	1.41	67	28.14	19.96	very smoky

4.1.1.2 Mixtures

Question 106 · continued

5 (b) (i) Calculate the energy released by 1.0 g of decane in kJ.

[2 marks]

Energy released = _____ kJ

5 (b) (ii) Suggest **one** improvement to the apparatus, or the use of the apparatus, that would make the temperature increase of the water for each fuel more accurate.

Give a reason why this is an improvement.

[2 marks]

5 (b) (iii) The students noticed that the bottom of the beaker became covered in a black substance when burning these fuels.

Name this black substance.

Suggest why it is produced.

[2 marks]

5 (b) (iv) A student concluded that hexane is the best of the four fuels.

Give **two** reasons why the results in **Table 2** support this conclusion.

[2 marks]

1 _____

2 _____

Question 5 continues on the next page

4.1.1.2 Mixtures

Question 106 · continued

5 (c) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Most car engines use petrol as a fuel.

- Petrol is produced from the fractional distillation of crude oil.
- Crude oil is a mixture of hydrocarbons.
- Sulfur is an impurity in crude oil.

Car engines could be developed to burn hydrogen as a fuel.

- Hydrogen is produced from natural gas.
- Natural gas is mainly methane.

Table 3 shows information about petrol and hydrogen.

Table 3

	Petrol	**Hydrogen**
State of fuel at room temperature	Liquid	Gas
Word equation for combustion of the fuel	petrol + oxygen ⟶ carbon dioxide + water	hydrogen + oxygen ⟶ water
Energy released from combustion of 1 g of the fuel	47 kJ	142 kJ

Describe the **advantages** and **disadvantages** of using hydrogen instead of petrol in car engines.

Use the information given and your knowledge and understanding to answer this question.

[6 marks]

4.1.1.2 Mixtures

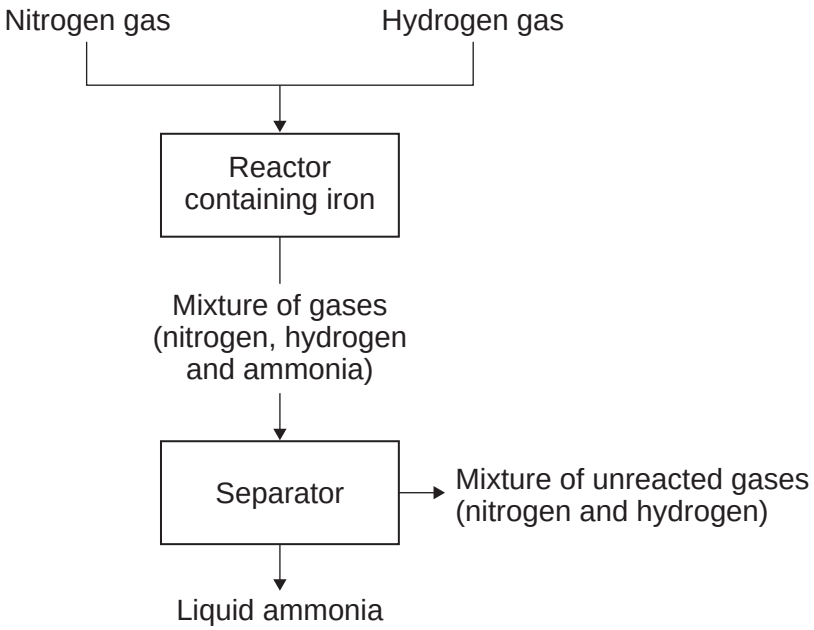
Question 107

June 2016 | CH3FP | Original Q4 | Legacy

4 This question is about the Haber process.

Figure 6 shows a flow diagram for the Haber process.

Figure 6



4 (a) (i) Nitrogen gas and hydrogen gas are obtained from different sources.
Draw **one** line from each gas to its source.

[2 marks]

Gas	Source
	Air
Nitrogen	Iron ore
Hydrogen	Limestone
	Natural gas

Question 4 continues on the next page

4.1.1.2 Mixtures

Question 107 · continued

4 (a) (ii) Explain why iron is used in the reactor for the Haber process.

[2 marks]

4 (a) (iii) Describe how the ammonia is separated from the other gases.

[2 marks]

4 (a) (iv) What happens to the mixture of unreacted gases (nitrogen and hydrogen)?

[1 mark]

4 (b) The reaction to produce ammonia is reversible.
Complete the word equation for this reaction.

[2 marks]

nitrogen + _____

9

4.1.1.2 Mixtures

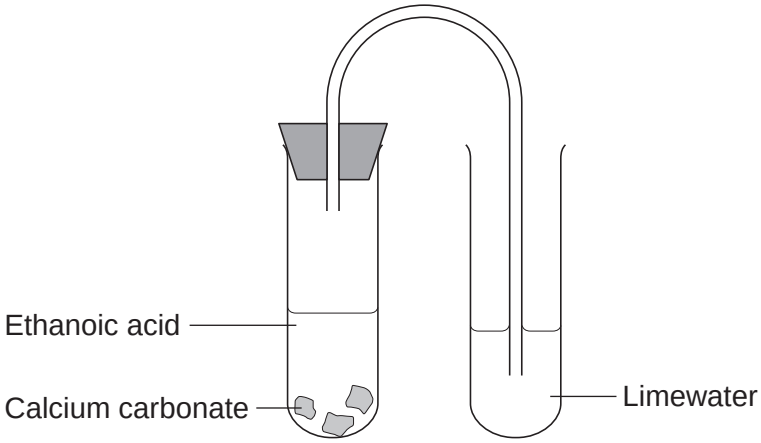
Question 108

June 2016 | CH3FP | Original Q5 | Legacy

5 This question is about reactions of ethanoic acid and the analysis of salts.

5 (a) **Figure 7** shows the apparatus used to investigate the reaction of ethanoic acid with calcium carbonate.

Figure 7



5 (a) (i) Describe a change that would be seen in each test tube.

Give a reason for each change.

[4 marks]

Test tube 1 _____

_____

_____

_____

Test tube 2 _____

_____

_____

_____

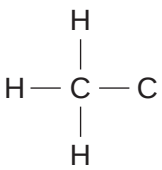
Question 5 continues on the next page

4.1.1.2 Mixtures

Question 108 · continued

5 (a) (ii) Complete the displayed structure of ethanoic acid.

[1 mark]



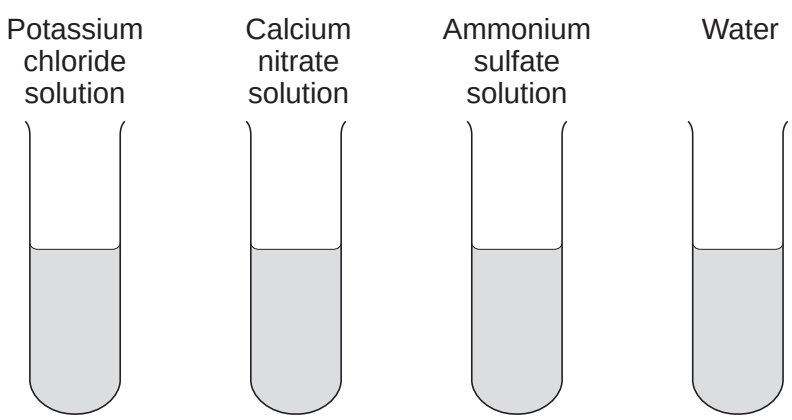
5 (a) (iii) Ethanoic acid is a carboxylic acid.
Complete the sentence.

[2 marks]

Carboxylic acids react with alcohols in the presence of an _____ catalyst to produce pleasant-smelling compounds called _____ .

5 (b) **Figure 8** shows four test tubes containing three different salt solutions and water.

Figure 8



Each solution and the water was tested with:

- silver nitrate in the presence of dilute nitric acid
- barium chloride in the presence of dilute hydrochloric acid.

4.1.1.2 Mixtures

Question 108 · continued

Complete the table of results.

[2 marks]

	Potassium chloride solution	Calcium nitrate solution	Ammonium sulfate solution	Water
Test with silver nitrate in the presence of dilute nitric acid			no change	no change
Test with barium chloride in the presence of dilute hydrochloric acid		no change	white precipitate	

5 (c) Flame tests can be used to identify metal ions.

5 (c) (i) Complete the following sentences.

[2 marks]

The flame colour for potassium ions is _____ .

The flame colour for calcium ions is _____ .

5 (c) (ii) Give **one** reason why a flame test would **not** show the presence of both potassium ions and calcium ions in a mixture.

[1 mark]

_____

_____

_____

12

4.1.1.2 Mixtures

Question 109

June 2017 | CH1FP | Original Q3 | Legacy

3 This question is about metals.

3 (a) Complete the word equation for the reaction of magnesium with oxygen.

[1 mark]

magnesium + oxygen ⟶ _____

3 (b) Iron oxide is reduced to iron in a blast furnace.

The chemical equation for the reaction is:

$$2\ Fe_2O_3 + 3\ C \longrightarrow 4\ Fe + 3\ CO_2$$

3 (b) (i) Give the name of the element used for the reduction of iron oxide.

[1 mark]

_____

3 (b) (ii) How can you tell that iron oxide is reduced?

[1 mark]

_____

_____

3 (b) (iii) Complete the sentences.

[3 marks]

For many uses, iron from the blast furnace is too _____ .

For many uses, pure iron is too _____ .

Mixtures of iron with carbon are called _____ .

6

4.1.1.2 Mixtures

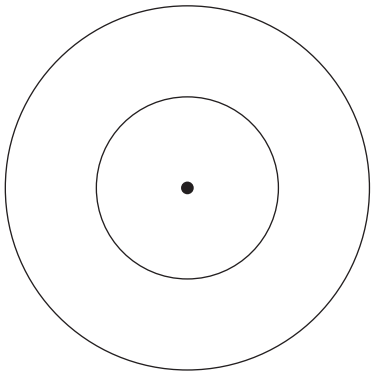
Question 110

June 2017 | CH1FP | Original Q6 | Legacy

6 This question is about compounds of carbon.

6 (a) **Figure 7** shows an atom with two energy levels (shells).

Figure 7



6 (a) (i) A carbon atom has six electrons.

Complete **Figure 7** to show the electronic structure of a carbon atom.

Use **x** to represent an electron.

[1 mark]

6 (a) (ii) Complete the following description about the central part of this carbon atom.

[3 marks]

The central part is made up of six neutrons that have no electrical charge and _____

_____

_____

_____

_____

6 (b) Crude oil is a mixture of compounds. These compounds are mainly hydrocarbons.

What does the term hydrocarbon mean?

[1 mark]

_____

_____

4.1.1.2 Mixtures

Question 110 · continued

6 (c) Alkanes and alkenes are hydrocarbons.

Table 2 shows the boiling points of some alkanes and alkenes.

Table 2

Alkanes

Name	Formula	Boiling point in °C
Ethane	C_2H_6	−88
Propane	C_3H_8	−42
Butane	C_4H_{10}	0
Pentane	C_5H_{12}	+36
Hexane	C_6H_{14}	+69

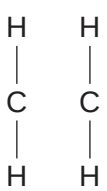
Alkenes

Name	Formula	Boiling point in °C
Ethene	C_2H_4	−104
Propene	C_3H_6	−48
Butene	C_4H_8	−6
Pentene	C_5H_{10}	+30
Hexene	C_6H_{12}	+64

6 (c) (i) Complete the displayed structure of ethane and the displayed structure of ethene.

[2 marks]

Ethane



Ethene



6 (c) (ii) Describe the relationship between the number of carbon atoms in an alkane molecule and the boiling point of the alkane molecule.

[1 mark]

4.1.1.2 Mixtures

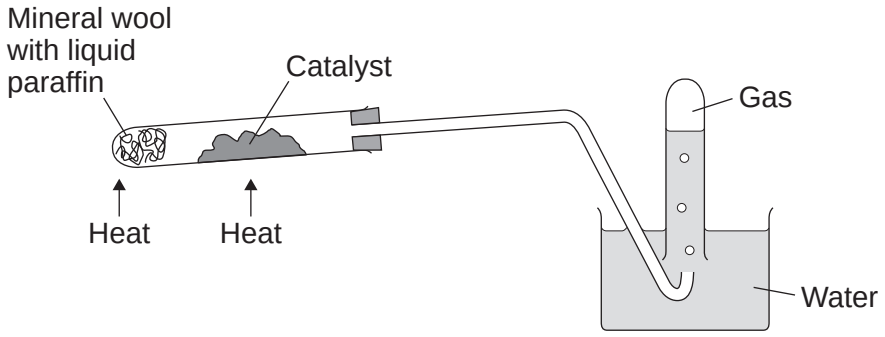
Question 110 · continued

6 (c) (iii) Use the information in **Table 2** to compare the boiling points of alkanes with the boiling points of alkenes.

[2 marks]

6 (d) A student used the apparatus in **Figure 8** to investigate what happens when liquid paraffin is heated to a high temperature.

Figure 8



Liquid paraffin contains alkanes.

Describe what happens to the alkane molecules in this investigation.

[3 marks]

13

4.1.1.2 Mixtures

Question 111

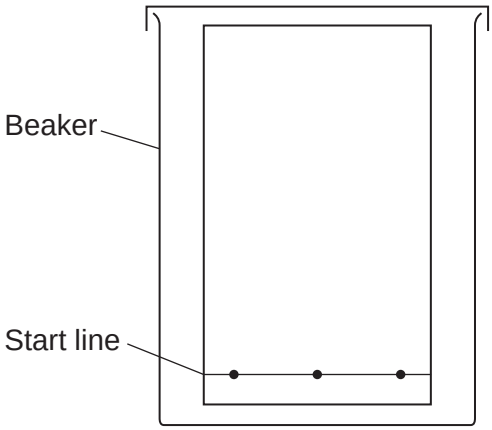
June 2017 | CH2FP | Original Q1 | Legacy

1 This question is about methods of analysis.

1 (a) A student used paper chromatography to identify colours in an ink.

Figure 1 shows the apparatus the student used.

Figure 1



1 (a) (i) Why should the student use a pencil and not a pen to draw the start line?

[1 mark]

_____

1 (a) (ii) The student put water in the beaker.

Use the correct answer from the box to complete the sentence.

[1 mark]

above	**below**	**on**

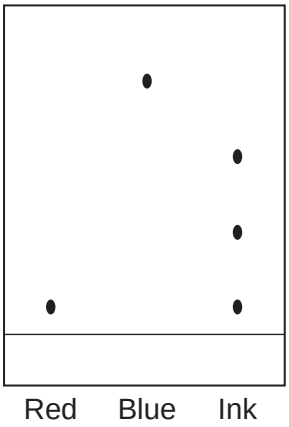
The water level should be _____ the start line drawn by the student.

4.1.1.2 Mixtures

Question 111 · continued

1 (a) (iii) **Figure 2** shows the student's results.

Figure 2



Give **two** conclusions about the colours in the ink.

[2 marks]

Question 1 continues on the next page

4.1.1.2 Mixtures

Question 111 · continued

1 (b) Gas chromatography is an instrumental method of analysis.

1 (b) (i) Use the correct answer from the box to complete the sentence.

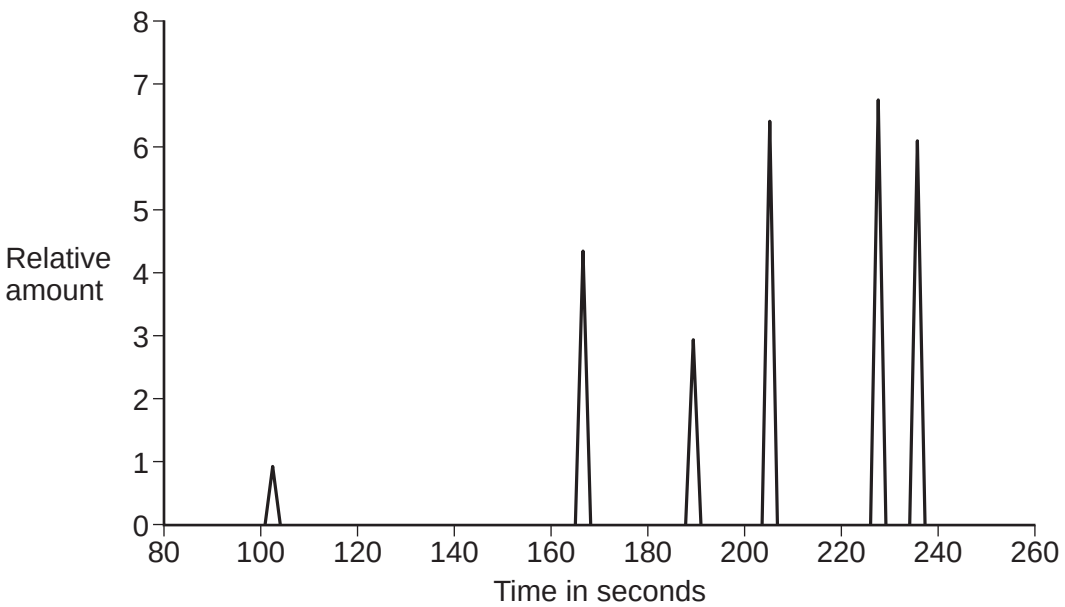
[1 mark]

neutralised	**reduced**	**separated**

The mixture of compounds in gas chromatography is _____ .

1 (b) (ii) **Figure 3** shows the results from a gas chromatograph.

Figure 3



How many compounds were in the sample?

[1 mark]

_____

1 (b) (iii) Give **one** advantage of using instrumental methods of analysis.

[1 mark]

_____

7

4.1.1.2 Mixtures

Question 112

June 2017 | CH3FP | Original Q2 | Legacy

2 This question is about drinking water.

2 (a) Water in reservoirs is filtered and sterilised to make it suitable for drinking.

2 (a) (i) Draw **one** line from each treatment to the reason for the treatment.

[2 marks]

Treatment	Reason
	To add dissolved salts
Filter	To kill microbes
Sterilise	To remove solids
	To soften the water

2 (a) (ii) Which substance is used to sterilise the water?

[1 mark]

Tick (✓) **one** box.

- Ammonia ☐
- Chlorine ☐
- Limewater ☐
- Sodium carbonate ☐

4.1.1.2 Mixtures

Question 112 · continued

2 (b) Pure water can be produced by distillation.

Why is distillation expensive?

[1 mark]

2 (c) Some water companies add fluoride to drinking water.

2 (c) (i) Give **one** benefit of adding fluoride to drinking water.

[1 mark]

2 (c) (ii) There is a lot of evidence to support the benefit of adding fluoride to drinking water.

Suggest why some people disagree with adding fluoride to drinking water.

[1 mark]

6

4.1.1.2 Mixtures

Question 113

June 2018 | 8462/1F | Original Q1

0 1 This question is about mixtures.

0 1 . 1 Substances are separated from a mixture using different methods.

Draw **one** line from each substance and mixture to the best method of separation.

[3 marks]

Substance and mixture	Method of separation
	Chromatography
Ethanol from ethanol and water	
	Crystallisation
Salt from sea water	Electrolysis
	Filtration
The different colours in black ink	
	Fractional distillation

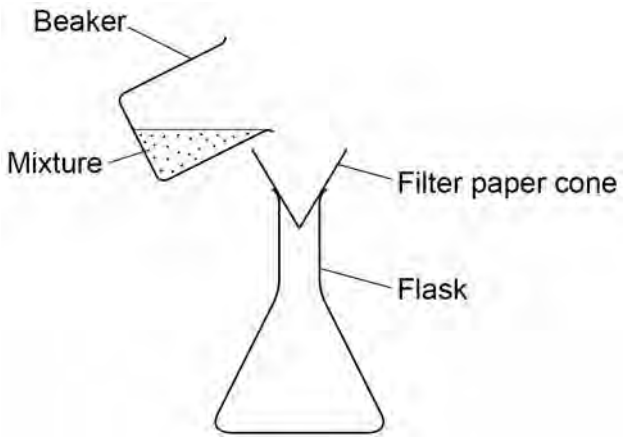
4.1.1.2 Mixtures

Question 113 · continued

0 1 . 2 A student filters a mixture.

Figure 1 shows the apparatus.

Figure 1



Suggest **one** improvement to the apparatus.

[1 mark]

_____

_____

0 1 . 3 Complete the sentences.

Choose answers from the box.

[2 marks]

condense	**evaporate**	**freeze**	**melt**	**solidify**

In simple distillation, the mixture is heated to make the liquid _____.

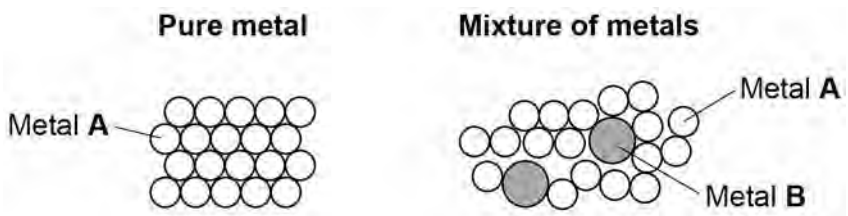
The vapour is then cooled to make it _____.

4.1.1.2 Mixtures

Question 113 · continued

Figure 2 shows the arrangement of atoms in a pure metal and in a mixture of metals.

Figure 2



0 1 . 4 Calculate the percentage of metal **B** atoms in the mixture of metals shown in **Figure 2**.

[2 marks]

Percentage of metal **B** atoms = _____ %

0 1 . 5 What is a mixture of metals called?

[1 mark]

Tick **one** box.

- An alloy ☐
- A compound ☐
- A molecule ☐
- A polymer ☐

4.1.1.2 Mixtures

Question 113 · continued

0 1 . 6 Why is the mixture of metals in **Figure 2** harder than the pure metal?

[1 mark]

Tick **one** box.

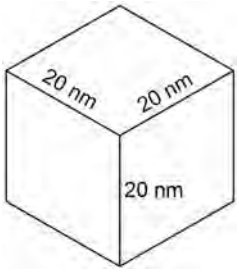
- The atoms in the mixture are different shapes. ☐
- The layers in the mixture are distorted. ☐
- The layers in the mixture slide more easily. ☐
- The mixture has a giant structure. ☐

0 1 . 7 A nanoparticle of pure metal **A** is a cube.

Each side of the cube has a length of 20 nm.

