AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.3.3.1

Percentage yield

Past-paper questions

Tier	**Foundation**
Question groups	**7**
Available paper years	**2015–2025**

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.

4.3.3.1 Percentage yield

Question 01

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

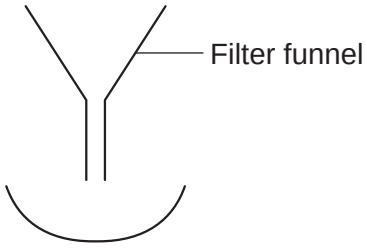
4.3.3.1 Percentage yield

Question 01 · 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

4.3.3.1 Percentage yield

Question 02

June 2018 | 8462/1F | Original Q2

0 2 The halogens are elements in Group 7.

0 2 . 1 Bromine is in Group 7.

Give the number of electrons in the outer shell of a bromine atom.

[1 mark]

0 2 . 2 Bromine reacts with hydrogen. The gas hydrogen bromide is produced.

What is the structure of hydrogen bromide?

[1 mark]

Tick **one** box.

- Giant covalent ☐
- Ionic lattice ☐
- Metallic structure ☐
- Small molecule ☐

0 2 . 3 What is the formula for fluorine gas?

[1 mark]

Tick **one** box.

- F ☐
- F_2 ☐
- F^2 ☐
- 2F ☐

4.3.3.1 Percentage yield

Question 02 · continued

A student mixes solutions of halogens with solutions of their salts.

Table 1 shows the student's observations.

Table 1

	Potassium chloride (colourless)	Potassium bromide (colourless)	Potassium iodide (colourless)
Chlorine (colourless)		Solution turns orange	Solution turns brown
Bromine (orange)	No change		Solution turns brown
Iodine (brown)	No change	No change	

0 2 . 4 Explain how the reactivity of the halogens changes going down Group 7.

Use the results in **Table 1**.

[3 marks]

Question 2 continues on the next page

4.3.3.1 Percentage yield

Question 02 · continued

A company uses chlorine to produce titanium chloride from titanium dioxide.

0 2 . 5 What is the relative formula mass (M_r) of titanium dioxide, TiO_2?

Relative atomic masses (A_r): O = 16 Ti = 48

[1 mark]

Tick **one** box.

64 ☐

80 ☐

128 ☐

768 ☐

0 2 . 6 The company calculates that 500 g of titanium dioxide should produce 1.2 kg of titanium chloride.

However, the company finds that 500 g of titanium dioxide only produces 900 g of titanium chloride.

Calculate the percentage yield.

[2 marks]

Percentage yield = _____ %

9

4.3.3.1 Percentage yield

Question 03

0 6 This question is about the extraction of metals.

0 6 . 1 Tungsten is a metal.

The symbol of tungsten is W

Tungsten is produced from tungsten oxide by reaction with hydrogen.

The equation for the reaction is:

$$WO_3 + 3H_2 \rightarrow W + 3H_2O$$

Calculate the percentage atom economy when tungsten is produced in this reaction.

Use the equation:

$$\text{percentage atom economy} = \frac{184}{(M_r\ WO_3) + (3 \times M_r\ H_2)} \times 100$$

Relative formula masses (M_r): $WO_3 = 232$ $H_2 = 2$

[2 marks]

Percentage atom economy = _____ %

4.3.3.1 Percentage yield

Question 03 · continued

Aluminium is extracted from aluminium oxide.

0 6 . 2 38% of a rock sample is aluminium oxide.

Calculate the mass of aluminium oxide in 40 kg of the rock sample.

[2 marks]

Mass of aluminium oxide = _____ kg

0 6 . 3 The formula of aluminium oxide is Al_2O_3

Calculate the relative formula mass (M_r) of aluminium oxide.

Relative atomic masses (A_r): O = 16 Al = 27

[2 marks]

Relative formula mass (M_r) = _____

Question 6 continues on the next page

4.3.3.1 Percentage yield

Question 03 · continued

0 6 . 4 60.0 kg of aluminium oxide produces a maximum of 31.8 kg of aluminium.

In an extraction process only 28.4 kg of aluminium is produced from 60.0 kg of aluminium oxide.

Calculate the percentage yield.

Give your answer to 3 significant figures.

Use the equation:

$$\text{percentage yield} = \frac{\text{mass of product actually made}}{\text{maximum theoretical mass of product}} \times 100$$

[3 marks]

Percentage yield = _____ %

0 6 . 5 Extracting metals by electrolysis is a very expensive process.

Explain why aluminium is extracted using electrolysis and not by reduction with carbon.