Figure 3 shows the cube.

Figure 3



What is the volume of the nanoparticle?

[1 mark]

Tick **one** box.

- 20 nm^3 ☐
- 60 nm^3 ☐
- 400 nm^3 ☐
- 8000 nm^3 ☐

11

4.1.1.2 Mixtures

Question 114

June 2018 | 8462/1F | Original Q6

0 6 A student investigated the temperature change in displacement reactions between metals and copper sulfate solution.

This is the method used.

1. Measure 50 cm^3 of the copper sulfate solution into a polystyrene cup.
2. Record the starting temperature of the copper sulfate solution.
3. Add the metal and stir the solution.
4. Record the highest temperature the mixture reaches.
5. Calculate the temperature increase for the reaction.
6. Repeat steps 1-5 with different metals.

0 6 . 1 Draw **one** line from each type of variable to the name of the variable in the investigation.

[2 marks]

Type of variable	Name of variable in the investigation
	Concentration of solution
Dependent variable	Particle size of solid
	Temperature change
Independent variable	Type of metal
	Volume of solution

4.1.1.2 Mixtures

Question 114 · continued

0 6 . 2 The student used a polystyrene cup and **not** a glass beaker.

Why did this make the investigation more accurate?

[1 mark]

Tick **one** box.

- Glass is breakable ☐
- Glass is transparent ☐
- Polystyrene is a better insulator ☐
- Polystyrene is less dense ☐

Question 6 continues on the next page

Question 114 · continued

Table 5 shows the student's results.

Table 5

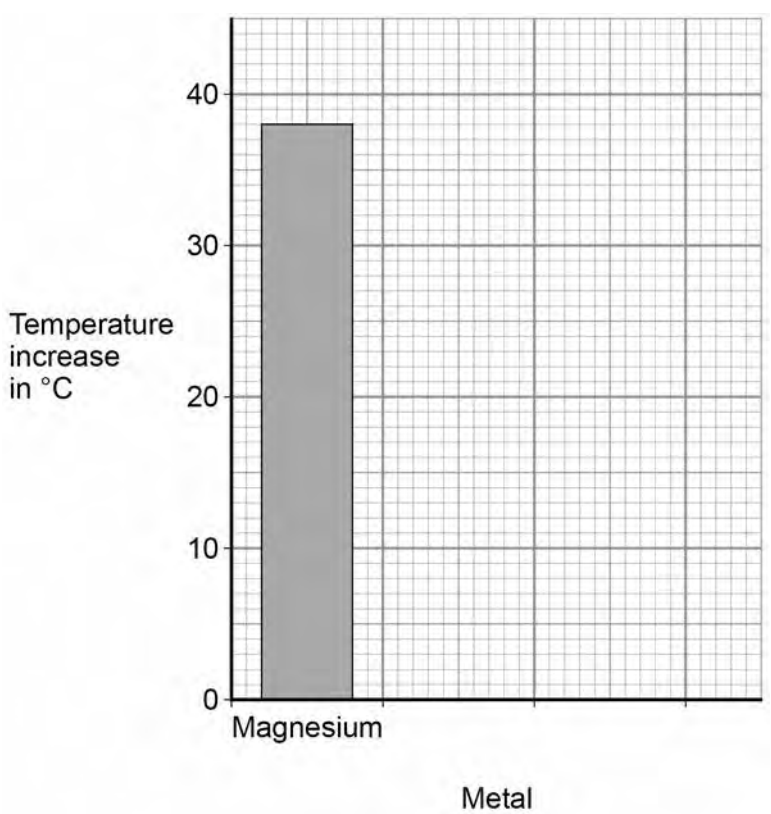
Metal	Temperature increase in °C
Magnesium	38
Nickel	8
Zinc	16

0 6 . 3 Complete **Figure 9**.

Use data from **Table 5**.

[2 marks]

Figure 9



4.1.1.2 Mixtures

Question 114 · continued

0 6 . 4 The student concluded that the reactions between the metals and copper sulfate solution are endothermic.

Give **one** reason why this conclusion is **not** correct.

[1 mark]

0 6 . 5 The temperature increase depends on the reactivity of the metal.

Write the metals magnesium, nickel and zinc in order of reactivity.

Use **Table 5**.

[1 mark]

Most reactive _____

_____

Least reactive _____

0 6 . 6 **Y** is an unknown metal.

Describe a method to find the position of **Y** in the reactivity series in Question **06.5**

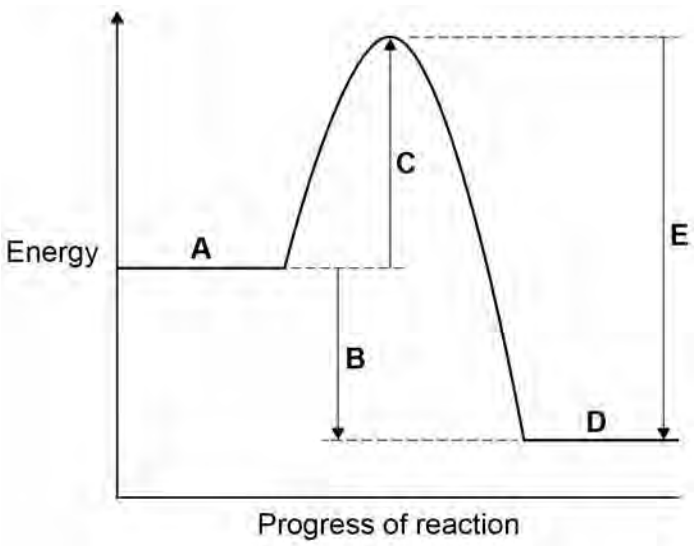
[3 marks]

4.1.1.2 Mixtures

Question 114 · continued

Figure 10 shows the reaction profile for the reaction between zinc and copper sulfate solution.

Figure 10



0 6 . 7 Which letter represents the products of the reaction?

[1 mark]

Tick **one** box.

A		B		C		D		E	

0 6 . 8 Which letter represents the activation energy?

[1 mark]

Tick **one** box.

A		B		C		D		E	

12

4.1.1.2 Mixtures

Question 115

June 2018 | 8462/2F | Original Q5

0 5 A student investigated the colours in three different flowers, **A**, **B** and **C**, using paper chromatography.

The colours are soluble in ethanol but are insoluble in water.

This is the method used.

1. Place ethanol in a beaker.
2. Add the flower.
3. Stir until the colours dissolve in the ethanol.
4. Filter the mixture.
5. Put spots of the coloured filtrate on the chromatography paper.

0 5 . 1 The filtrate was a very pale coloured solution.

How could the student obtain a darker coloured solution?

[2 marks]

Tick **two** boxes.

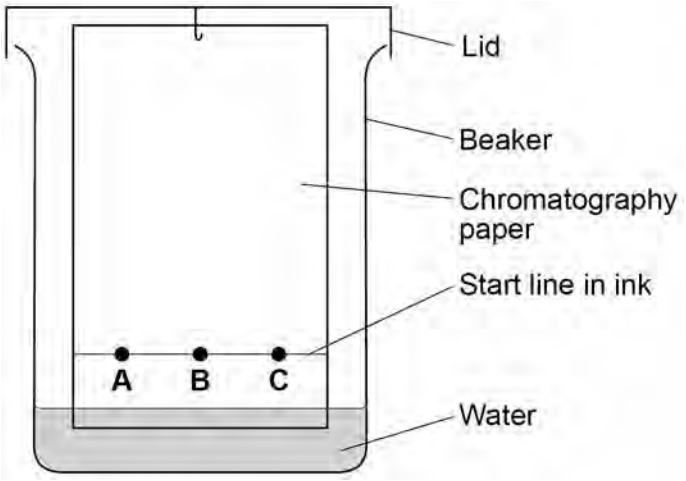
- Crush the flower ☐
- Filter the mixture three times ☐
- Use a larger beaker ☐
- Use more ethanol ☐
- Use more flowers ☐

4.1.1.2 Mixtures

Question 115 · continued

0 5 . 2 **Figure 2** shows the apparatus used.

Figure 2



What **two** mistakes did the student make in setting up the apparatus?

[2 marks]

Tick **two** boxes.

- The paper does not touch the beaker ☐
- The start line is drawn in ink ☐
- The water level is below the start line ☐
- Uses a lid on the beaker ☐
- Uses water as the solvent ☐

Question 5 continues on the next page

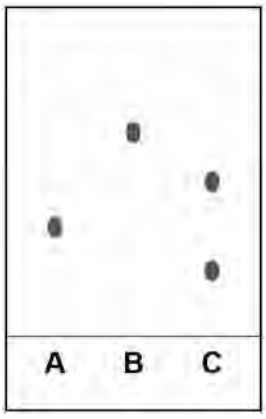
4.1.1.2 Mixtures

Question 115 · continued

0 5 . 3 Another student sets up the apparatus correctly.

Figure 3 represents the student's results.

Figure 3



What **two** conclusions can be made from **Figure 3**?

[2 marks]

Tick **two** boxes.

- Flower **A** contains a single pure colour ☐
- Flowers **A** and **B** contain the same colours ☐
- The colour in flower **C** is a mixture ☐
- The colour in flower **B** was the least soluble ☐
- Two of the colours have the same R_f value ☐

4.1.1.2 Mixtures

Question 115 · continued

0 5 . 4 The student records some measurements.

The measurements are:

- the colour from flower **B** moves 7.2 cm
- the solvent moves 9.0 cm

Calculate the R_f value for the colour from flower **B**.

Use the equation:

$$R_f = \frac{\text{distance moved by colour}}{\text{distance moved by solvent}}$$

[2 marks]

R_f value = _____

Turn over for the next question

4.1.1.2 Mixtures

Question 116

June 2018 | 8462/2F | Original Q8

0 8 This question is about chemicals in fireworks.

Coloured flames are produced because of the metal ions in the fireworks.

0 8 . 1 What colour flame would sodium ions produce?

[1 mark]

0 8 . 2 Name a metal ion that would produce a green flame.

[1 mark]

0 8 . 3 Some fireworks contain a mixture of metal ions.

Why is it difficult to identify the metal ions from the colour of the flame?

[1 mark]

4.1.1.2 Mixtures

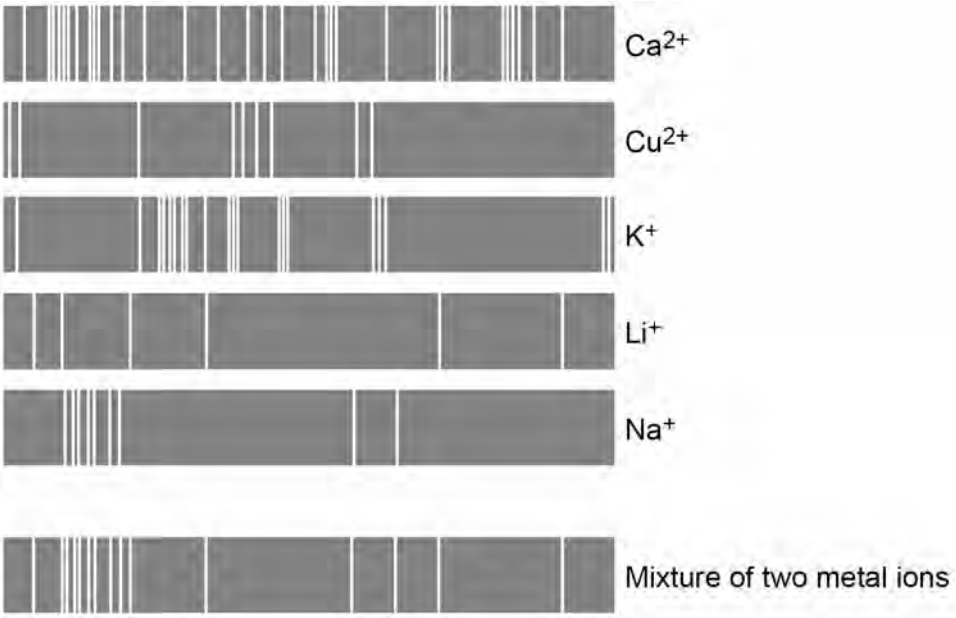
Question 116 · continued

0 8 . 4 Flame emission spectroscopy is used to identify metal ions in a firework.

Figure 8 shows:

- the flame emission spectra of five individual metal ions
- a flame emission spectrum for a mixture of two metal ions.

Figure 8



Which **two** metal ions are in the mixture?

[2 marks]

Tick **two** boxes.

Ca^{2+} ☐

Cu^{2+} ☐

K^+ ☐

Li^+ ☐

Na^+ ☐

Question 8 continues on the next page

4.1.1.2 Mixtures

Question 116 · continued

The compounds in fireworks also contain non-metal ions.

A scientist tests a solution of the chemicals used in a firework.

0 8 . 5 Silver nitrate solution and dilute nitric acid are added to the solution.

A cream precipitate forms.

Which ion is shown to be present by the cream precipitate?

[1 mark]

_____

0 8 . 6 Describe a test to show the presence of sulfate ions in the solution.

Give the result of the test if there are sulfate ions in the solution.

[3 marks]

Test _____

_____

_____

_____

Result _____

_____

4.1.1.2 Mixtures

Question 117

June 2018 | 8462/2F | Original Q9

0 9 Methylated spirit is a useful product made from a mixture of substances.

Table 6 shows the mass of the substances in a sample of methylated spirit.

Table 6

Substance	Mass in grams
Ethanol	265.5
Methanol	23.3
Pyridine	3.0
Methyl violet	1.5

0 9 . 1 What name is given to a useful product such as methylated spirit?

[1 mark]

_____

0 9 . 2 Calculate the percentage by mass of methanol in methylated spirit.

Use **Table 6**.

[2 marks]

_____

_____

_____

_____

Percentage = _____ %

Question 9 continues on the next page

4.1.1.2 Mixtures

Question 117 · continued

Methylated spirit contains ethanol and is available cheaply.

Methylated spirit also contains:

- pyridine which has a very unpleasant smell
- methyl violet which makes the mixture purple.

0 9 . 3 Suggest why pyridine and methyl violet are added to ethanol to make methylated spirit.

[1 mark]

0 9 . 4 Suggest **one** use of methylated spirit.

[1 mark]

0 9 . 5 Describe how ethanol is produced from sugar solution.

Give the name of this process.

[3 marks]

4.1.1.2 Mixtures

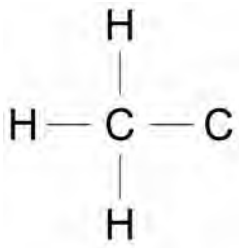
Question 117 · continued

0 9 . 6 **Figure 9** shows part of the displayed formula for ethanol.

Complete **Figure 9**.

[1 mark]

Figure 9



0 9 . 7 Name the gas produced when sodium is added to ethanol.

[1 mark]

0 9 . 8 Methanol is used to produce methanoic acid.

What type of substance reacts with methanol to produce methanoic acid?

[1 mark]

4.1.1.2 Mixtures

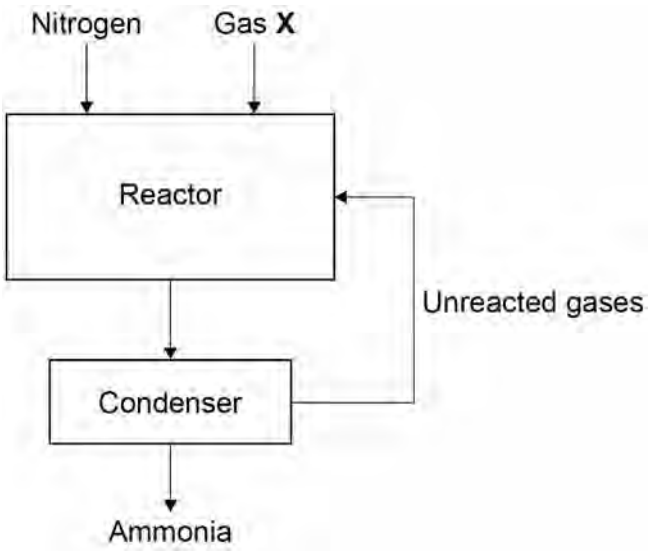
Question 118

June 2018 | 8462/2F | Original Q10

1 0 This question is about gases.

Figure 10 shows how nitrogen is used in the Haber Process to produce ammonia.

Figure 10



1 0 . 1 Gas **X** in **Figure 10** is obtained from methane.

Name gas **X**.

[1 mark]

_____

1 0 . 2 Give the approximate temperature and pressure used in the reactor.

[2 marks]

Temperature _____

Pressure _____

1 0 . 3 The mixture of gases from the reactor cools in the condenser.

Suggest why ammonia condenses but the other gases do not.

[1 mark]

_____

_____

4.1.1.2 Mixtures

Question 118 · continued

The Earth's early atmosphere was different to Earth's atmosphere today.

Scientists think that the Earth's early atmosphere was like the atmosphere found on Venus today.

Table 7 shows the amounts of carbon dioxide and oxygen in the atmospheres of Venus and Earth today.

Table 7

Gas	Percentage (%) in Venus' atmosphere today	Percentage (%) in Earth's atmosphere today
Carbon dioxide	96.50	0.04
Oxygen	0.00	20.95

1 0 . 4 The percentages of carbon dioxide and oxygen have changed from Earth's early atmosphere to Earth's atmosphere today.

Explain the processes that led to these changes.

[6 marks]

4.1.1.2 Mixtures

Question 118 · continued

June 2018 | 8462/2F | Original Q10

1 0 . 5 Why are scientists **not** certain about the percentage of each gas in the Earth's early atmosphere?

[1 mark]

4.1.1.2 Mixtures

Question 119

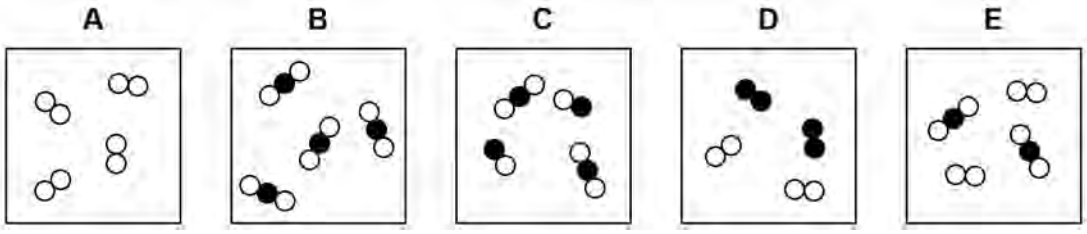
June 2019 | 8462/1F | Original Q3

0 3 This question is about elements, compounds and mixtures.

Figure 5 shows five different substances, **A**, **B**, **C**, **D** and **E**.

○ and ● represent atoms of different elements.

Figure 5



Use **Figure 5** to answer Questions **03.1** to **03.3**

0 3 . 1 Which substance is only one compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 3 . 2 Which substance is a mixture of elements?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 3 . 3 Which substance is a mixture of an element and a compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

4.1.1.2 Mixtures

Question 119 · continued

Substances are separated from a mixture using different methods.

0 3 . 4 Draw **one** line from each method of separation to the substance and mixture it would separate.

[2 marks]

Method of separation	Substance and mixture
	blue food colour from a mixture of food colours
chromatography	
	copper from an alloy of copper and zinc
	copper sulfate from copper sulfate solution
crystallisation	
	ethanol from a mixture of ethanol and water

4.1.1.2 Mixtures

Question 119 · continued

0 3 . 5 Sand does not dissolve in water. A student separates a mixture of sand and water by filtration.

Draw a diagram of the apparatus the student could use.

You should label:

- where the sand is collected
- where the water is collected.

[3 marks]

Diagram

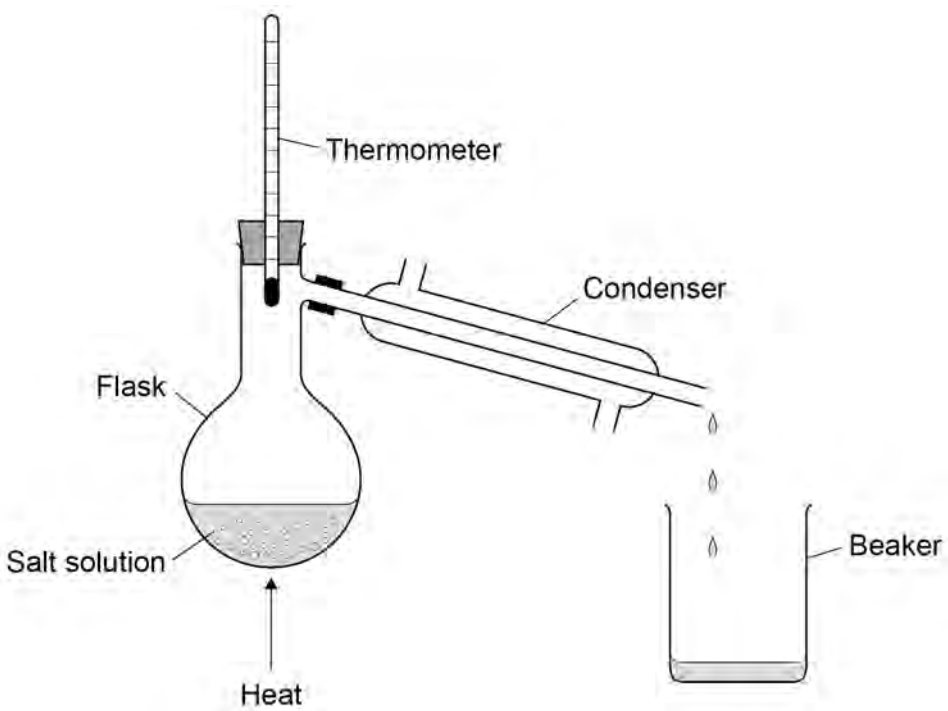
Question 3 continues on the next page

Question 119 · continued

0 3 . 6 A student distils a sample of salt solution to produce pure water.

Figure 6 shows the apparatus.

Figure 6



What temperature would you expect the thermometer to show?

[1 mark]

Tick (✓) **one** box.

0 °C ☐

10 °C ☐

50 °C ☐

100 °C ☐

4.1.1.2 Mixtures

Question 119 · continued

0 3 . 7 Describe how the process of distillation shown in **Figure 6** produces pure water from salt solution.

[4 marks]

13

Turn over for the next question

4.1.1.2 Mixtures

Question 120

June 2019 | 8462/2F | Original Q1

0 1 This question is about drinking water.

There are two main steps in producing drinking water from fresh water.

0 1 . 1 Draw **one** line from each step to the reason for the step.

[2 marks]

Step	Reason for step
	Desalination
Filtration	Improve taste
	Increase pH
Sterilisation	Kill bacteria
	Remove solids

0 1 . 2 Which **two** substances are used to sterilise fresh water?

[2 marks]

Tick (✓) **two** boxes.

- Ammonia ☐
- Chlorine ☐
- Hydrogen ☐
- Nitrogen ☐
- Ozone ☐

4.1.1.2 Mixtures

Question 120 · continued

A large amount of aluminium sulfate was accidentally added to the drinking water supply at a water treatment works.

0 1 . 3 Scientists tested a sample of the drinking water to show that it contained dissolved solids.

Which **two** methods show the presence of dissolved solids in the sample of drinking water?

[2 marks]

Tick (✓) **two** boxes.

- Add damp litmus paper to the sample. ☐
- Evaporate all water from the sample. ☐
- Measure the sample's boiling point. ☐
- Test the sample with a glowing splint. ☐

4.1.1.2 Mixtures

Question 120 · continued

0 1 . 4 Scientists tested two water samples from the drinking water supply.

The scientists tested one sample for aluminium ions and the other sample for sulfate ions.

Draw **one** line from each ion to the compound needed to identify the ion.

[2 marks]

Ion	**Compound needed to identify ion**
	Barium chloride
Aluminium ion	Copper sulfate
	Silver nitrate
Sulfate ion	Sodium hydroxide
	Sulfuric acid

0 1 . 5 How could pure water be produced from drinking water that contained dissolved solids?

[1 mark]

Tick (✓) **one** box.

- Chromatography ☐
- Cracking ☐
- Distillation ☐
- Sedimentation ☐

9

4.1.1.2 Mixtures

Question 121

June 2019 | 8462/2F | Original Q9

0 9 This question is about lithium carbonate.

Lithium carbonate is used in medicines.

Figure 7 shows a tablet containing lithium carbonate.

Figure 7



0 9 . 1 Lithium carbonate contains lithium ions and carbonate ions.

A student tested the tablet for lithium ions and for carbonate ions.

The student used:

- a metal wire
- dilute hydrochloric acid
- limewater.

Plan an investigation to show the presence of lithium ions **and** of carbonate ions in the tablet.

You should include the results of the tests for the ions.

[6 marks]

4.1.1.2 Mixtures

Question 121 · continued

0 9 . 2 The tablet also contains other substances.

The substances in tablets are present in fixed amounts.

What name is given to mixtures like tablets?

[1 mark]

0 9 . 3 The tablet has a mass of 1.20 g and contains 700 mg of lithium carbonate.

Calculate the percentage by mass of lithium carbonate in this tablet.

[3 marks]

Percentage by mass of lithium carbonate = _____ %

10

4.1.1.2 Mixtures

Question 122

November 2020 | 8462/1F | Original Q5

0 5 This question is about aluminium.

0 5 . 1 Aluminium is a metal.

Draw **one** line from each property of aluminium to the correct reason for that property.

[2 marks]

Property	Reason
	Aluminium has delocalised electrons
Conducts electricity	Aluminium has layers of atoms which can slide
	Aluminium has strong metallic bonds
High melting point	Aluminium has weak intermolecular forces
	Aluminium has a random arrangement of atoms

0 5 . 2 Aluminium can be used to make alloys.

What is meant by an 'alloy'?

[1 mark]

4.1.1.2 Mixtures

Question 122 · continued

Aluminium is extracted from bauxite.

Bauxite is a mixture which contains aluminium oxide.

0 5 . 3 Bauxite contains between 15% and 25% aluminium.

Aluminium oxide always contains 53% aluminium.

How does this show that bauxite is a mixture and **not** a compound?

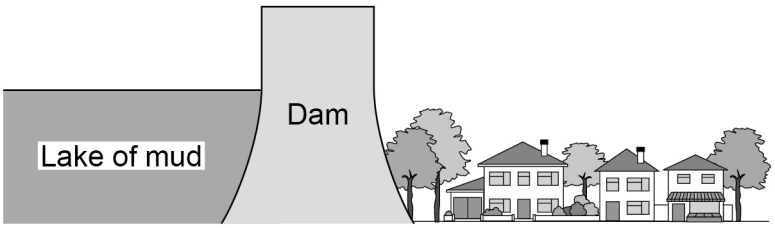
[1 mark]

0 5 . 4 The waste material from the bauxite is stored in lakes of mud.

The lakes of mud are held in place by dams.

Figure 6 shows one of these lakes.

Figure 6



Suggest **two** possible problems with storing the waste material in lakes of mud.

[2 marks]

1

2

4.1.1.2 Mixtures

Question 122 · continued

Aluminium is extracted by electrolysis.

The aluminium oxide is mixed with cryolite and melted.

The mixture is then electrolysed.

0 5 . 5 The formula of cryolite is Na_3AlF_6

Give the total number of atoms in the formula.

[1 mark]

Number of atoms = _____

0 5 . 6 What is the reason for adding cryolite to the aluminium oxide?

[1 mark]

Tick (✓) **one** box.

To increase the amount of aluminium extracted ☐

To lower the melting point of the mixture ☐

To reduce the amount of aluminium oxide needed ☐

4.1.1.2 Mixtures

Question 122 · continued

0 5 . 7 Complete the sentences.

Choose answers from the box.

[2 marks]

aluminium	**carbon**	**fluorine**
oxygen	**sodium**	

When the molten aluminium oxide and cryolite mixture is electrolysed the product at the positive electrode is _____.

This product reacts with the positive electrode because the positive electrode is made of _____.

0 5 . 8 A sample of bauxite contains 25% aluminium.

Calculate the maximum mass of aluminium that can be extracted from 300 000 kg of the sample of bauxite.

Give your answer in standard form.

[3 marks]

Maximum mass (in standard form) = _____ kg

13

4.1.1.2 Mixtures

Question 123

November 2020 | 8462/1F | Original Q7

0 7 This question is about acids, bases and salts.

Zinc nitrate is a salt.

A student produces zinc nitrate using an acid and a base.

0 7 . 1 Which acid should the student use to produce zinc nitrate?

[1 mark]

Tick (✓) **one** box.

- Hydrochloric acid ☐
- Nitric acid ☐
- Sulfuric acid ☐

0 7 . 2 Which is a base the student could use to produce zinc nitrate?

[1 mark]

Tick (✓) **one** box.

- Zinc chloride ☐
- Zinc oxide ☐
- Zinc sulfate ☐

0 7 . 3 Name the salt with the formula $MgBr_2$

[1 mark]

_____

4.1.1.2 Mixtures

Question 123 · continued

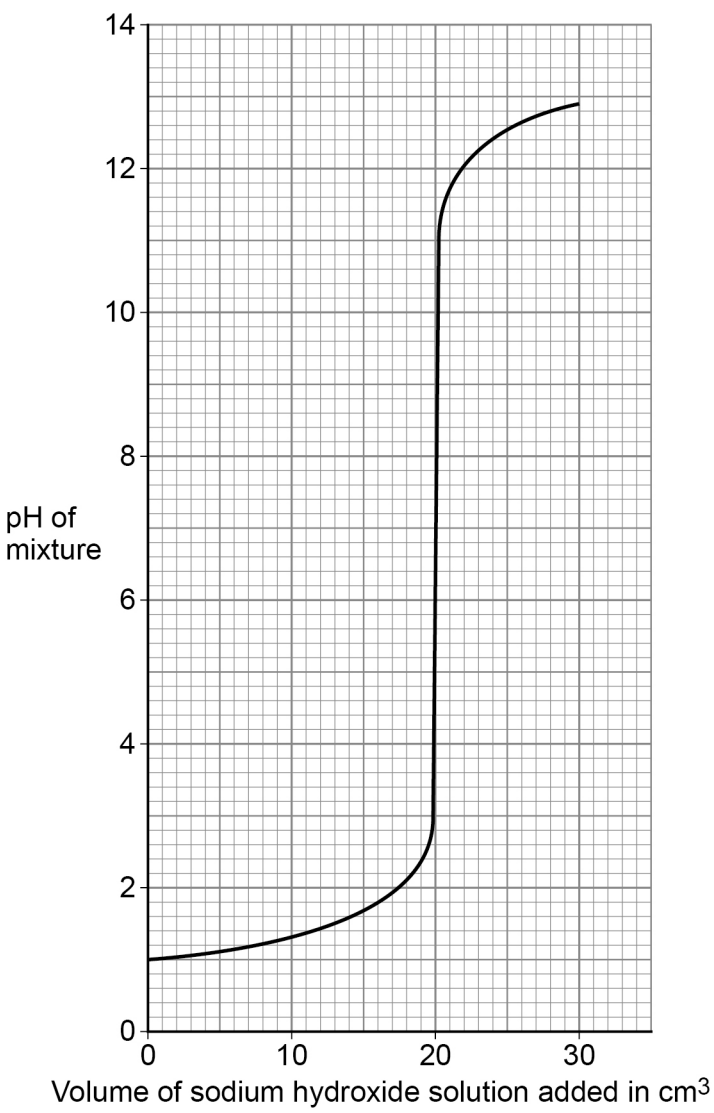
A student investigated how pH changes during a titration.

This is the method used.

1. Pour 25.0 cm^3 of hydrochloric acid into a beaker.
2. Measure the pH of the hydrochloric acid with a pH probe.
3. Add 1.0 cm^3 of sodium hydroxide solution from a burette.
4. Swirl the mixture.
5. Measure the pH of the mixture.
6. Repeat steps 3 to 5 until a total of 30.0 cm^3 of sodium hydroxide solution has been added.

Figure 10 shows the student's results.

Figure 10



4.1.1.2 Mixtures

Question 123 · continued

0 7 . 4 Describe how the pH of the mixture changes as sodium hydroxide solution is added to hydrochloric acid.

Use data from **Figure 10** in your answer.

[3 marks]

0 7 . 5 What volume of sodium hydroxide solution is needed to neutralise 25.0 cm^3 of hydrochloric acid?

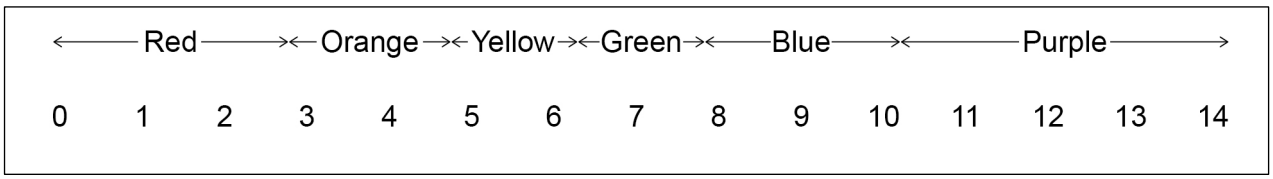
Use **Figure 10**.

[1 mark]

Volume = _____ cm^3

0 7 . 6 **Figure 11** shows the colour of universal indicator at different pH values.

Figure 11



The student could have used universal indicator instead of a pH probe.

Determine the colour of universal indicator when 10.0 cm^3 of sodium hydroxide solution has been added to 25.0 cm^3 of hydrochloric acid.

Use **Figure 10** and **Figure 11**.

[1 mark]

Colour = _____

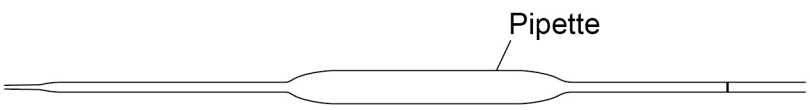
4.1.1.2 Mixtures

Question 123 · continued

0 7 . 7 The student used a pipette to measure 25.0 cm^3 of hydrochloric acid.

Figure 12 shows a pipette.

Figure 12



The pipette is labelled 25.0 ± 0.06 cm^3

Calculate the percentage uncertainty in the volume measured using this pipette.

Use the equation:

$$\text{percentage uncertainty} = \frac{\text{uncertainty}}{\text{volume measured}} \times 100$$

[2 marks]

Percentage uncertainty = _____ %

0 7 . 8 Give **one** advantage of using a pipette rather than using a measuring cylinder to measure the volume of hydrochloric acid.

[1 mark]

11

4.1.1.2 Mixtures

Question 124

November 2020 | 8462/1F | Original Q10

1 0 This question is about silver iodide.

Silver iodide is produced in the reaction between silver nitrate solution and sodium iodide solution.

The equation for the reaction is:

$$AgNO_3(aq) + NaI(aq) \rightarrow AgI(s) + NaNO_3(aq)$$

1 0 . 1 A student investigated the law of conservation of mass.

This is the method used.

1. Pour silver nitrate solution into a beaker labelled **A**.
2. Pour sodium iodide solution into a beaker labelled **B**.
3. Measure the masses of both beakers and their contents.
4. Pour the solution from beaker **B** into beaker **A**.
5. Measure the masses of both beakers and their contents again.

Table 7 shows the student's results.

Table 7

	Mass before mixing in g	**Mass after mixing in g**
Beaker **A** and contents	78.26	108.22
Beaker **B** and contents	78.50	48.54

Explain how the results demonstrate the law of conservation of mass.

You should use data from **Table 7** in your answer.

[2 marks]

4.1.1.2 Mixtures

Question 124 · continued

1 0 . 2 Suggest how the student could separate the insoluble silver iodide from the mixture at the end of the reaction.

[1 mark]

The student purified the separated silver iodide.

This is the method used.

1. Rinse the silver iodide with distilled water.

2. Warm the silver iodide.

1 0 . 3 Suggest **one** impurity that was removed by rinsing with water.

[1 mark]

1 0 . 4 Suggest why the student warmed the silver iodide.

[1 mark]

Question 10 continues on the next page

4.1.1.2 Mixtures

Question 124 · continued

10.5 Calculate the percentage atom economy for the production of silver iodide in this reaction.

The equation for the reaction is:

$$AgNO_3(aq) + NaI(aq) \rightarrow AgI(s) + NaNO_3(aq)$$

Give your answer to 3 significant figures.

Relative formula masses (M_r): $AgNO_3 = 170$ NaI = 150 AgI = 235 $NaNO_3 = 85$

[4 marks]

Percentage atom economy (3 significant figures) = _____ %

10.6 Give **one** reason why reactions with a high atom economy are used in industry.

[1 mark]

10

4.1.1.2 Mixtures

Question 125

November 2020 | 8462/2F | Original Q4

0 4 This question is about ink.

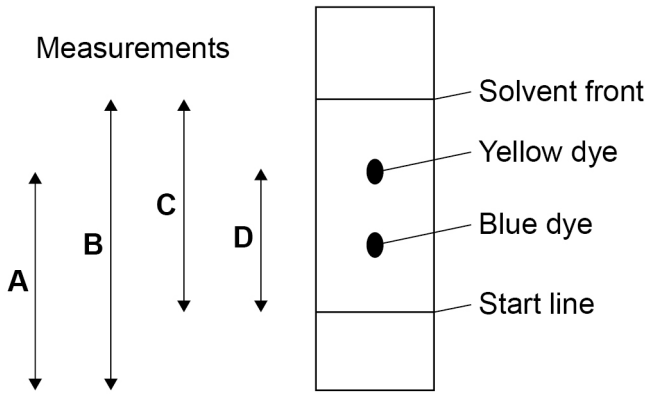
A student investigated green ink using paper chromatography in a beaker.

Figure 6 shows:

- the results the student obtained
- measurements **A**, **B**, **C** and **D** the student could make.

Figure 6

Diagram not to scale



0 4 . 1 The student calculated the R_f value of the blue dye.

The student measured:

- the distance moved by the blue dye = 2.7 cm
- the distance moved by the solvent = 9.0 cm

Calculate the R_f value of the blue dye.

Use the equation:

$$R_f = \frac{\text{distance moved by dye}}{\text{distance moved by solvent}}$$

[2 marks]

R_f = _____

4.1.1.2 Mixtures

Question 125 · continued

0 4 . 2 Which measurements on **Figure 6** are needed to calculate the R_f value of the yellow dye?

[1 mark]

Tick (✓) **one** box.

A and **B** ☐

A and **C** ☐

B and **D** ☐

C and **D** ☐

0 4 . 3 Paper chromatography has a stationary phase and a mobile phase.

Draw **one** line from each phase to the identity of that phase in the student's investigation.

[2 marks]

Phase	Identity
	Beaker
Mobile phase	Ink
	Paper
Stationary phase	Solvent
	Start line

4.1.1.2 Mixtures

Question 125 · continued

The green ink contains 85% yellow dye and 15% blue dye.

0 4 . 4 Determine the simplest whole number ratio of yellow dye : blue dye in the green ink.

[1 mark]

Yellow dye : Blue dye = _____ : _____

0 4 . 5 Which word correctly describes the green ink?

[1 mark]

Tick (✓) **one** box.

- Compound ☐
- Element ☐
- Formulation ☐
- Solvent ☐

0 4 . 6 The student repeated the investigation using green ink containing 75% yellow dye and 25% blue dye.

What would happen to the R_f value of the yellow dye?

[1 mark]

Tick (✓) **one** box.

- The R_f value would decrease. ☐
- The R_f value would increase. ☐
- The R_f value would stay the same. ☐

8

4.1.1.2 Mixtures

Question 126

November 2020 | 8462/2F | Original Q8

0 8 This question is about chemical analysis.

A student tested copper sulfate solution and calcium iodide solution using flame tests.

This is the method used.

1. Dip a metal wire in copper sulfate solution.

2. Put the metal wire in a blue Bunsen burner flame.

3. Record the flame colour produced.

4. Repeat steps 1 to 3 using the same metal wire but using calcium iodide solution.

0 8 . 1 What flame colour is produced by copper sulfate solution?

[1 mark]

0 8 . 2 Calcium compounds produce an orange-red flame colour.

The student left out an important step before reusing the metal wire.

The student's method did **not** produce a distinct orange-red flame colour using calcium iodide solution.

Explain why.

[2 marks]

4.1.1.2 Mixtures

Question 126 · continued

0 8 . 3 The student added sodium hydroxide solution to:

- copper sulfate solution
- calcium iodide solution.

Give the results of the tests.

[2 marks]

Copper sulfate solution _____

_____

Calcium iodide solution _____

_____

0 8 . 4 To test for sulfate ions the student added dilute hydrochloric acid to copper sulfate solution.

Name the solution that would show the presence of sulfate ions when added to this mixture.

[1 mark]

_____

0 8 . 5 To test for iodide ions the student added dilute nitric acid to calcium iodide solution.

Name the solution that would show the presence of iodide ions when added to this mixture.

Give the result of the test.

[2 marks]

Solution _____

Result _____

_____

8

4.1.1.2 Mixtures

Question 127

November 2021 | 8462/1F | Original Q1

0 1 This question is about elements, compounds and mixtures.

0 1 . 1 Substance **A** contains only one type of atom.

Substance **A** does **not** conduct electricity.

Which type of substance is **A**?

[1 mark]

Tick (✓) **one** box.

- Compound ☐
- Metallic element ☐
- Mixture ☐
- Non-metallic element ☐

0 1 . 2 Substance **B** contains two types of atoms.

The atoms are chemically combined together in fixed proportions.

Which type of substance is **B**?

[1 mark]

Tick (✓) **one** box.

- Compound ☐
- Metallic element ☐
- Mixture ☐
- Non-metallic element ☐

4.1.1.2 Mixtures

Question 127 · continued

0 1 . 3 What is the name of the elements in Group 0 of the periodic table?

[1 mark]

Tick (✓) **one** box.

- Alkali metals ☐
- Halogens ☐
- Noble gases ☐
- Transition metals ☐

0 1 . 4 Which statement about the elements in Group 0 is correct?

[1 mark]

Tick (✓) **one** box.

- All elements in the group are very reactive. ☐
- All elements in the group form negative ions. ☐
- The boiling points increase down the group. ☐
- The relative atomic masses (A_r) decrease down the group. ☐

4.1.1.2 Mixtures

Question 127 · continued

0 1 . 5 Neon is in Group 0.

What type of particles are in a sample of neon?

[1 mark]

Tick (✓) **one** box.

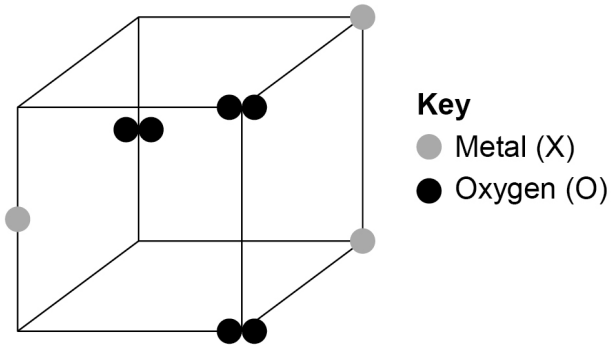
Atoms ☐

Ions ☐

Molecules ☐

0 1 . 6 **Figure 1** represents part of the structure of an oxide of a metal.

Figure 1



Determine the empirical formula of this oxide.

[1 mark]

Empirical formula = XO

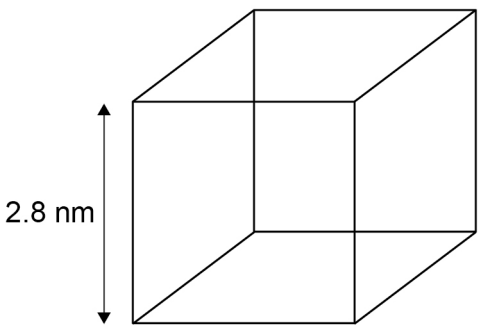
4.1.1.2 Mixtures

Question 127 · continued

A nanoparticle of a metallic element is a cube.

Figure 2 shows a diagram of the nanoparticle.

Figure 2



0 1 . 7 The surface area of a cube is given by the equation:

surface area = (length of side)^2 × 6

Calculate the surface area of the cube in **Figure 2**.

Give your answer to 2 significant figures.

[3 marks]

Surface area (2 significant figures) = _____ nm^2

4.1.1.2 Mixtures

Question 127 · continued

0 1 . 8 Fine and coarse particles of the metallic element are also cubes.

The length of a fine particle cube is 10 times smaller than the length of a coarse particle cube.