[2 marks]

11

4.3.3.1 Percentage yield

Question 04

November 2021 | 8462/2F | Original Q7

0 7 This question is about organic compounds.

0 7 . 1 Butane is an alkane with small molecules.

Complete the sentence.

Choose the answer from the box.

[1 mark]

fertiliser	**formulation**	**fuel**

Butane can be used as a _____.

0 7 . 2 Poly(propene) is a polymer.

What is the name of the monomer used to produce poly(propene)?

[1 mark]

Tick (✓) **one** box.

Propane ☐

Propanoic acid ☐

Propanol ☐

Propene ☐

4.3.3.1 Percentage yield

Question 04 · continued

Ethene and steam react to produce ethanol.

The equation for the reversible reaction is:

ethene + steam ⇌ ethanol

0 7 . 3 The reaction produces a maximum theoretical mass of 400 kg of ethanol from 243 kg of ethene and 157 kg of steam.

A company produces 380 kg of ethanol from 243 kg of ethene and 157 kg of steam.

The percentage yield of ethanol is less than 100%

Calculate the percentage yield of ethanol.

Use the equation:

$$\text{percentage yield of ethanol} = \frac{\text{mass of ethanol actually made}}{\text{maximum theoretical mass of ethanol}} \times 100$$

[2 marks]

Percentage yield = _____ %

0 7 . 4 What are **two** possible reasons why the percentage yield of ethanol is less than 100%?

[2 marks]

Tick (✓) **two** boxes.

- Ethanol is the only product of the reaction. ☐
- Ethanol is very unreactive. ☐
- Some ethanol changes back into ethene and steam. ☐
- Some ethanol escapes from the apparatus. ☐
- Some ethanol reacts with steam. ☐

4.3.3.1 Percentage yield

Question 04 · continued

0 7 . 5 Ethanol burns in oxygen.

Balance the equation for the reaction.

[1 mark]

$$C_2H_5OH + ___ O_2 \rightarrow 3H_2O + 2CO_2$$

0 7 . 6 Two processes for producing ethanol are:

- fermentation
- hydration (reacting ethene with steam).

Table 5 shows information about the processes.

Table 5

Feature	Process	
	Fermentation	Hydration
Raw material	sugar	crude oil
Energy usage	low	high
Rate of reaction	slow	fast
Purity of ethanol	15%	98%

Give **two** advantages and **two** disadvantages of using fermentation to produce ethanol.

[4 marks]

Advantage of fermentation 1 _____

_____

Advantage of fermentation 2 _____

_____

Disadvantage of fermentation 1 _____

_____

Disadvantage of fermentation 2 _____

_____

11

4.3.3.1 Percentage yield

Question 05

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	☐

4.3.3.1 Percentage yield

Question 05 · 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.

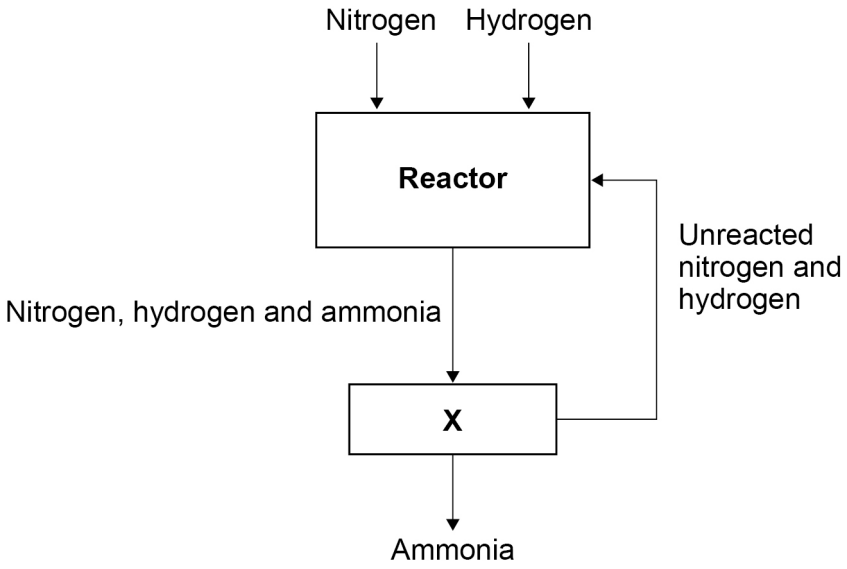
- The reaction is reversible. ☐
- There are two reactants. ☐
- There is one product. ☐