How does the surface area to volume ratio of the fine particle cube compare with that of the coarse particle cube?

[1 mark]

Tick (✓) **one** box.

Both surface area to volume ratios are the same. ☐

The surface area to volume ratio of the fine particle is 10 times greater. ☐

The surface area to volume ratio of the fine particle is 10 times smaller. ☐

10

Turn over for the next question

4.1.1.2 Mixtures

Question 128

November 2021 | 8462/1F | Original Q4

0 4 A student investigated the reactivity of metals with hydrochloric acid.

This is the method used.

1. Measure 50 cm^3 of hydrochloric acid into a polystyrene cup.
2. Measure the temperature of the hydrochloric acid.
3. Add one spatula of metal powder to the hydrochloric acid and stir.
4. Measure the highest temperature the mixture reaches.
5. Calculate the temperature increase for the reaction.
6. Repeat steps 1 to 5 three more times.
7. Repeat steps 1 to 6 with different metals.

Table 4 shows the student's results.

Table 4

Metal	Temperature increase in °C				Mean temperature increase in °C
	Trial 1	Trial 2	Trial 3	Trial 4	
Cobalt	6	7	5	9	7
Magnesium	54	50	37	55	**X**
Zinc	18	16	18	20	18

0 4 . 1 Calculate the mean temperature increase **X** for magnesium in **Table 4**.

Do **not** include the anomalous result in your calculation.

[2 marks]

X = _____ °C

Question 128 · continued

0 4 . 2 Determine the order of reactivity for the metals cobalt, magnesium and zinc.

Use **Table 4**.

[1 mark]

Most reactive _____

_____

Least reactive _____

0 4 . 3 The range of measurements either side of the mean shows the uncertainty in the mean temperature increase.

Complete the sentence.

Use **Table 4**.

[1 mark]

The mean temperature increase for zinc is 18 ± _____ °C

0 4 . 4 What type of variable is the volume of hydrochloric acid in this investigation?

[1 mark]

Tick (✓) **one** box.

Control ☐

Dependent ☐

Independent ☐

0 4 . 5 Suggest **one** way of improving **step 3** in the method to give results which are more repeatable.

[1 mark]

_____

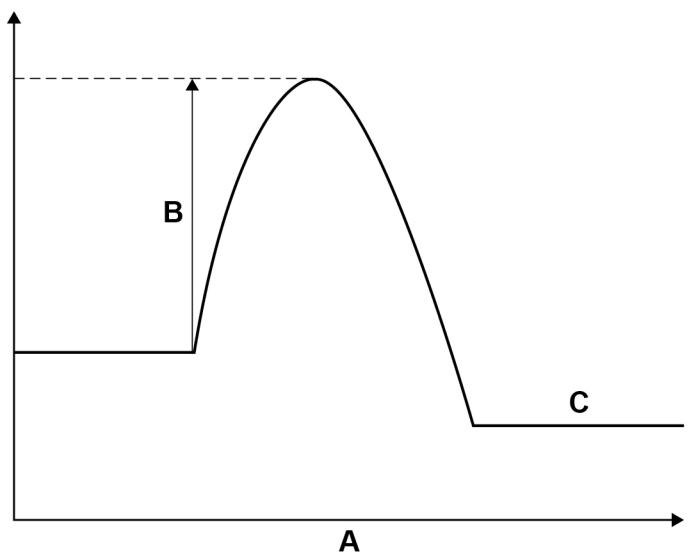
_____

_____

Question 128 · continued

0 4 . 6 **Figure 6** shows a reaction profile for the reaction of magnesium with hydrochloric acid.

Figure 6



What do labels **A**, **B** and **C** represent on **Figure 6**?

Choose answers from the box.

[3 marks]

activation energy	**energy**	**overall energy change**
products	**progress of reaction**	**reactants**

A _____

B _____

C _____

9

4.1.1.2 Mixtures

Question 129

November 2021 | 8462/2F | Original Q2

0 2 This question is about water.

A student investigated the concentration of salt in sea water.

This is the method used.

1. Filter the sea water to remove sand.
2. Measure the mass of an empty evaporating dish.
3. Measure 50 cm^3 of sea water into the evaporating dish.
4. Heat the evaporating dish and sea water.
5. Evaporate the sea water to dryness.
6. Measure the mass of the evaporating dish and salt.

0 2 . 1 What equipment should the student use to measure:

- the mass of the evaporating dish
- the volume of sea water?

[2 marks]

Mass of evaporating dish _____

Volume of sea water _____

Question 129 · continued

0 2 . 2 **Table 2** shows the student's results.

Table 2

	Mass in g
Evaporating dish	30.44
Evaporating dish and salt	30.49

The student used 50 cm^3 of sea water.

Calculate the mass of salt in 1000 cm^3 of this sea water.

[3 marks]

Mass of salt = _____ g

0 2 . 3 The salt must be completely dry.

Which **two** extra steps are needed to show that the salt is completely dry?

[2 marks]

Tick (✓) **two** boxes.

- Filter the sea water again. ☐
- Heat the evaporating dish and salt again. ☐
- Measure the 50 cm^3 of sea water again. ☐
- Measure the mass of the empty evaporating dish again. ☐
- Measure the mass of the evaporating dish and salt again. ☐

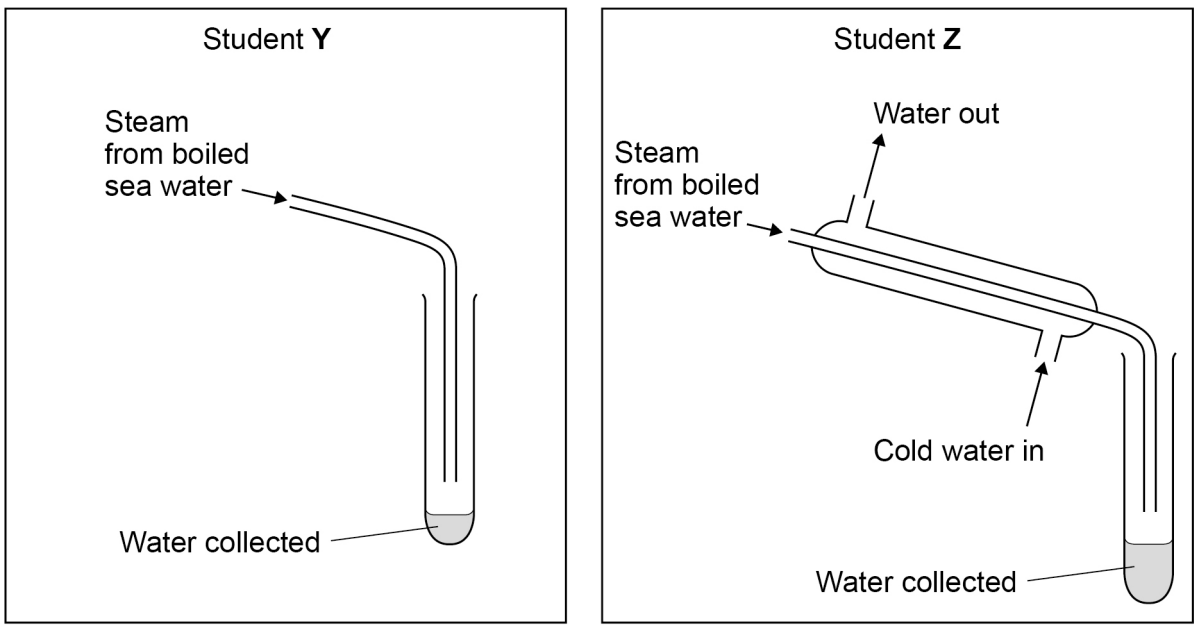
4.1.1.2 Mixtures

Question 129 · continued

Two students, **Y** and **Z**, distil sea water to collect water.

Figure 1 shows the apparatus used by each student to collect the water.

Figure 1



0 2 . 4 Students **Y** and **Z** boil the same volume of sea water for the same period of time.

Explain why student **Y** collects a smaller volume of water than student **Z**.

[2 marks]

0 2 . 5 Water obtained by distillation does **not** need to be sterilised and is safe to drink.

Suggest why.

[1 mark]

4.1.1.2 Mixtures

Question 129 · continued

November 2021 | 8462/2F | Original Q2

Fresh water needs to be sterilised before it is safe to drink.

0 2 . 6 How is fresh water sterilised?

[2 marks]

Tick (✓) **two** boxes.

- Using ammonia ☐
- Using chlorine ☐
- Using chromatography ☐
- Using filtration ☐
- Using ozone ☐

0 2 . 7 A student tests the pH of fresh water using universal indicator solution.

When added to the fresh water, the colour of the universal indicator solution is green.

What is the pH of this fresh water?

[1 mark]

pH = _____

13

4.1.1.2 Mixtures

Question 130

November 2021 | 8462/2F | Original Q4

0 4 This question is about reactions between gases.

When hydrogen gas is heated with iodine gas, hydrogen iodide gas is produced.

The equation for this reversible reaction is:

$$\text{hydrogen} + \text{iodine} \rightleftharpoons \text{hydrogen iodide}$$

This reversible reaction reaches equilibrium in a sealed container.

0 4 . 1 How does the equation show that the reaction is reversible?

[1 mark]

0 4 . 2 Which **two** statements are correct when the reaction reaches equilibrium?

[2 marks]

Tick (✓) **two** boxes.

- The forward reaction and reverse reaction are both exothermic. ☐
- The gases have escaped from the container. ☐
- The hydrogen no longer reacts with iodine. ☐
- The mass of each substance does not change. ☐
- The rates of the forward reaction and reverse reaction are equal. ☐

4.1.1.2 Mixtures

Question 130 · continued

0 4 . 3 The initial mixture of hydrogen and iodine in the sealed container is purple.

Hydrogen iodide is colourless.

How will the colour of the mixture in the sealed container have changed when equilibrium is reached?

[1 mark]

Tick (✓) **one** box.

The mixture will have become a deeper purple. ☐

The mixture will have become a paler purple. ☐

The mixture will have become colourless. ☐

0 4 . 4 The rate of reaction between gases is affected by changing the pressure.

Complete the sentences.

[3 marks]

When the pressure of the reacting gases is increased,

the rate of reaction _____.

This is because at higher pressures the distance

between the particles _____.

This means that the frequency of collisions _____.

0 4 . 5 Give **one** other way of changing the rate of reaction between gases.

You should **not** refer to pressure in your answer.

[1 mark]

_____

_____

8

4.1.1.2 Mixtures

Question 131

November 2021 | 8462/2F | Original Q9

0 9 This question is about alkanes.

Table 6 shows information about some alkanes.

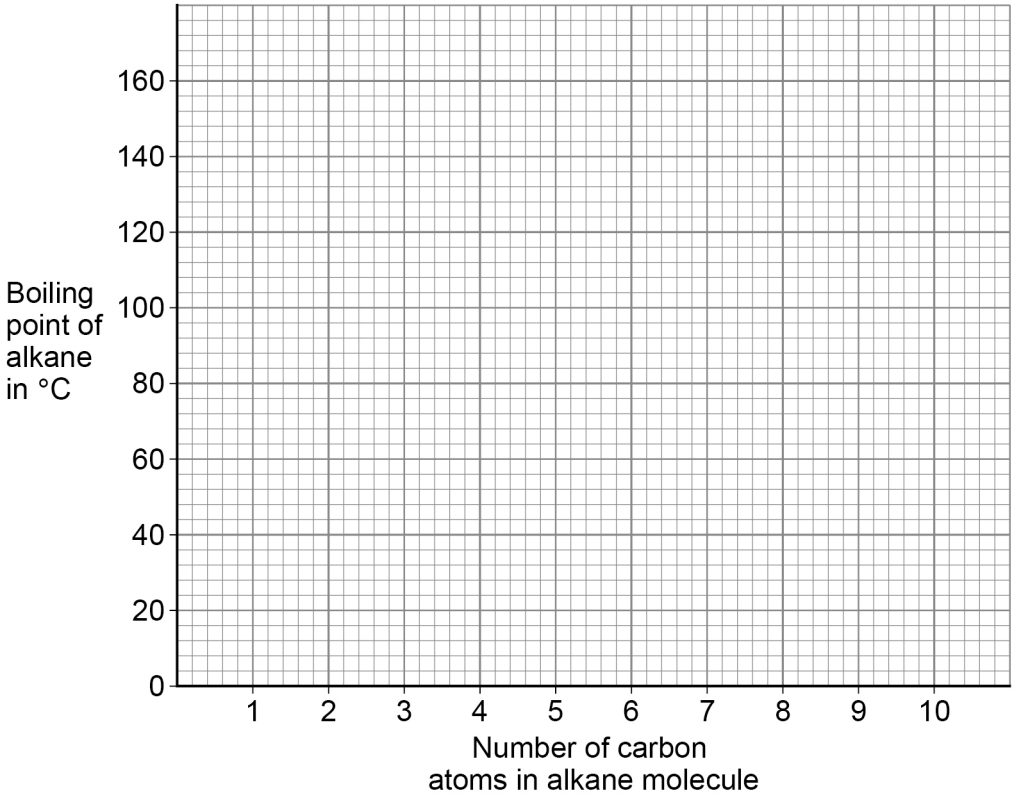
Table 6

Number of carbon atoms in alkane molecule	Boiling point of alkane in °C
4	0
5	36
6	69
7	**X**
8	126
9	151

0 9 . 1 Plot the data from **Table 6** on **Figure 7**.

[2 marks]

Figure 7



4.1.1.2 Mixtures

Question 131 · continued

November 2021 | 8462/2F | Original Q9

0 9 . 2 Predict the boiling point **X** of the alkane with seven carbon atoms in a molecule.

Use **Table 6** and **Figure 7**.

[1 mark]

X = _____ °C

0 9 . 3 **Figure 7** is **not** suitable to show the boiling point of the alkane with three carbon atoms in a molecule.

Suggest **one** reason why.

[1 mark]

_____

_____

0 9 . 4 What is the state at 20 °C of the alkane with four carbon atoms in a molecule?

Use **Table 6**.

[1 mark]

_____

Question 9 continues on the next page

Question 131 · continued

Table 6 is repeated below.

Table 6

Number of carbon atoms in alkane molecule	Boiling point of alkane in °C
4	0
5	36
6	69
7	**X**
8	126
9	151

The alkane with nine carbon atoms in a molecule is called nonane.

0 9 . 5 Complete the formula of nonane.

[1 mark]

C_9H____

0 9 . 6 Nonane will condense lower in a fractionating column during fractional distillation than the other alkanes in **Table 6**.

Explain why.

You should refer to the temperature gradient in the fractionating column.

[2 marks]

8

4.1.1.2 Mixtures

Question 132

November 2021 | 8462/2F | Original Q10

1 0 This question is about paper chromatography.

A food colouring contains a dye.

1 0 . 1 Plan an investigation to determine the R_f value for the dye in this food colouring.

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

Your plan should include the use of:

- a beaker
- a solvent
- chromatography paper.

[6 marks]

4.1.1.2 Mixtures

Question 132 · continued

1 0 . 2 Two students investigated a dye in a food colouring using paper chromatography.

Each student did the investigation differently.

The R_f values they determined for the **same** dye were different.

How did the students' investigations differ?

[1 mark]

Tick (✓) **one** box.

- Different length of paper used ☐
- Different period of time used ☐
- Different size of beaker used ☐
- Different solvent used ☐

1 0 . 3 Paper chromatography involves a stationary phase.

What is the stationary phase in paper chromatography?

[1 mark]

Tick (✓) **one** box.

- Beaker ☐
- Dye ☐
- Paper ☐
- Solvent ☐

8

4.1.1.2 Mixtures

Question 133

June 2022 | 8462/1F | Original Q2

0 2 This question is about elements, compounds and mixtures.

0 2 . 1 Which type of substance is hydrogen?

[1 mark]

Tick (✓) **one** box.

Element ☐

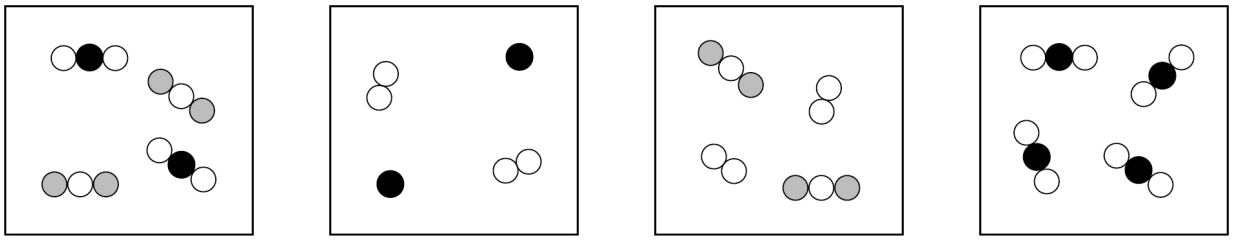
Compound ☐

Mixture ☐

The diagrams in **Figure 2** represent different substances.

○ ● and ○ represent atoms of three different elements.

Figure 2



A **B** **C** **D**

Use **Figure 2** to answer questions **02.2** and **02.3**.

0 2 . 2 Which diagram represents a mixture of compounds?

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

0 2 . 3 Which diagram represents a mixture of elements?

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

4.1.1.2 Mixtures

Question 133 · continued

Substances can be separated from mixtures by using different methods.

0 2 . 4 Complete the sentence.

[1 mark]

Sand can be separated from a mixture of sand and water by

_____.

A mixture of four liquids was fractionally distilled.

Figure 3 shows the apparatus used.

Figure 3

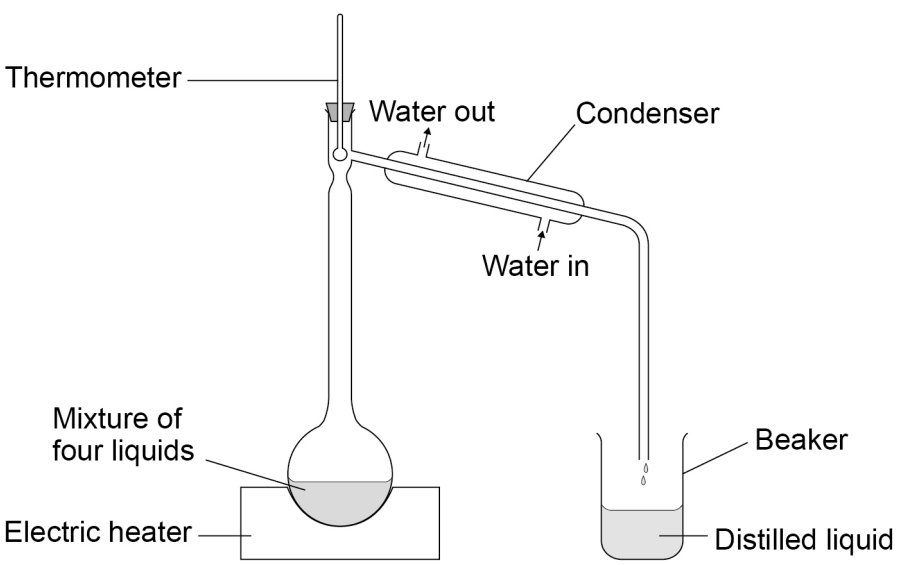


Table 2 shows the boiling points of the four liquids in the mixture.

Table 2

Liquid	Boiling point in °C
A	97
B	138
C	78
D	118

4.1.1.2 Mixtures

Question 133 · continued

0 2 . 5 Which liquid in **Table 2** would distil and be collected in the beaker first?

[1 mark]

Liquid _____

0 2 . 6 Suggest what would happen to the temperature of the water as the water flows through the condenser.

[1 mark]

_____

_____

0 2 . 7 Describe how to obtain sodium chloride crystals from sodium chloride solution by crystallisation.

[2 marks]

_____

_____

_____

_____

8

4.1.1.2 Mixtures

Question 134

June 2022 | 8462/1F | Original Q10

1 0 Sodium carbonate reacts with hydrochloric acid in an exothermic reaction.

The equation for the reaction is:

$$Na_2CO_3(s) + 2\,HCl(aq) \rightarrow 2\,NaCl(aq) + CO_2(g) + H_2O(l)$$

A student investigated the effect of changing the mass of sodium carbonate powder on the highest temperature reached by the reaction mixture.

1 0 . 1 Plan a method to investigate the effect of changing the mass of sodium carbonate powder on the highest temperature reached.

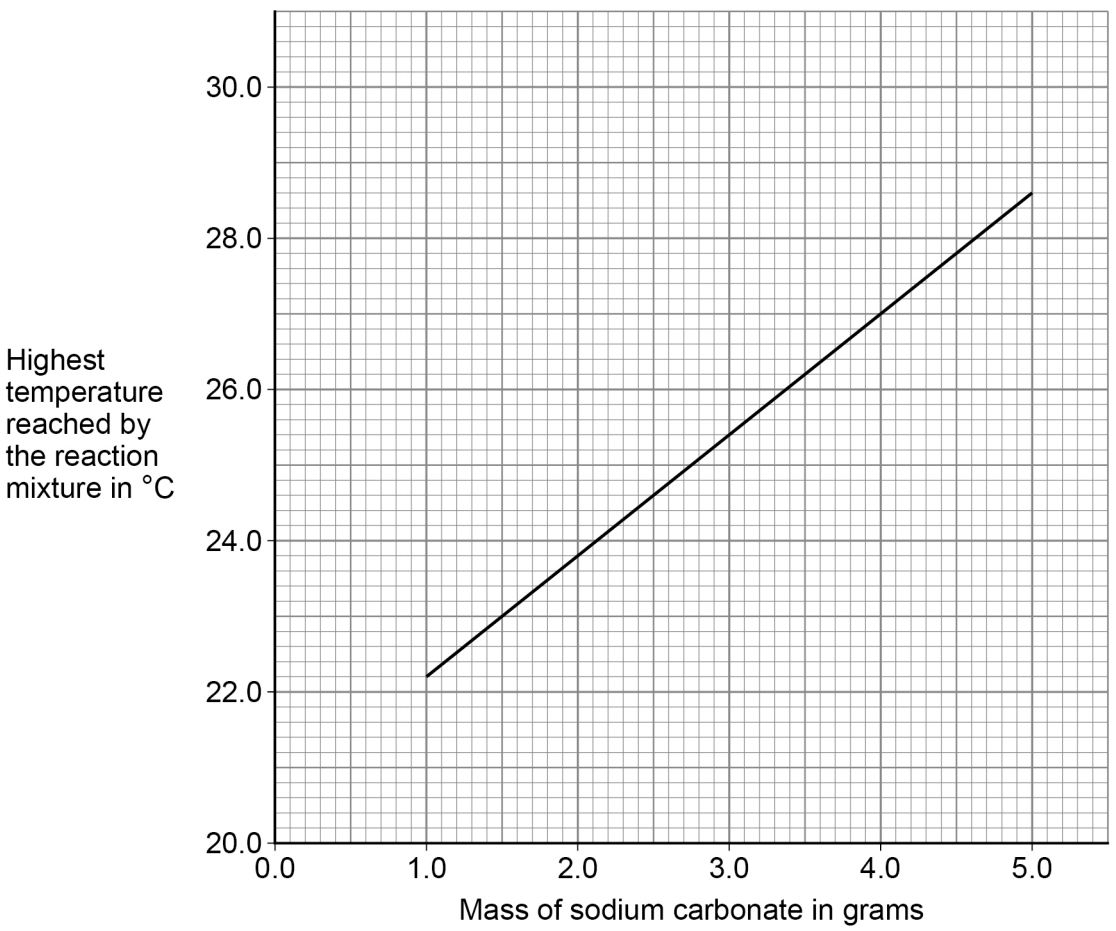
[6 marks]

4.1.1.2 Mixtures

Question 134 · continued

Figure 17 shows a line of best fit drawn through the student's results.

Figure 17



4.1.1.2 Mixtures

Question 134 · continued

June 2022 | 8462/1F | Original Q10

1 0 . 2 Determine the gradient of the line of best fit in **Figure 17**.

Use the equation:

$$\text{Gradient} = \frac{\text{Change in highest temperature}}{\text{Change in mass}}$$

Give the unit.

[5 marks]

Gradient = _____ Unit _____

1 0 . 3 The initial temperature of the reaction mixture is where the line of best fit would meet the *y*-axis.

Determine the initial temperature of the reaction mixture.

Show your working on **Figure 17**.

[2 marks]

Initial temperature of the reaction mixture = _____ °C

4.1.1.2 Mixtures

Question 134 · continued

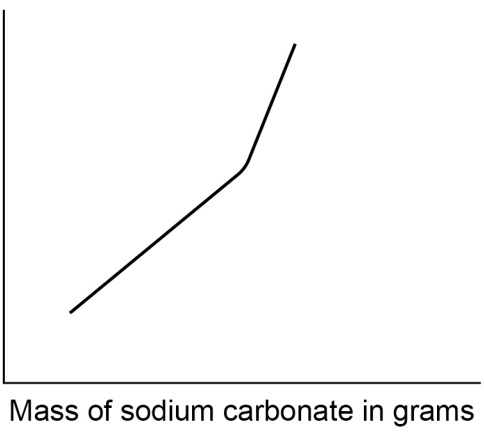
1 0 . 4 Another student repeated the investigation but added sodium carbonate until the sodium carbonate was in excess.

Which sketch graph shows the results obtained when sodium carbonate was added until in excess?

[1 mark]

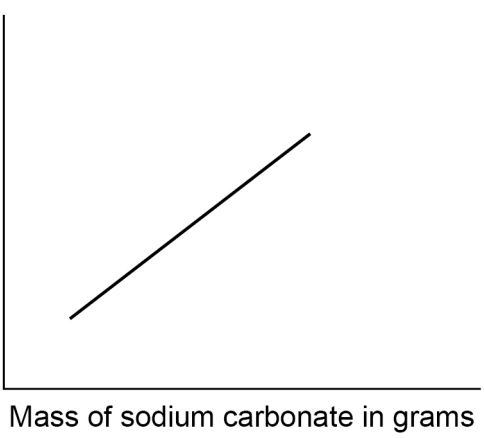
Tick (✓) **one** box.

A



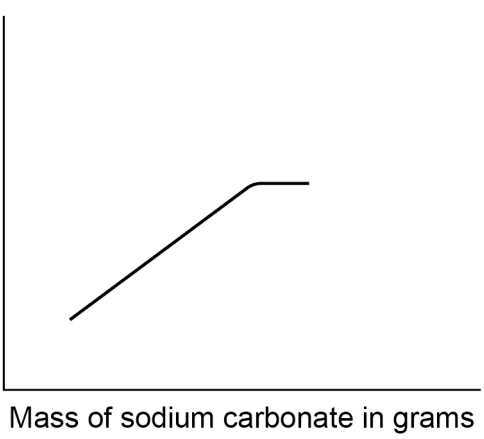
☐

B



☐

C



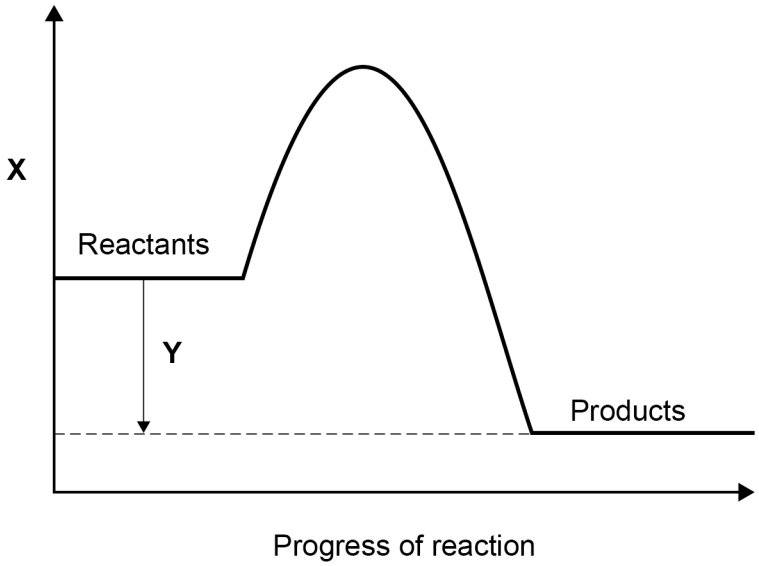
☐

4.1.1.2 Mixtures

Question 134 · continued

Figure 18 shows a reaction profile for the reaction of sodium carbonate with hydrochloric acid.

Figure 18



1 0 . 5 What do labels **X** and **Y** represent on **Figure 18**?

[2 marks]

X _____

Y _____

1 0 . 6 How does the reaction profile show that the reaction is exothermic?

Use **Figure 18**.

[1 mark]

_____

_____

17

4.1.1.2 Mixtures

Question 135

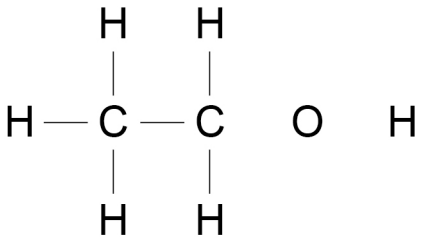
June 2022 | 8462/2F | Original Q4

0 4 This question is about ethanol.

0 4 . 1 The formula of ethanol is C_2H_5OH

Complete the displayed structural formula of ethanol.

[1 mark]



0 4 . 2 Which is **one** use of ethanol?

[1 mark]

Tick (✓) **one** box.

As a protective coating on aluminium ☐

In hand gel to kill microbes ☐

To test for the presence of hydrogen gas ☐

4.1.1.2 Mixtures

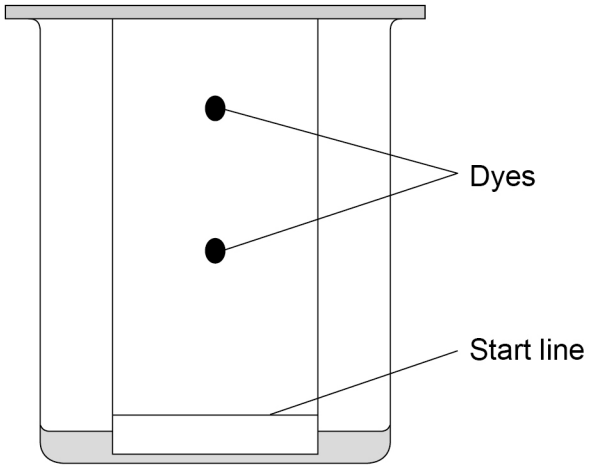
Question 135 · continued

0 4 . 3 Ethanol is used as a solvent in some inks.

A student used paper chromatography to show that an ink contained two different dyes.

Figure 4 shows the apparatus at the end of the investigation.

Figure 4



Describe a method the student could have used for the investigation.

[4 marks]

4.1.1.2 Mixtures

Question 135 · continued

0 4 . 4 Ethanol can be produced from sugar solution by fermentation.

What must be added to sugar solution to produce ethanol?

[1 mark]

E5 and E10 are types of fuel used in cars.

These fuels contain ethanol and petrol.

Table 6 shows information about E5 and E10.

Table 6

Fuel	Percentage (%) by mass of ethanol	Percentage (%) by mass of petrol
E5	5	95
E10	10	90

0 4 . 5 Calculate the mass of ethanol in 4.4 kg of E5.

Give your answer in grams.

Use **Table 6**.

[3 marks]

Mass = _____ g

4.1.1.2 Mixtures

Question 135 · continued

0 4 . 6 The ethanol in E5 and E10 is produced from sugar.

Sugar is produced from plants.

Explain why the production of E10 removes more carbon dioxide from the atmosphere than the production of E5.

Use **Table 6**.

[3 marks]

0 4 . 7 **Table 7** shows the energy content of ethanol and petrol.

Table 7

	Energy content in MJ (megajoules) per kg
Ethanol	30.0
Petrol	46.4

Suggest **one** disadvantage of using E10 instead of E5.

Complete the sentence.

[1 mark]

A disadvantage of using E10 is that _____

14

4.1.1.2 Mixtures

Question 136

June 2022 | 8462/2F | Original Q5

0 5 Ammonia is produced in the Haber process.

The raw materials for the Haber process are nitrogen and hydrogen.

0 5 . 1 Draw **one** line from each raw material to the source of that raw material.

[2 marks]

Raw material	Source of raw material
	Air
	Clay
Nitrogen	
	Limestone
Hydrogen	
	Natural gas
	Sand

0 5 . 2 What are the states of nitrogen and of hydrogen when used in the Haber process?

[1 mark]

Tick (✓) **one** box.

State of nitrogen	State of hydrogen	
Gas	Gas	☐
Gas	Liquid	☐
Liquid	Gas	☐
Liquid	Liquid	☐

4.1.1.2 Mixtures

Question 136 · continued

0 5 . 3 The word equation for the production of ammonia is:

nitrogen + hydrogen ⇌ ammonia

The atom economy of the reaction is 100%.

How does the word equation show that the atom economy is 100%?

[1 mark]

Tick (✓) **one** box.

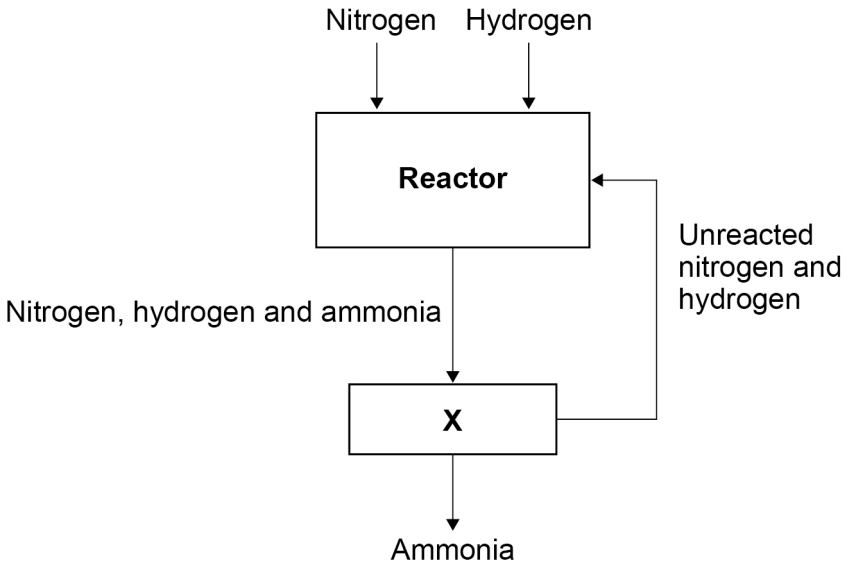
- The reaction is reversible. ☐
- There are two reactants. ☐
- There is one product. ☐

4.1.1.2 Mixtures

Question 136 · continued

0 5 . 4 **Figure 5** represents the Haber process.

Figure 5



A mixture of nitrogen, hydrogen and ammonia enters **X**.

Complete the sentences.

Choose answers from the box.

[2 marks]

evaporated	**filtered**	**liquefied**	**recycled**

In **X**, the mixture is cooled.

The ammonia can be removed from **X** because the ammonia is

_____.

The unreacted nitrogen and hydrogen are

_____.

4.1.1.2 Mixtures

Question 136 · continued

Table 8 shows the percentage yield of ammonia at different pressures.

Table 8

Pressure in atmospheres	Percentage (%) yield of ammonia
50	20
100	33
150	44
200	52
250	59
300	64

4.1.1.2 Mixtures

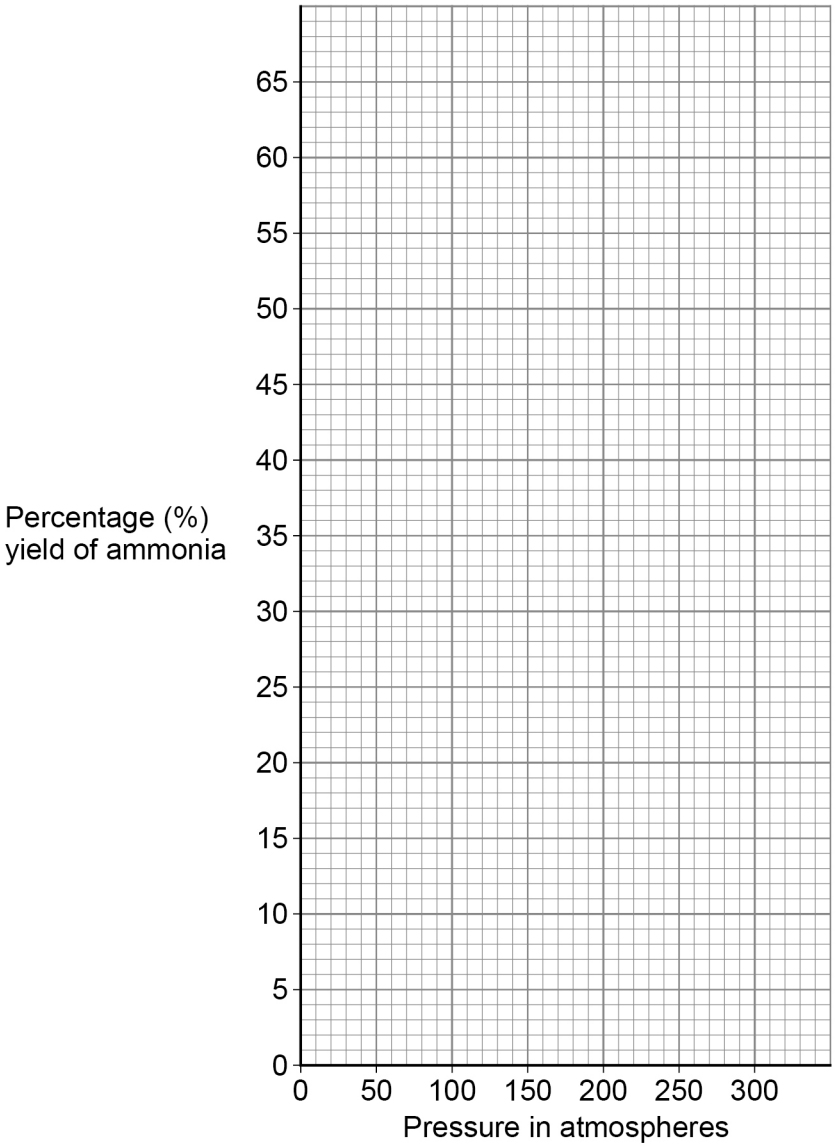
Question 136 · continued

0 5 . 5 Plot the data from **Table 8** on **Figure 6**.

Draw a line of best fit.

[3 marks]

Figure 6



0 5 . 6 What is the effect of increasing the pressure on the percentage yield of ammonia?

Use **Table 8**.

[1 mark]

10

4.1.1.2 Mixtures

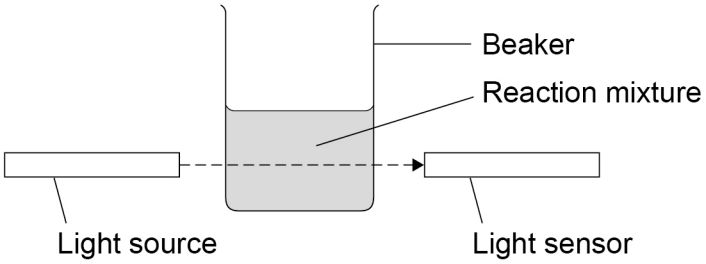
Question 137

June 2022 | 8462/2F | Original Q6

0 6 A student investigated the rate of reaction between sodium thiosulfate solution and hydrochloric acid.

Figure 7 shows the apparatus used.

Figure 7



When hydrochloric acid is added to sodium thiosulfate solution, the mixture gradually becomes cloudy.

A smaller percentage of light from the light source reaches the light sensor as the mixture becomes more cloudy.

This is the method used.

1. Measure 50 cm^3 of sodium thiosulfate solution into the beaker.
2. Add 10 cm^3 of hydrochloric acid to the sodium thiosulfate solution.
3. Immediately start a timer.
4. Record the percentage of light from the light source that reaches the light sensor every 20 seconds for 120 seconds.

0 6 . 1 Balance the equation for this reaction.

[1 mark]

$$Na_2S_2O_3 + 2\,HCl \rightarrow ____\ NaCl + H_2O + SO_2 + S$$

4.1.1.2 Mixtures

Question 137 · continued

0 6 . 2 The mixture becomes cloudy because the sulfur produced is a solid.

What is the state symbol for a solid?

[1 mark]

Tick (✓) **one** box.

(aq) ☐

(g) ☐

(l) ☐

(s) ☐

0 6 . 3 The student monitored the cloudiness of the reaction mixture using a light sensor.

What other piece of equipment could be used to monitor the cloudiness of the reaction mixture?

[1 mark]

Tick (✓) **one** box.

A balance ☐

A cross on a piece of paper ☐

A gas syringe ☐

A thermometer ☐

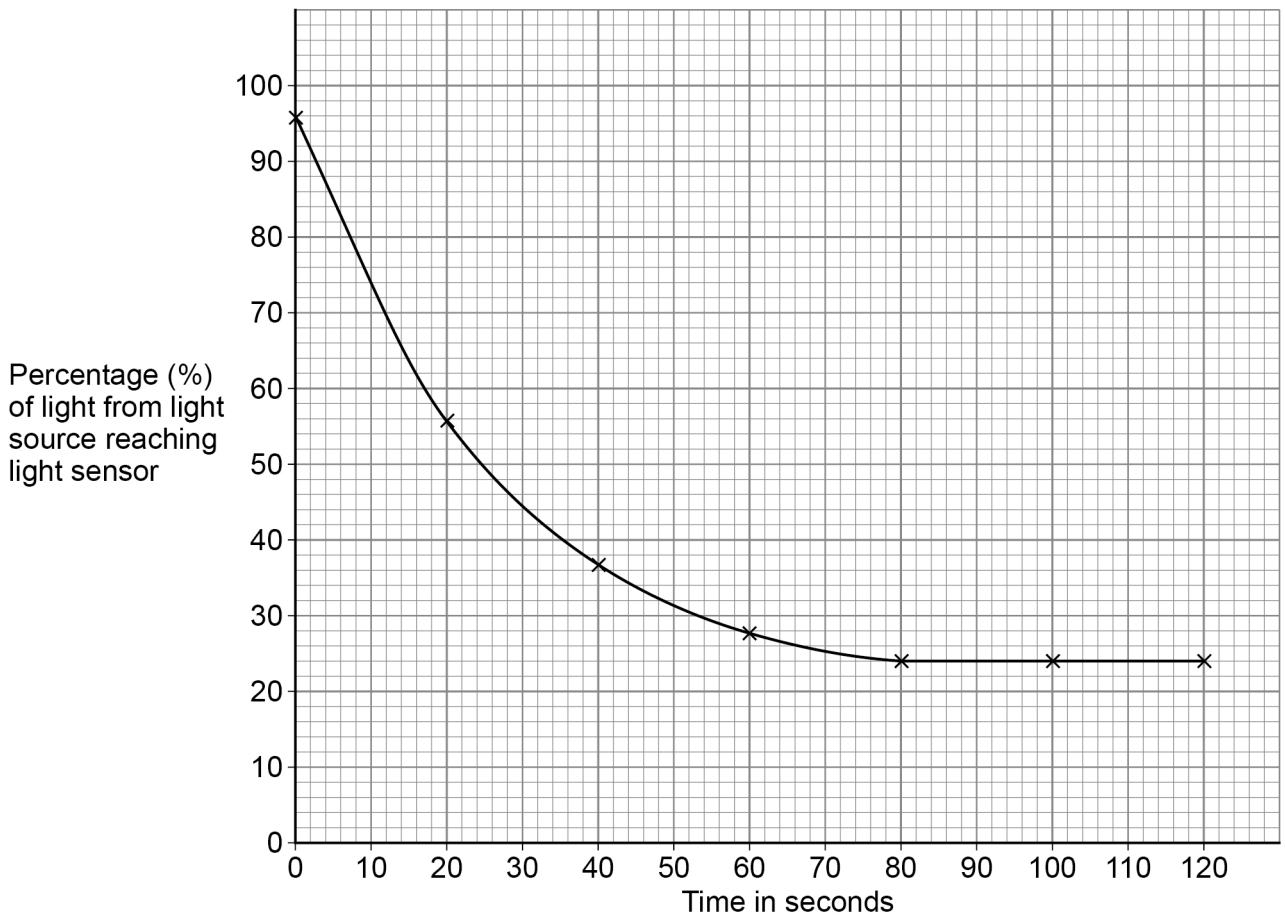
Question 6 continues on the next page

4.1.1.2 Mixtures

Question 137 · continued

Figure 8 shows the results.