4.3.3.1 Percentage yield

Question 05 · 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

_____.

4.3.3.1 Percentage yield

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

4.3.3.1 Percentage yield

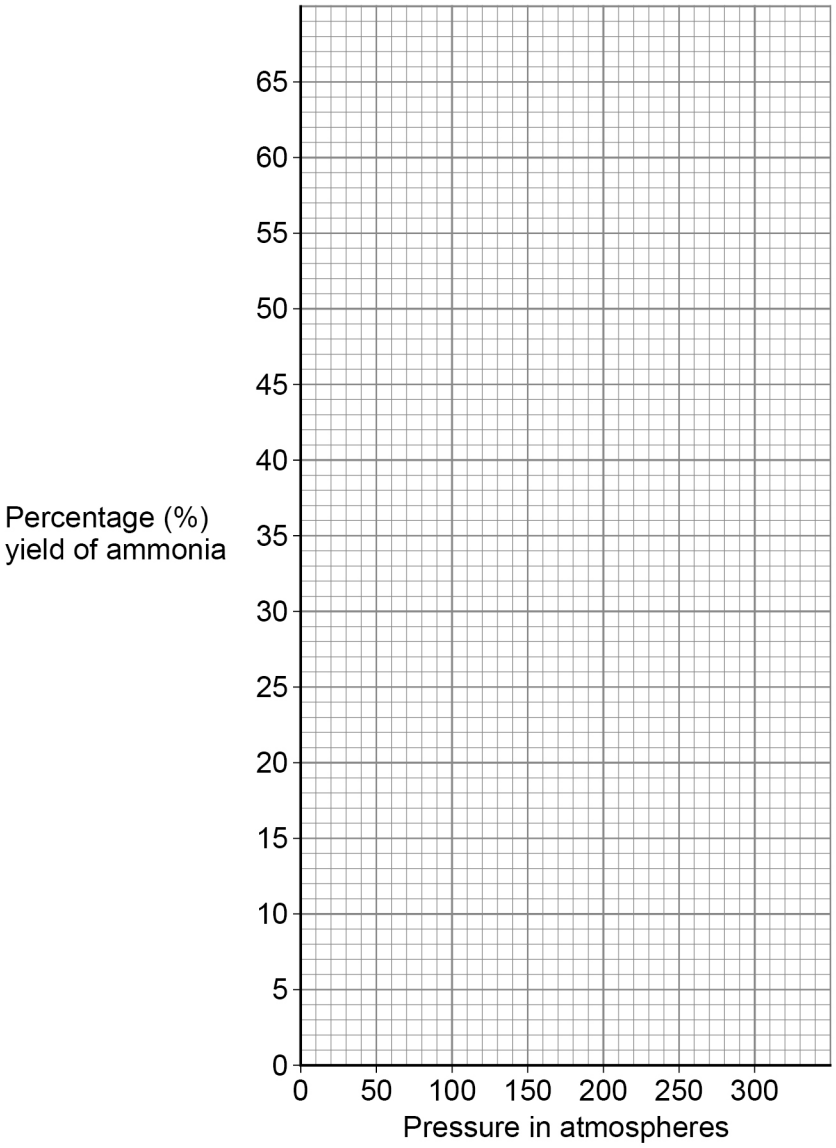
Question 05 · continued

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

4.3.3.1 Percentage yield

Question 06

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]

_____

_____

4.3.3.1 Percentage yield

Question 06 · 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

4.3.3.1 Percentage yield

Question 06 · 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

4.3.3.1 Percentage yield

Question 07

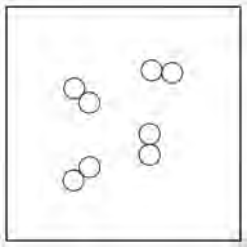
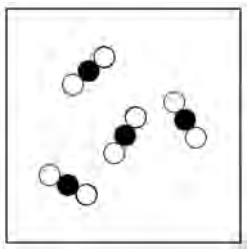
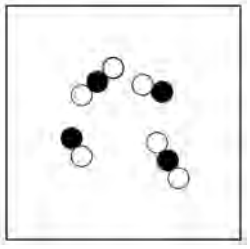
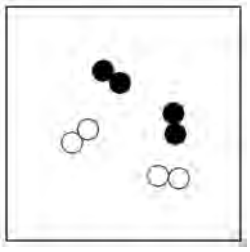
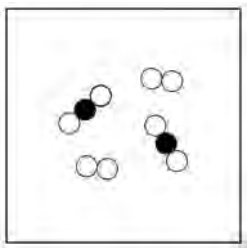
June 2025 | 8462/1F | Original Q7

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 07 · 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



4.3.3.1 Percentage yield

Question 07 · 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