Figure 8



0 6 . 4 What happened to the rate of reaction between 40 and 60 seconds?

Use **Figure 8**.

[1 mark]

Tick (✓) **one** box.

The rate of reaction decreased. ☐

The rate of reaction stayed at zero. ☐

The rate of reaction increased. ☐

4.1.1.2 Mixtures

Question 137 · continued

0 6 . 5 The student stopped taking measurements after 120 seconds because the percentage of light reaching the sensor stayed constant.

Why did the percentage of light reaching the sensor stay constant?

[1 mark]

Tick (✓) **one** box.

- No light was reaching the sensor. ☐
- One of the reactants was used up. ☐
- The reaction was too vigorous. ☐

0 6 . 6 The student repeated the experiment using sodium thiosulfate solution of a higher concentration.

How would the line of best fit for sodium thiosulfate solution of a higher concentration compare with the line of best fit on **Figure 8**?

[1 mark]

Tick (✓) **one** box.

- Initially the line of best fit would be less steep. ☐
- Initially the line of best fit would be the same steepness. ☐
- Initially the line of best fit would be steeper. ☐

Question 6 continues on the next page

4.1.1.2 Mixtures

Question 137 · continued

0 6 . 7 The student then investigated the effect of changing the temperature on the rate of reaction.

The student used sodium thiosulfate solution and hydrochloric acid which had been kept in an ice bath.

Which are **two** effects of using reactants kept in an ice bath rather than at room temperature?

[2 marks]

Tick (✓) **two** boxes.

- Fewer reactant particles have the activation energy. ☐
- The reactant particles collide more frequently. ☐
- The reactant particles have more energy. ☐
- The reactant particles move more slowly. ☐
- There are fewer reactant particles in the same volume. ☐

8

4.1.1.2 Mixtures

Question 138

June 2022 | 8462/2F | Original Q7

0 7 This question is about fertilisers.

Ammonium nitrate is a fertiliser containing nitrogen.

0 7 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

hydrochloric acid	**nitric acid**	**sulfuric acid**

Ammonium nitrate is produced by reacting ammonia with

_____.

0 7 . 2 Ammonium nitrate fertiliser is sold in 600 kg bags.

A farmer spreads 40 bags of ammonium nitrate fertiliser on land with an area of 800 000 m^2.

Calculate the mass of ammonium nitrate fertiliser spread per m^2 of land.

[2 marks]

_____

_____

_____

Mass per m^2 = _____ kg/m^2

Question 7 continues on the next page

4.1.1.2 Mixtures

Question 138 · continued

0 7 . 3 A scientist works for a company which makes ammonium nitrate fertiliser.

The scientist investigates the effect of different fertilisers on crop growth.

The scientist concludes that the ammonium nitrate fertiliser improves crop growth more than other fertilisers.

Suggest **one** reason why this conclusion might **not** be valid.

[1 mark]

4.1.1.2 Mixtures

Question 138 · continued

A different fertiliser containing nitrogen has the formula $K_2NH_4PO_4$

0 7 . 4 How many atoms of nitrogen are in the formula $K_2NH_4PO_4$?

[1 mark]

0 7 . 5 Nitrogen and potassium in the fertiliser $K_2NH_4PO_4$ are important for good crop growth.

Which other element in the fertiliser $K_2NH_4PO_4$ is important for good crop growth?

[1 mark]

Tick (✓) **one** box.

Hydrogen ☐

Oxygen ☐

Phosphorus ☐

0 7 . 6 Some fertilisers are mixtures of different compounds in fixed proportions.

What name is given to a mixture of different compounds in fixed proportions?

[1 mark]

7

4.1.1.2 Mixtures

Question 139

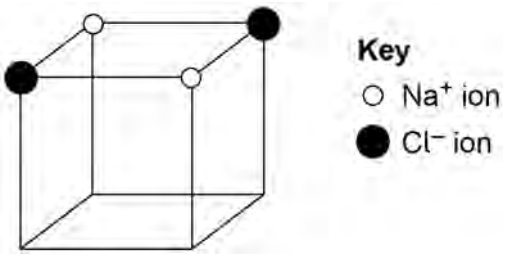
June 2023 | 8462/1F | Original Q7

0 7 This question is about ionic compounds and electrolysis.

Sodium chloride is an ionic compound.

0 7 . 1 **Figure 8** represents part of the structure of solid sodium chloride.

Figure 8



Complete **Figure 8**.

[2 marks]

0 7 . 2 Give **one** reason why molten sodium chloride conducts electricity.

Refer to ions in your answer.

[1 mark]

0 7 . 3 **Table 3** shows products of the electrolysis of two molten ionic compounds.

Complete **Table 3**.

[2 marks]

Table 3

Molten compound	Product at the negative electrode	Product at the positive electrode
Magnesium bromide	Magnesium	
Potassium chloride		Chlorine

4.1.1.2 Mixtures

Question 139 · continued

0 7 . 4 Aluminium is extracted by electrolysis.

The electrolyte is a molten mixture of aluminium oxide and cryolite.

Why is a mixture used instead of pure aluminium oxide as the electrolyte?

[1 mark]

Tick (✓) **one** box.

- The mixture has a lower melting point than pure aluminium oxide. ☐
- The mixture has the same melting point as pure aluminium oxide. ☐
- The mixture has a higher melting point than pure aluminium oxide. ☐

0 7 . 5 Electrolysis of an aqueous solution of sodium sulfate produces hydrogen and oxygen.

What is the source of the hydrogen and the oxygen produced during the electrolysis of aqueous sodium sulfate solution?

[1 mark]

Tick (✓) **one** box.

- Air ☐
- Sulfate ions ☐
- Water ☐

Question 7 continues on the next page

Question 139 · continued

Electrolysis of an aqueous solution of sodium sulfate produces hydrogen and oxygen.

0 7 . 6 Why is hydrogen produced instead of sodium in the electrolysis of aqueous sodium sulfate solution?

[1 mark]

Tick (✓) **one** box.

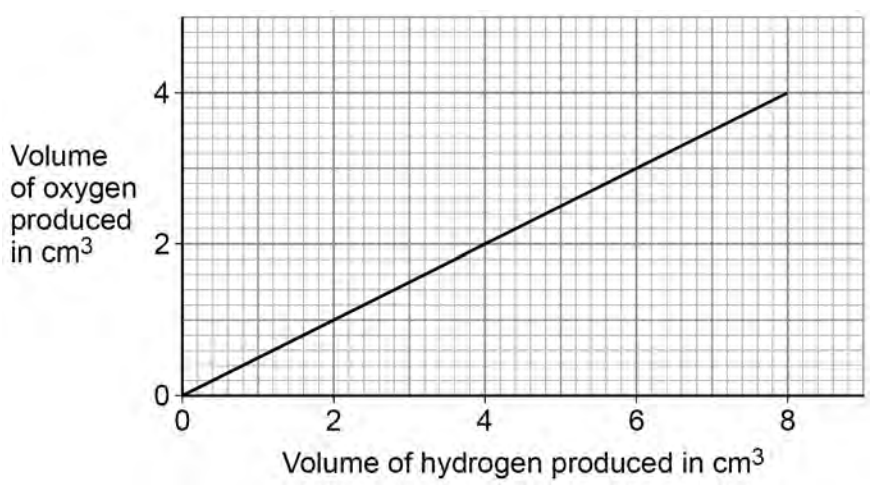
Hydrogen is less reactive than sodium. ☐

Hydrogen has the same reactivity as sodium. ☐

Hydrogen is more reactive than sodium. ☐

0 7 . 7 **Figure 9** shows the relationship between the volume of hydrogen and the volume of oxygen produced during the electrolysis.

Figure 9



Give **one** conclusion that can be made about the volume of hydrogen produced compared to the volume of oxygen produced.

[1 mark]

9

4.1.1.2 Mixtures

Question 140

June 2023 | 8462/2F | Original Q2

0 2 This question is about glass and polymers.

Beakers can be made from borosilicate glass or poly(propene).

Table 1 shows information about materials used to make beakers.

Table 1

	Material used to make beakers	
	borosilicate glass	**poly(propene)**
Temperature at which melting begins in °C	850	160
Flammability	does not burn	burns
Resistance to impact	shatters	tough
Cost of 100 cm^3 beaker in £	1.50	2.00

0 2 . 1 Suggest **two** reasons why a Bunsen burner should **not** be used to heat a liquid in a poly(propene) beaker.

Use **Table 1**.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 2 Poly(propene) beakers are more expensive than borosilicate glass beakers.

Suggest **one** reason why using poly(propene) beakers instead of borosilicate glass beakers could save money.

Use **Table 1**.

[1 mark]

_____

_____

4.1.1.2 Mixtures

Question 140 · continued

0 2 . 3 Which is a raw material used to make borosilicate glass?

[1 mark]

Tick (✓) **one** box.

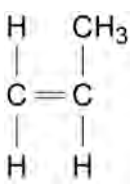
Boron trioxide ☐

Clay ☐

Limestone ☐

Poly(propene) is produced from propene.

The displayed structural formula of propene is:



0 2 . 4 **Table 2** shows some information about the elements in one molecule of propene.

Table 2

Symbol for element	Name of element	Number of atoms of element in one molecule of propene
C		
H		

Complete **Table 2**.

[2 marks]

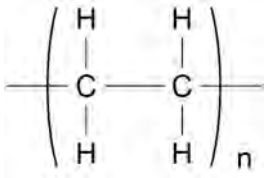
4.1.1.2 Mixtures

Question 140 · continued

0 2 . 5 Which structure is the repeating unit of poly(propene)?

[1 mark]

Tick (✓) **one** box.



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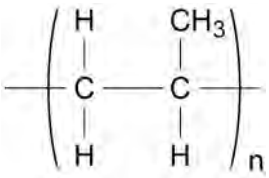

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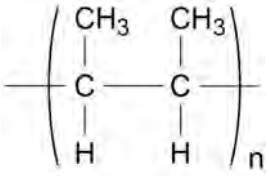


☐

0 2 . 6 Poly(propene) is produced in three stages:

- **Stage 1:** separating large alkane molecules from crude oil
- **Stage 2:** producing propene molecules from large alkane molecules
- **Stage 3:** joining many propene molecules together.

Name **Stage 1**, **Stage 2** and **Stage 3**.

Choose answers from the box.

[3 marks]

cracking	**fermentation**	**fractional distillation**
polymerisation	**reverse osmosis**	

Stage 1 is _____.

Stage 2 is _____.

Stage 3 is _____.

4.1.1.2 Mixtures

Question 140 · continued

0 2 . 7 A molecule of hexene contains a double carbon–carbon bond.

Many hexene molecules join together to form poly(hexene).

Which **two** words describe a hexene molecule in this process?

[2 marks]

Tick (✓) **two** boxes.

- Alkene ☐
- Catalyst ☐
- Composite ☐
- Element ☐
- Monomer ☐

12

4.1.1.2 Mixtures

Question 141

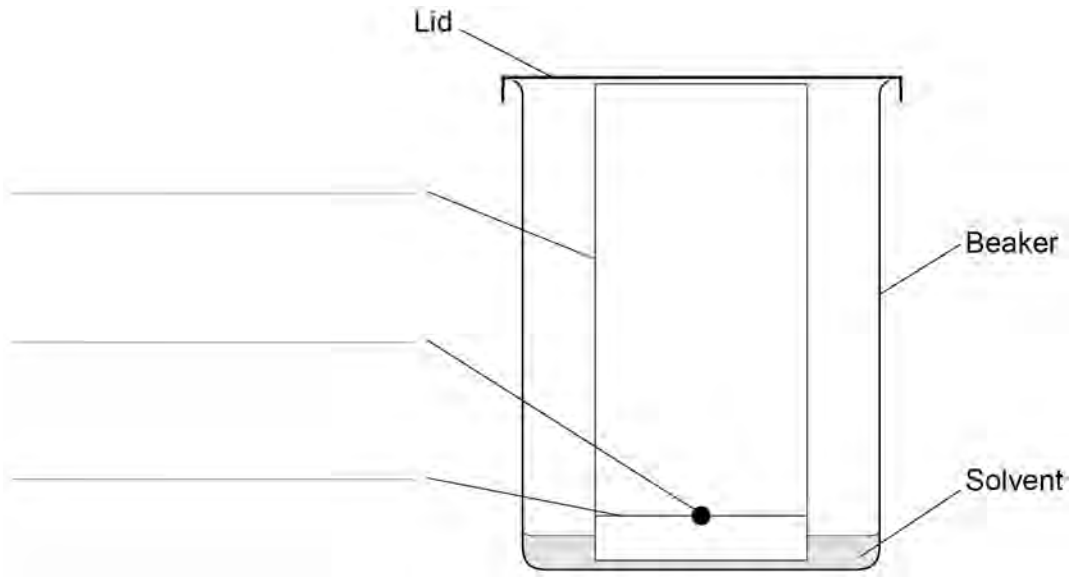
June 2023 | 8462/2F | Original Q3

0 3 This question is about chromatography.

A student investigated an orange dye using paper chromatography.

0 3 . 1 **Figure 3** shows the apparatus at the start of the investigation.

Figure 3



Complete the labels on **Figure 3**.

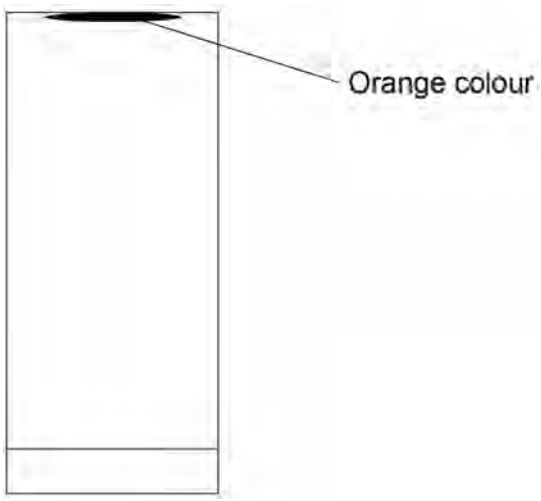
[3 marks]

4.1.1.2 Mixtures

Question 141 · continued

0 3 . 2 **Figure 4** shows the results at the end of the investigation.

Figure 4



The student made a mistake in the investigation.

What mistake did the student make to produce the results shown in **Figure 4**?

[1 mark]

Tick (✓) **one** box.

Left the investigation for too long ☐

Used a lid on the beaker ☐

Used a solvent which did not dissolve the dye ☐

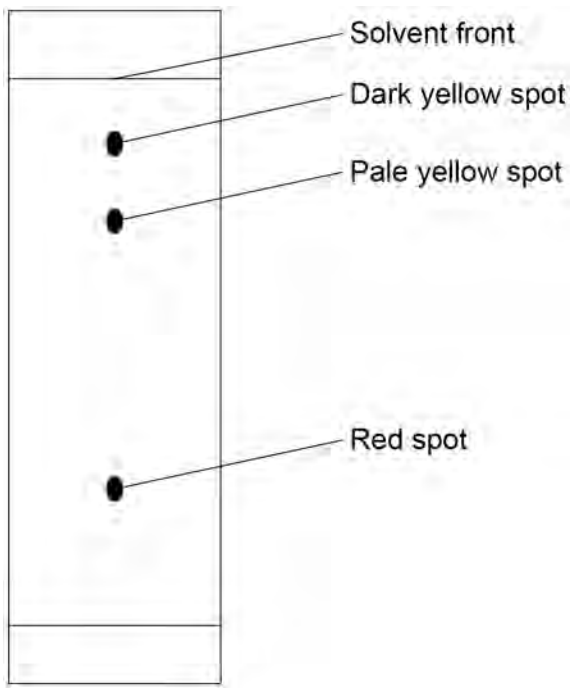
Question 3 continues on the next page

Question 141 · continued

A different student did the investigation correctly.

Figure 5 shows the results.

Figure 5



0 3 . 3 How do the results in **Figure 5** show that the orange dye is **not** a pure substance?

[1 mark]

4.1.1.2 Mixtures

Question 141 · continued

0 3 . 4 Determine the R_f value for the red spot.

You should measure:

- the distance moved by the red spot
- the distance moved by the solvent.

Use **Figure 5** and the equation:

$$R_f = \frac{\text{distance moved by red spot}}{\text{distance moved by solvent}}$$

[4 marks]

Distance moved by red spot _____ cm

Distance moved by solvent _____ cm

_____

_____

R_f = _____

0 3 . 5 Which spot had the greatest R_f value?

Use **Figure 5**.

[1 mark]

Tick (✓) **one** box.

Dark yellow spot ☐

Pale yellow spot ☐

Red spot ☐

10

4.1.1.2 Mixtures

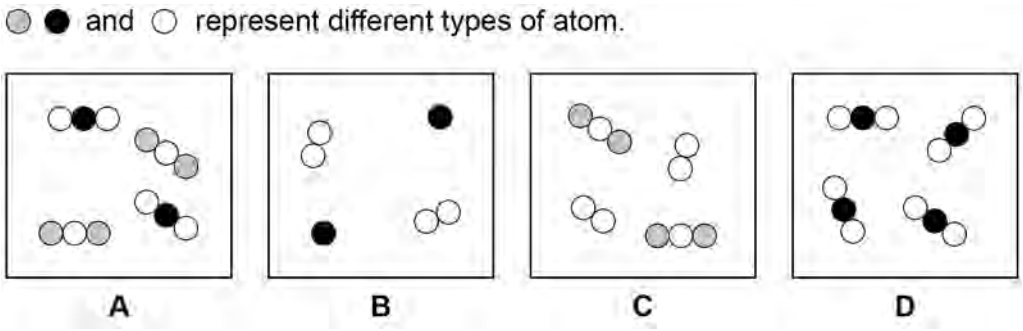
Question 142

June 2024 | 8462/1F | Original Q1

0 1 This question is about elements, compounds and mixtures.

Figure 1 shows diagrams which represent the atoms and molecules in different substances.

Figure 1



0 1 . 1 Which diagram in **Figure 1** represents a pure compound?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

0 1 . 2 Which diagram in **Figure 1** represents a mixture of an element and a compound?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

Question 1 continues on the next page

4.1.1.2 Mixtures

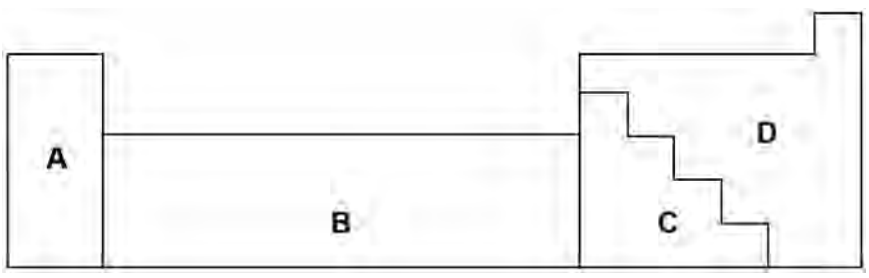
Question 142 · continued

0 1 . 3 Elements are metals or non-metals.

Figure 2 shows an outline of the periodic table.

The periodic table is divided into sections.

Figure 2



Where are metals found in the periodic table?

[1 mark]

Tick (✓) **one** box.

Section **A** only ☐

Sections **A**, **B** and **C** ☐

Sections **B**, **C** and **D** ☐

Section **D** only ☐

4.1.1.2 Mixtures

Question 142 · continued

0 1 . 4 Which **two** of the following are typical properties of a transition metal?

[2 marks]

Tick (✓) **two** boxes.

- Can be bent and shaped ☐
- Good conductor of electricity ☐
- Low density ☐
- Low melting point ☐
- Poor conductor of heat ☐

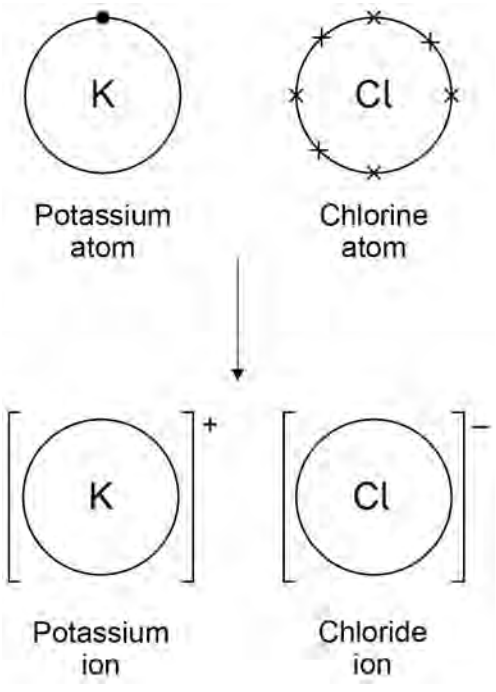
0 1 . 5 Potassium and chlorine react to produce potassium chloride.

An atom of potassium loses an electron to form a potassium ion.

An atom of chlorine gains an electron to form a chloride ion.

Complete the dot and cross diagram.

[2 marks]



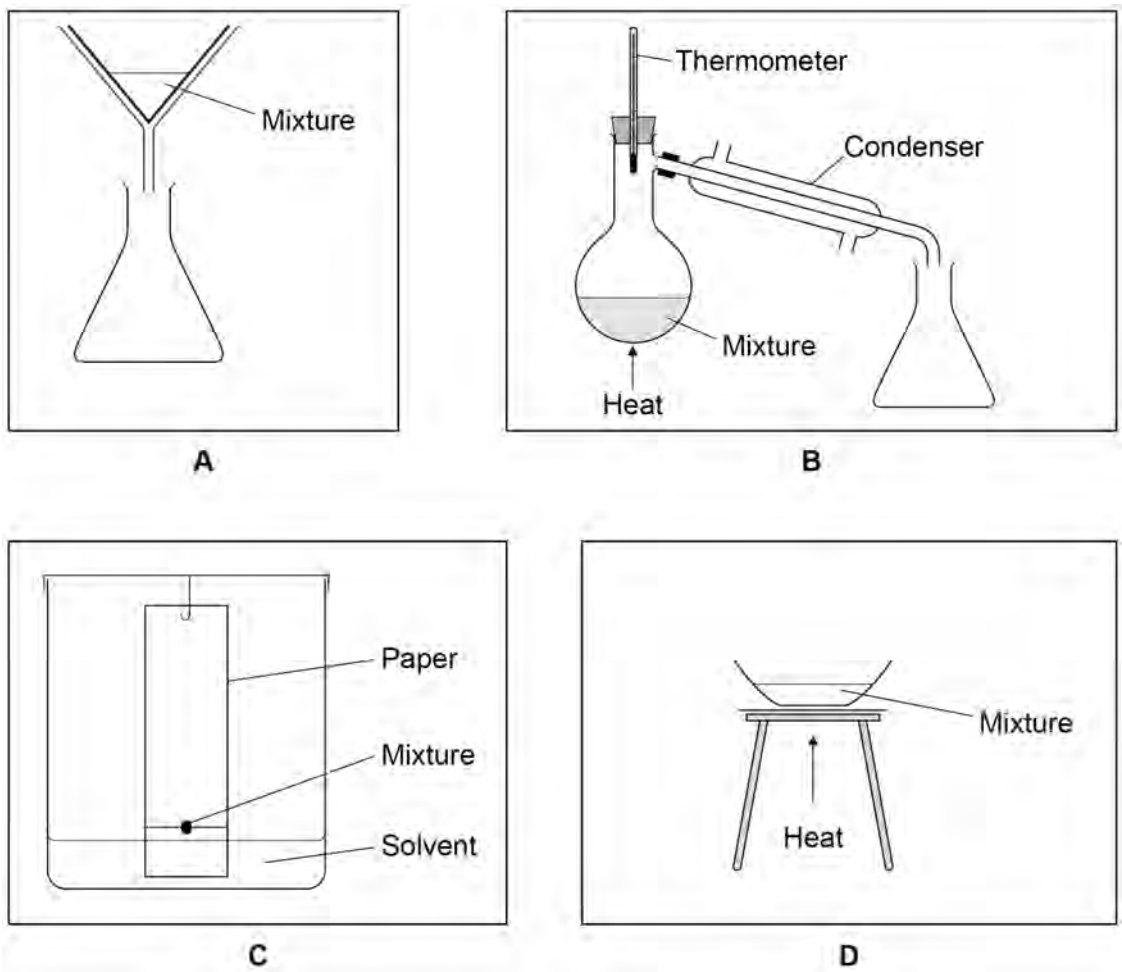
4.1.1.2 Mixtures

Question 142 · continued

Mixtures are separated by different methods.

Figure 3 shows the apparatus for separating four different types of mixture.

Figure 3



4.1.1.2 Mixtures

Question 142 · continued

0 1 . 6 Which apparatus could be used to collect water from sodium chloride solution?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 7 Which apparatus shows filtration?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

9

4.1.1.2 Mixtures

Question 143

June 2024 | 8462/1F | Original Q3

0 3 This question is about energy changes of reactions.

Zinc reacts with copper sulfate solution.

The word equation for the reaction is:

zinc + copper sulfate → zinc sulfate + copper

0 3 . 1 What type of reaction is the reaction between zinc and copper sulfate solution?

[1 mark]

Tick (✓) **one** box.

Combustion ☐

Decomposition ☐

Displacement ☐

0 3 . 2 Calculate the percentage (%) by mass of copper in copper sulfate ($CuSO_4$).

Give your answer to 3 significant figures.

Relative atomic mass (A_r): Cu = 63.5

Relative formula mass (M_r): $CuSO_4$ = 159.5

[3 marks]

Percentage by mass (3 significant figures) = _____ %

4.1.1.2 Mixtures

Question 143 · continued

A student investigated the energy change in the reaction between zinc and copper sulfate solution.

This is the method used.

1. Measure 25 cm^3 of copper sulfate solution into a polystyrene cup.
2. Weigh 0.20 g of zinc powder.
3. Add the zinc powder to the copper sulfate solution.
4. Measure the highest temperature reached by the mixture.
5. Repeat steps 1 to 4 using different masses of zinc powder.

0 3 . 3 Control variables are used to make an investigation a fair test.

Which is a control variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Highest temperature reached by the mixture ☐

Mass of zinc powder ☐

Volume of copper sulfate solution ☐

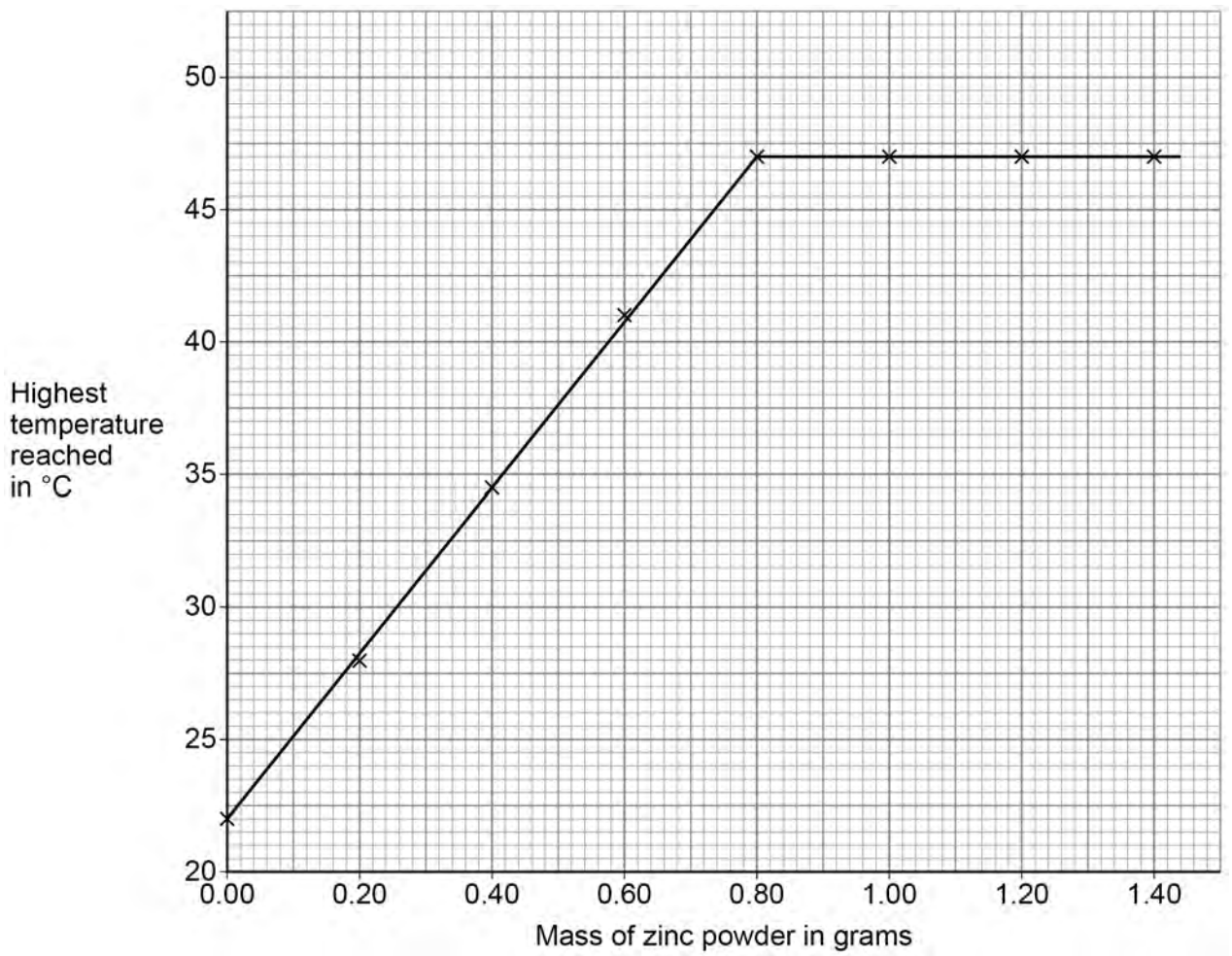
Question 3 continues on the next page

4.1.1.2 Mixtures

Question 143 · continued

Figure 6 shows the results.

Figure 6



0 3 . 4 What is the minimum mass of zinc powder needed to react with all the copper sulfate solution?

Use **Figure 6**.

[1 mark]

Minimum mass of zinc powder = _____ g

4.1.1.2 Mixtures

Question 143 · continued

0 3 . 5 What is the maximum temperature change in the reaction between zinc powder and 25 cm^3 of copper sulfate solution?

Use **Figure 6**.

[2 marks]

Maximum temperature change = _____ °C

0 3 . 6 25 cm^3 of copper sulfate solution contained 6.75 g of copper sulfate.

Calculate the concentration of the solution in g/dm^3.

You should:

- calculate the volume of the solution in dm^3 (1000 cm^3 = 1 dm^3)
- use the equation:

$$\text{concentration of solution in g/dm}^3 = \frac{\text{mass of copper sulfate in grams}}{\text{volume of solution in dm}^3}$$

[3 marks]

Volume of solution = _____ dm^3

Concentration of solution = _____ g/dm^3

Question 3 continues on the next page

Question 143 · continued

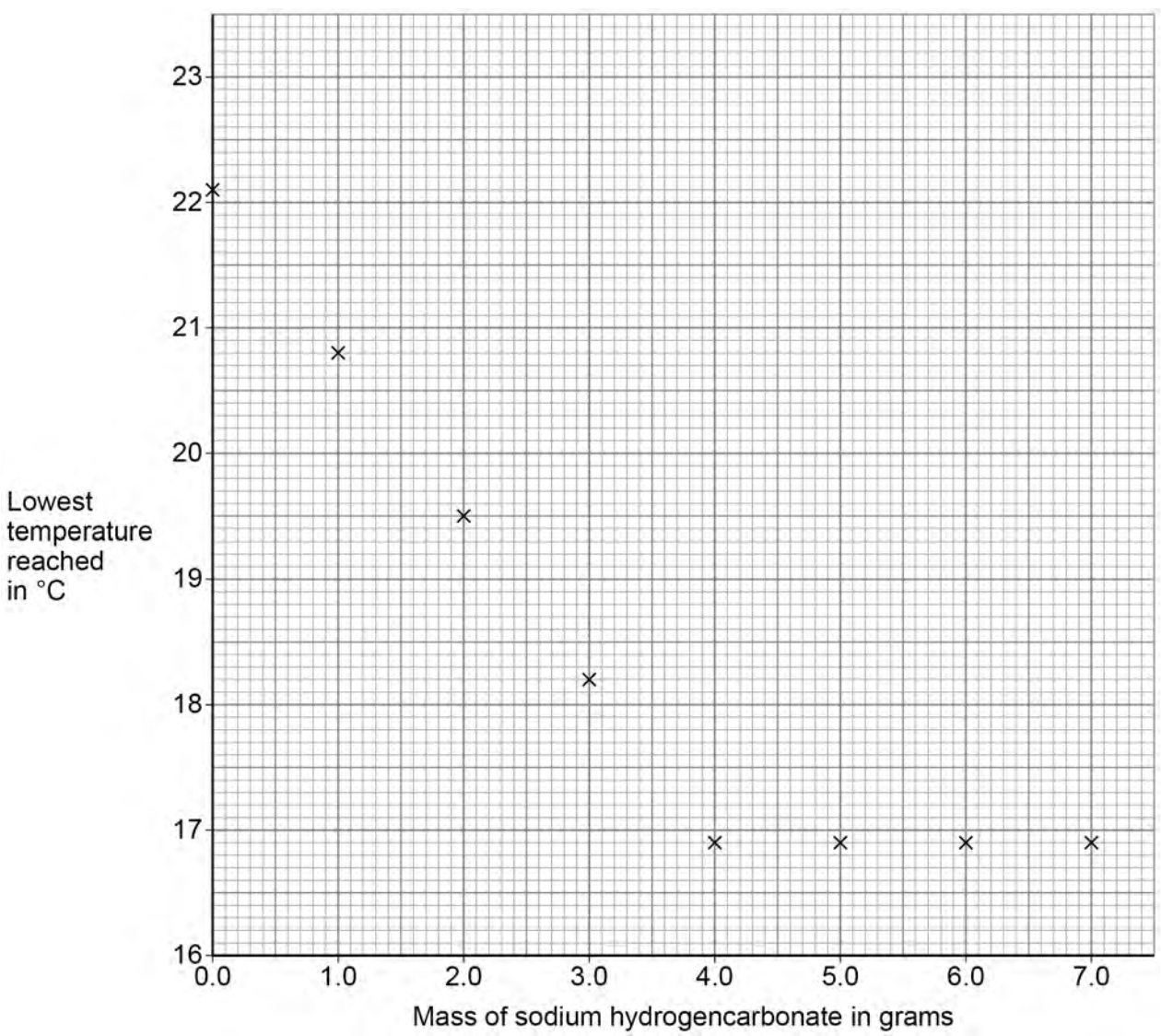
Another student investigated the energy change of the reaction between sodium hydrogencarbonate and hydrochloric acid.

This is the method used.

1. Measure 25 cm^3 of hydrochloric acid.
2. Weigh 1.0 g of sodium hydrogencarbonate.
3. Add the sample of sodium hydrogencarbonate to the hydrochloric acid.
4. Measure the lowest temperature reached by the mixture.
5. Repeat steps 1 to 4 using different masses of sodium hydrogencarbonate.

Figure 7 shows the results.

Figure 7



4.1.1.2 Mixtures

Question 143 · continued

0 3 . 7 Draw **two** straight lines of best fit on **Figure 7**.

The lines should cross.

[2 marks]

0 3 . 8 Which statement describes the energy change in the reaction shown in **Figure 7**?

[1 mark]

Tick (✓) **one** box.

Energy is **transferred to** the surroundings so the reaction is **endothermic**. ☐

Energy is **transferred to** the surroundings so the reaction is **exothermic**. ☐

Energy is **taken in from** the surroundings so the reaction is **endothermic**. ☐

Energy is **taken in from** the surroundings so the reaction is **exothermic**. ☐

14

4.1.1.2 Mixtures

Question 144

June 2024 | 8462/1F | Original Q8

0 8 A student produced a salt by reacting copper carbonate with sulfuric acid.

This is the method used.

1. Measure 50 cm^3 of sulfuric acid into a beaker.
2. Add copper carbonate powder.
3. Stir the mixture.
4. Repeat steps 2 and 3 until copper carbonate is in excess.
5. Filter the mixture.
6. Warm the filtrate gently until crystals start to appear.
7. Leave the solution to cool and crystallise.

0 8 . 1 Complete the word equation for the reaction.

[2 marks]

copper carbonate + sulfuric acid → _____ + _____ + carbon dioxide

0 8 . 2 Give **one** observation the student could make during **Step 4** which shows that the copper carbonate is in excess.

[1 mark]

_____

_____

0 8 . 3 Give **one** reason for filtering the mixture in **Step 5**.

[1 mark]

_____

_____

4.1.1.2 Mixtures

Question 144 · continued

0 8 . 4 Name the equipment that can be used to warm the filtrate **gently** in **Step 6**.

[1 mark]

0 8 . 5 The maximum theoretical mass of the salt that could be produced using 50 cm^3 of the sulfuric acid is 12.5 g.

The percentage yield of the salt is 92.8%.

Calculate the mass of salt actually produced.

Use the equation:

$$\% \text{ yield} = \frac{\text{mass of salt actually produced}}{\text{maximum theoretical mass of salt that could be produced}} \times 100$$

[3 marks]

Mass of salt actually produced = _____ g

Question 8 continues on the next page

4.1.1.2 Mixtures

Question 144 · continued

0 8 . 6 Some salts can be produced by reacting sulfuric acid with a metal.

Neither copper nor sodium is used to produce a salt with sulfuric acid.

Give **one** reason why each metal is **not** used.

[2 marks]

Copper _____

_____

Sodium _____

_____

10

4.1.1.2 Mixtures

Question 145

June 2024 | 8462/2F | Original Q3

0 3 This question is about paper chromatography.

A student investigated substance **Y** using paper chromatography.

This is the method used.

1. Draw a start line in ink on a piece of chromatography paper.
2. Put spots of four different dyes, **A**, **B**, **C** and **D**, and a spot of substance **Y** on the start line.
3. Dip the paper into water so that the water level is below the start line.
4. Wait until the water has risen to near the top of the paper.

0 3 . 1 The student's method contains a mistake in **Step 1**.

What is the mistake in **Step 1**?

Give **one** reason for your answer.

[2 marks]

Mistake _____

_____

Reason _____

_____

Question 3 continues on the next page

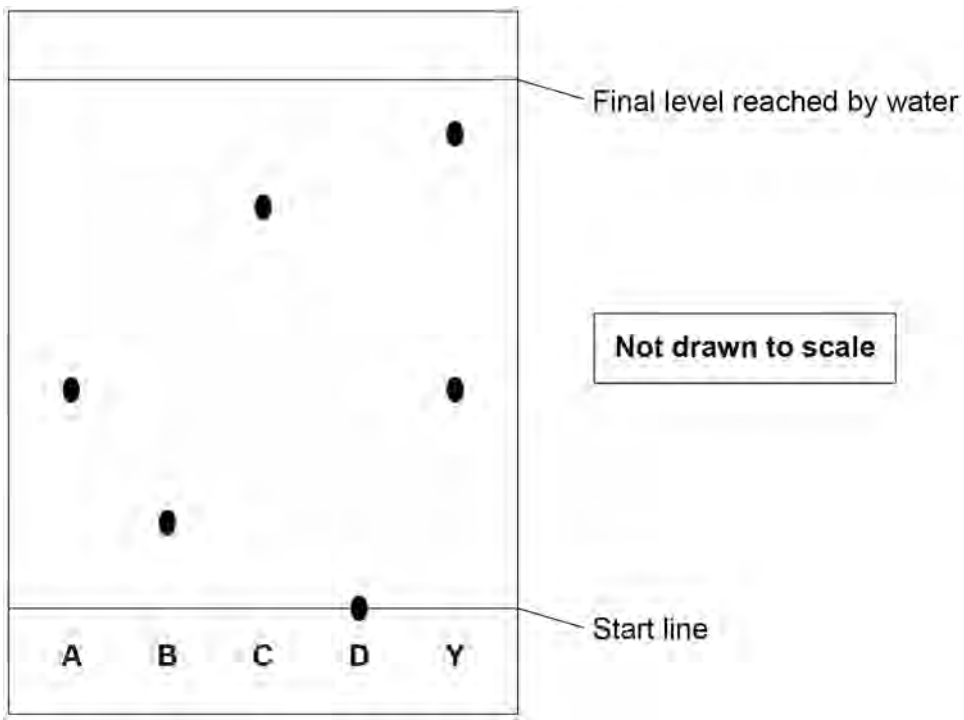
4.1.1.2 Mixtures

Question 145 · continued

A different student used a method which gave valid results.

Figure 4 shows the results.

Figure 4



0 3 . 2 How many different dyes are in substance **Y**?

Use **Figure 4**.

[1 mark]

_____

0 3 . 3 Which of the four dyes, **A**, **B**, **C** and **D**, could be in substance **Y**?

Give **one** reason for your answer.

Use **Figure 4**.

[2 marks]

Dye _____

Reason _____

_____

4.1.1.2 Mixtures

Question 145 · continued

0 3 . 4 Suggest why dye **D** remained on the start line at the end of the investigation.

Use **Figure 4**.

[1 mark]

0 3 . 5 The student determined that:

- the distance moved by the water was 6.0 cm
- the distance moved by dye **A** was 2.4 cm.

Calculate the R_f value of dye **A**.

Use the equation:

$$R_f = \frac{\text{distance moved by dye } \mathbf{A}}{\text{distance moved by water}}$$

[2 marks]

R_f = _____

0 3 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

solute	**solution**	**solvent**

The water in **step 3** is used as a _____ .

9

4.1.1.2 Mixtures

Question 146

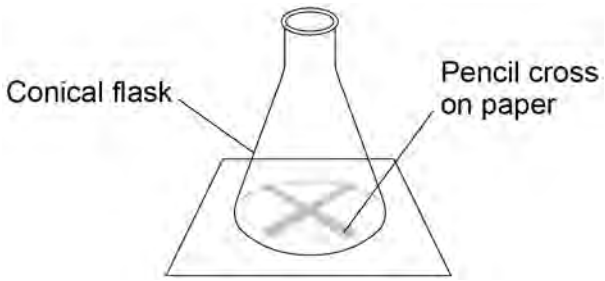
June 2024 | 8462/2F | Original Q5

0 5 A student investigated the rate of the reaction of sodium thiosulfate solution with hydrochloric acid.

When sodium thiosulfate solution reacts with hydrochloric acid, the mixture becomes cloudy.

Figure 6 shows the apparatus.

Figure 6



This is the method used.

1. Put 75 cm^3 of sodium thiosulfate solution in a conical flask.
2. Draw a pencil cross on paper.
3. Put the conical flask on the pencil cross.
4. Add 15 cm^3 of hydrochloric acid to the contents of the conical flask.
5. Swirl the conical flask to mix the contents and immediately start a timer.
6. Stop the timer when the pencil cross is no longer visible through the reaction mixture.
7. Repeat steps 1 to 6 using different concentrations of sodium thiosulfate solution.

0 5 . 1 Explain why a 50 cm^3 conical flask is unsuitable to use in this method.

[2 marks]

Question 146 · continued

0 5 . 2 Name a piece of equipment suitable for measuring the volume of sodium thiosulfate solution.

[1 mark]

0 5 . 3 The student measured the time taken for the pencil cross to be no longer visible for different concentrations of sodium thiosulfate solution.

Draw **one** line from each type of variable to the variable in this investigation.

[2 marks]

Type of variable	Variable in this investigation
	Concentration of sodium thiosulfate solution
	Size of conical flask
Dependent variable	
	Temperature of sodium thiosulfate solution
Independent variable	
	Time for pencil cross to become no longer visible
	Volume of hydrochloric acid

Question 5 continues on the next page

Question 146 · continued

0 5 . 4 What effect will using a darker pencil cross have on the time taken for the cross to be no longer visible?

[1 mark]

Tick (✓) **one** box.

The time taken will decrease. ☐

The time taken will be the same. ☐

The time taken will increase. ☐

0 5 . 5 **Table 2** shows the results.

Table 2

Concentration of sodium thiosulfate solution in g/dm^3	Time for cross to become no longer visible in seconds
8	120
16	60
24	40
32	30

Which concentration of sodium thiosulfate solution had the highest rate of reaction?

[1 mark]

Tick (✓) **one** box.

8 g/dm^3 ☐ 16 g/dm^3 ☐ 24 g/dm^3 ☐ 32 g/dm^3 ☐

Question 146 · continued

0 5 . 6 Increasing the concentration of sodium thiosulfate solution changes the rate of the reaction with hydrochloric acid.

Which **two** statements explain the effect of increasing the concentration?

[2 marks]

Tick (✓) **two** boxes.

- The particles are closer together. ☐
- The particles are further apart. ☐
- The particles collide less frequently. ☐
- The particles collide more frequently. ☐
- The particles move faster. ☐
- The particles move slower. ☐

0 5 . 7 The effect on the time taken for the cross to disappear can also be investigated by:

- changing the temperature of the hydrochloric acid
- changing the concentration of the hydrochloric acid.

Complete the sentences.

Choose the answers from the box.

[2 marks]

decreases	**stays the same**	**increases**

If the temperature of the hydrochloric acid is **increased**, the time taken for the cross to disappear _____.

If the concentration of the hydrochloric acid is **decreased**, the time taken for the cross to disappear _____.

11

4.1.1.2 Mixtures

Question 147

June 2025 | 8462/1F | Original Q2

0 2 Metals react with acids to produce a salt and a gas.

0 2 . 1 Which salt is produced when magnesium reacts with hydrochloric acid?

[1 mark]

Tick (✓) **one** box.

- Magnesium chloride ☐
- Magnesium nitrate ☐
- Magnesium sulfate ☐

0 2 . 2 Which gas is produced when magnesium reacts with hydrochloric acid?

[1 mark]

Tick (✓) **one** box.

- Carbon dioxide ☐
- Chlorine ☐
- Hydrogen ☐
- Oxygen ☐

Question 2 continues on the next page

4.1.1.2 Mixtures

Question 147 · continued

A student investigated the temperature change in the reaction between metals and hydrochloric acid.

This is the method used.

1. Measure 25 cm^3 of hydrochloric acid at 20 °C into a container.

2. Add 1 g of a metal.

3. Record the temperature change.

4. Repeat steps 1 to 3 using a different metal.

0 2 . 3 Draw **one** line from the type of variable to the name of the variable in the investigation.

[2 marks]

Type of variable	Name of variable
	Mass of metal
Dependent variable	Temperature change
Independent variable	Type of metal
	Volume of hydrochloric acid

4.1.1.2 Mixtures

Question 147 · continued

0 2 . 4 Which container would be the most suitable to reduce energy transfer with the surroundings?

[1 mark]

Tick (✓) **one** box.

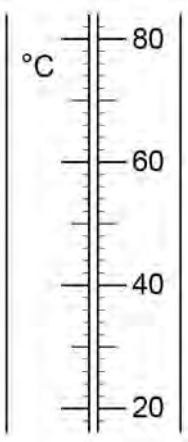
A copper can ☐

A glass beaker ☐

A polystyrene cup ☐

0 2 . 5 **Figure 1** shows part of the scale of the thermometer used in the investigation.

Figure 1



What is the resolution of the thermometer?

[1 mark]

Tick (✓) **one** box.

1 °C ☐ 2 °C ☐ 10 °C ☐ 20 °C ☐

4.1.1.2 Mixtures

Question 147 · continued

0 2 . 6 The reaction between a metal and an acid is exothermic.

What happens to the temperature of the mixture during the reaction?

[1 mark]

Tick (✓) **one** box.

Decreases ☐

Stays the same ☐

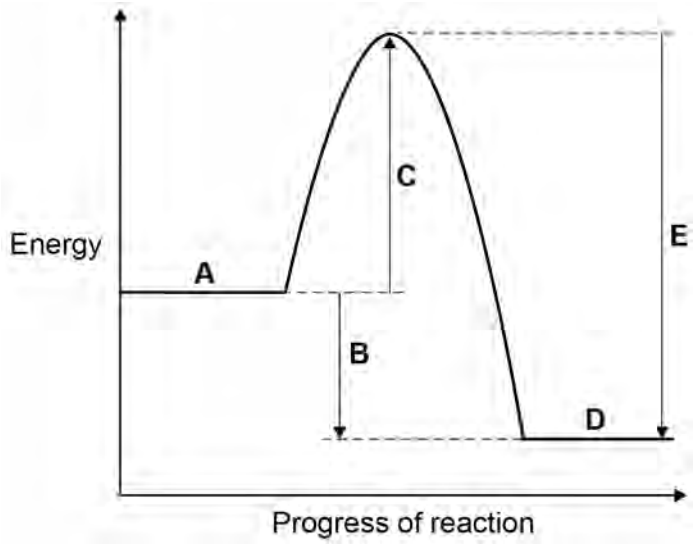
Increases ☐

4.1.1.2 Mixtures

Question 147 · continued

Figure 2 shows the reaction profile for the reaction between a metal and an acid.

Figure 2



0 2 . 7 Which letter in **Figure 2** represents the reactants?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 2 . 8 Which letter in **Figure 2** represents the activation energy?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 2 . 9 Which letter in **Figure 2** represents the overall energy change?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

10

4.1.1.2 Mixtures

Question 148

June 2025 | 8462/1F | Original Q5

0 5 This question is about electrolysis.

0 5 . 1 **Table 4** shows some of the products of electrolysis of two molten compounds.

Complete **Table 4**.

[2 marks]

Table 4

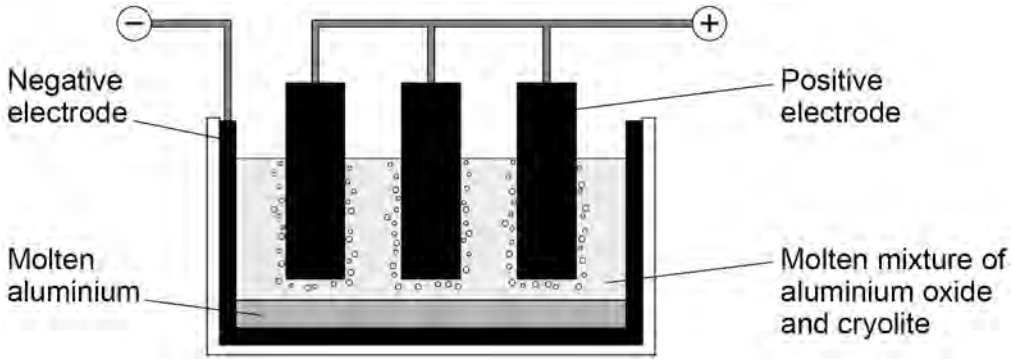
Molten compound	Product at the negative electrode	Product at the positive electrode
Copper chloride		Chlorine
Potassium bromide	Potassium	

Aluminium is extracted by electrolysis of a molten mixture of aluminium oxide and cryolite.

The products are molten aluminium and oxygen gas.

Figure 4 shows the electrolysis cell.

Figure 4



0 5 . 2 What is the formula of oxygen gas?

[1 mark]

Tick (✓) **one** box.

O ☐ O_2 ☐ O^2 ☐ 2O ☐

4.1.1.2 Mixtures

Question 148 · continued

June 2025 | 8462/1F | Original Q5

0 5 . 3 Aluminium oxide contains the ions Al^{3+} and O^{2-}

Explain why aluminium is produced at the **negative** electrode.

[2 marks]

0 5 . 4 The melting point of aluminium oxide is 2045 °C.

The melting point of the mixture of aluminium oxide and cryolite is 950 °C.

Explain why the electrolysis uses the mixture instead of pure aluminium oxide.

[2 marks]

0 5 . 5 The positive electrodes in the electrolysis cell are made of carbon.

Why do the positive electrodes need to be continually replaced?

[1 mark]

Tick (✓) **one** box.

Carbon reacts with the aluminium oxide. ☐

Carbon reacts with the aluminium produced. ☐

Carbon reacts with the oxygen produced. ☐

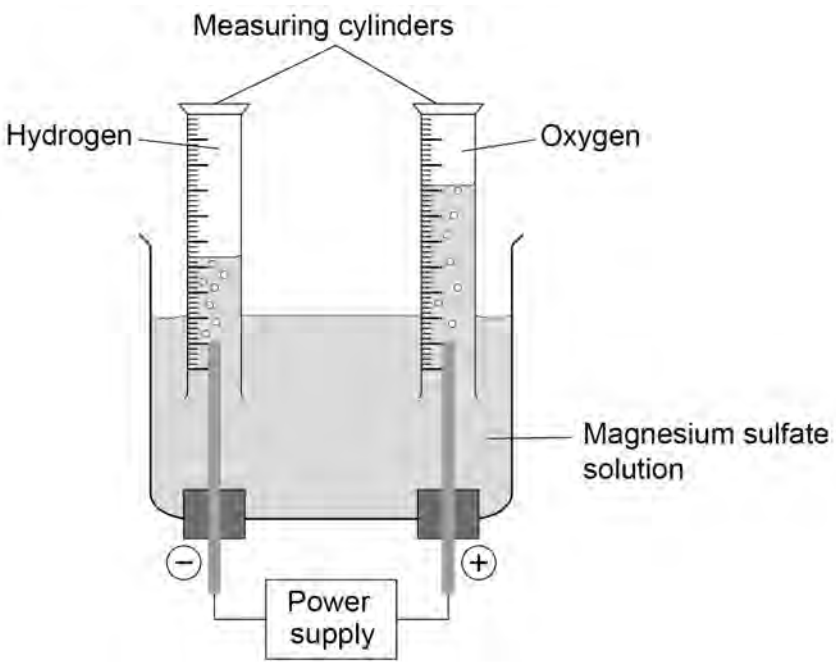
4.1.1.2 Mixtures

Question 148 · continued

A student investigated the electrolysis of magnesium sulfate solution.

Figure 5 shows the apparatus.

Figure 5



This is the method used.

1. Set the power supply to give a current of 0.05 A.

2. Measure the volume of each gas every minute for 5 minutes.

3. Repeat steps 1 and 2 using a current of 0.10 A in step 1.

4.1.1.2 Mixtures

Question 148 · continued

0 5 . 6 **Figure 6** shows a measuring cylinder during the electrolysis.

Figure 6



What is the volume of gas in the measuring cylinder?

[1 mark]

Tick (✓) **one** box.

2.7 cm^3 ☐ 3.4 cm^3 ☐ 4.6 cm^3 ☐

0 5 . 7 Hydrogen is produced instead of magnesium at the negative electrode.

Why is hydrogen produced at the negative electrode?

[1 mark]

Tick (✓) **one** box.

Hydrogen is less reactive than magnesium. ☐

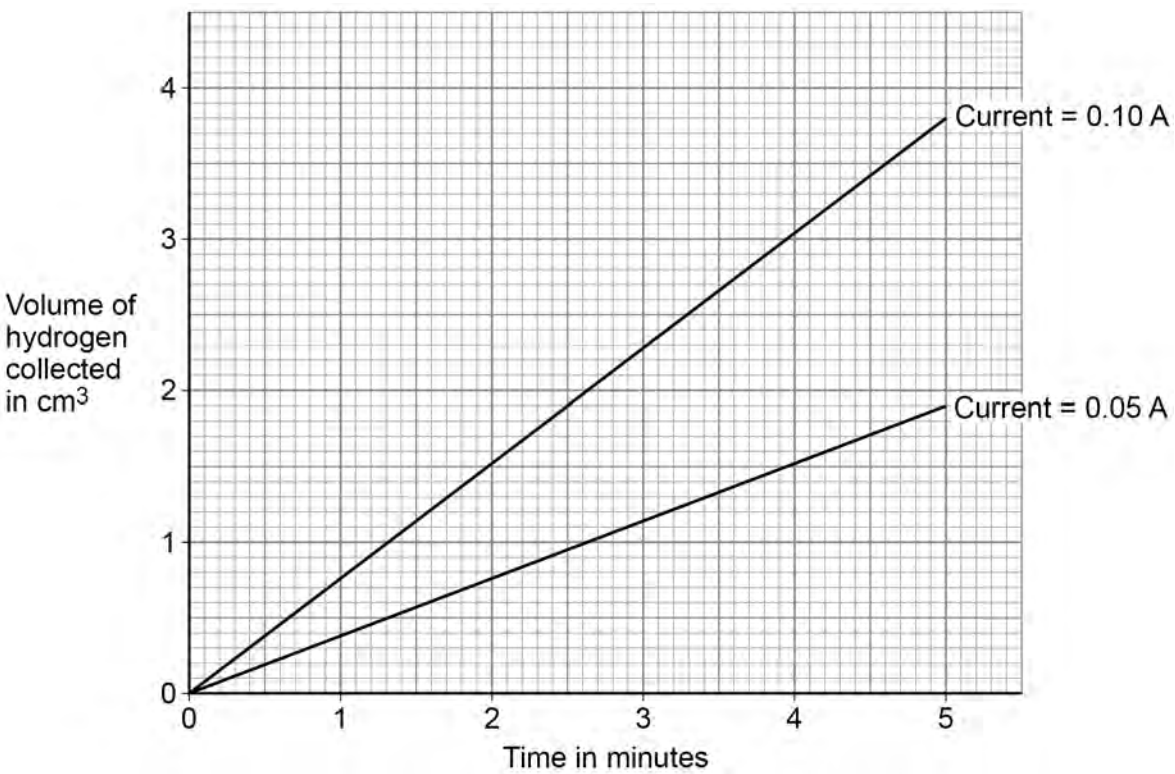
Hydrogen has the same reactivity as magnesium. ☐

Hydrogen is more reactive than magnesium. ☐

Question 148 · continued

0 5 . 8 **Figure 7** shows the results for the volume of hydrogen collected.

Figure 7



Which hypothesis explains the results in **Figure 7**?

[1 mark]

Tick (✓) **one** box.

The volume of hydrogen collected depends on **both** the current and the time. ☐

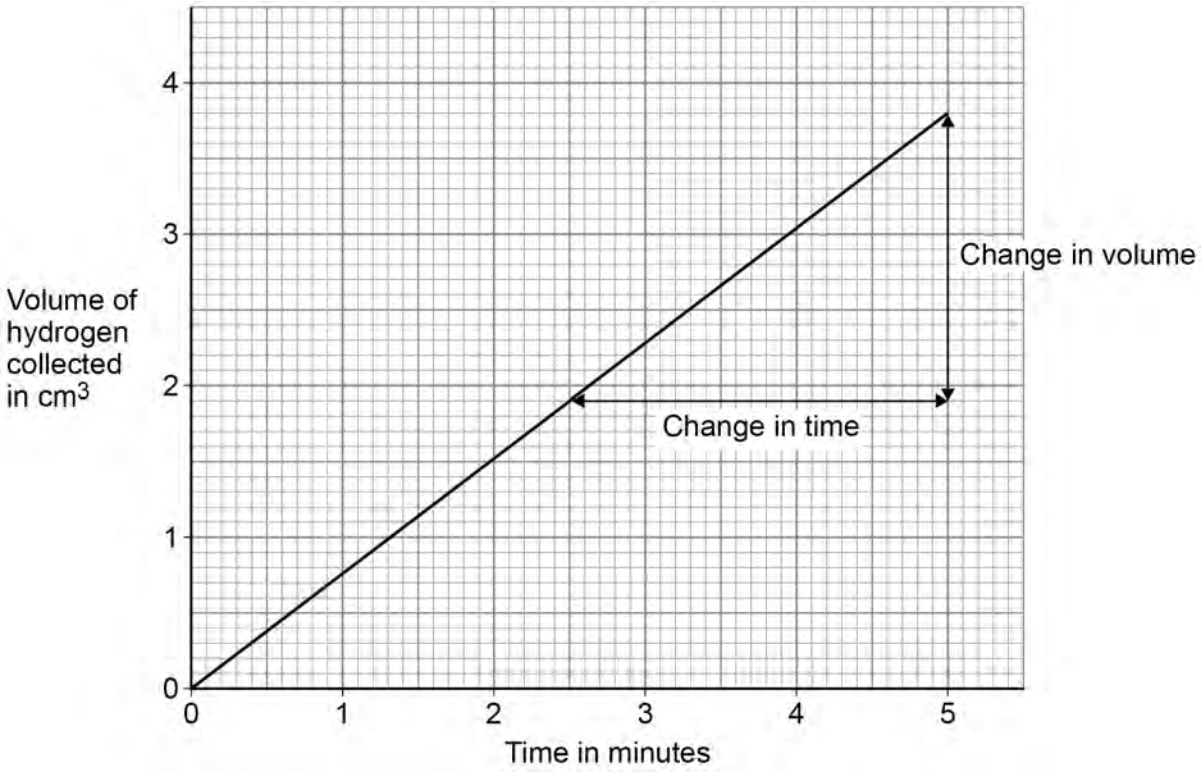
The volume of hydrogen collected depends on the current but **not** the time. ☐

The volume of hydrogen collected depends on the time but **not** the current. ☐

Question 148 · continued

0 5 . 9 **Figure 8** is a repeat of part of the graph for current = 0.10 A in **Figure 7**.

Figure 8



Determine the gradient of the graph in **Figure 8**.

Use the equation

$$\text{gradient} = \frac{\text{change in volume}}{\text{change in time}}$$

[4 marks]

Change in volume = _____ cm^3

Change in time = _____ min

Gradient = _____ cm^3/min

15

4.1.1.2 Mixtures

Question 149

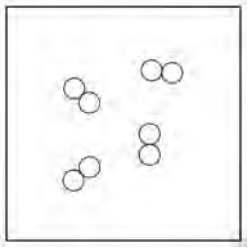
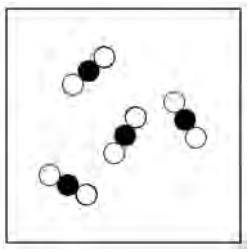
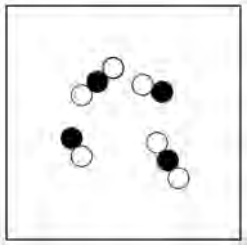
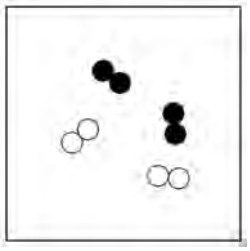
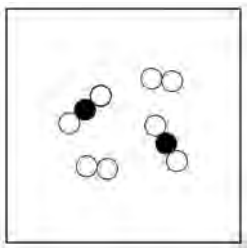
June 2025 | 8462/1F | Original Q7

0 7 This question is about mixtures.

0 7 . 1 Draw **one** line from each type of mixture to the representation of that mixture.

○ and ● represent atoms of different elements.

[2 marks]

Type of mixture	Representation
Mixture of compounds	
Mixture of a compound and an element	
	
	
	

Question 149 · continued

0 7 . 2 A student had a mixture of salt and sand.

Salt is soluble in water.

Sand is insoluble in water.

Plan a method to obtain pure dry samples of salt and of sand from the mixture.

Figure 11 shows the chemicals and equipment that can be used.

[6 marks]

Figure 11



4.1.1.2 Mixtures

Question 149 · continued

Extra space

0 7 . 3 A mixture of salt and sand contained 16.0 g of salt.

The student obtained 13.6 g of salt after separation from the mixture.

Calculate the percentage yield of the salt.

Use the equation

$$\% \text{ yield} = \frac{\text{mass of salt obtained}}{\text{mass of salt in mixture}} \times 100$$

[2 marks]

% yield = _____ %

10

4.1.1.2 Mixtures

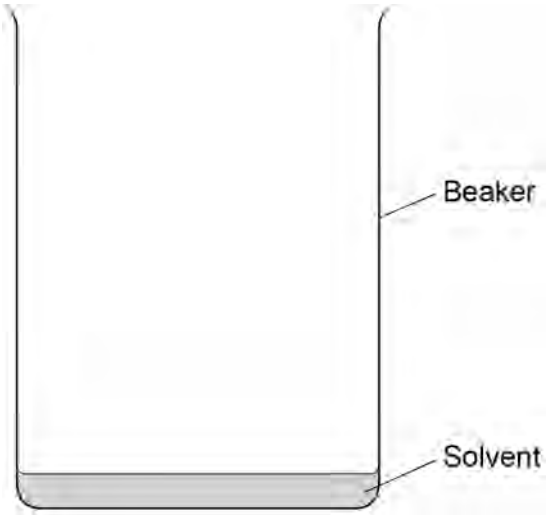
Question 150

June 2025 | 8462/2F | Original Q5

0 5 This question is about chromatography.

Figure 4 shows some equipment used for paper chromatography.

Figure 4



0 5 . 1 Complete **Figure 4** to show how the equipment can be used to separate the dyes in an ink.

You should draw and **label**:

- a piece of chromatography paper **in the beaker**
- a start line on the chromatography paper
- a spot of the ink on the chromatography paper at the **start** of the experiment.

[3 marks]

0 5 . 2 Why should a pencil be used to draw the start line on the chromatography paper?

[1 mark]

4.1.1.2 Mixtures

Question 150 · continued

The R_f value of a dye was 0.80

A spot of the dye moved a distance of 5.2 cm.

0 5 . 3 Calculate the distance moved by the solvent.

Use the equation:

$$R_f = \frac{\text{distance moved by spot}}{\text{distance moved by solvent}}$$

[3 marks]

Distance moved by solvent = _____ cm

0 5 . 4 How is the distance moved by the spot of the dye measured?

[1 mark]

Tick (✓) **one** box.

From the start line to the bottom of the spot ☐

From the start line to the centre of the spot ☐

From the start line to the top of the spot ☐

Question 5 continues on the next page

4.1.1.2 Mixtures

Question 150 · continued

0 5 . 5 Which **two** changes could produce a different R_f value for this dye?

[2 marks]

Tick (✓) **two** boxes.

- Use a different beaker. ☐
- Use a different length of time. ☐
- Use a different sized spot of dye. ☐
- Use a different solvent. ☐
- Use a different type of chromatography paper. ☐

0 5 . 6 A different dye is a pure substance.

How many spots will this dye produce during chromatography?

[1 mark]

_____

0 5 . 7 Which is an advantage of using gas chromatography instead of paper chromatography?

Choose the answer from the box.

[1 mark]

less sensitive	**more accurate**	**slower**

Gas chromatography is _____.

12