

GCSE Chemistry

Worksheet: Percentage yield

TIME 25 min	TOTAL 22 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Percentage yield

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Chemists calculate the percentage yield of a reaction to judge how successful a preparation has been.

0 1 . 1

Which equation correctly defines percentage yield?

Tick (✓) **one** box.

(actual mass ÷ theoretical mass) × 100

☐

(theoretical mass ÷ actual mass) × 100

☐

actual mass – theoretical mass

☐

actual mass ÷ theoretical mass

☐

[1 mark]

0 1 . 2

A reaction has a maximum theoretical yield of 12.0 g. A student obtains 9.0 g of product.

Calculate the percentage yield.

.....

.....

.....

.....

Percentage yield = %

[2 marks]

0 2

The percentage yield of a reaction can be calculated using the equation:

percentage yield = (mass of product actually made ÷ maximum theoretical mass of product) × 100

0 2 . 1

A student made 4.2 g of a product. The maximum theoretical mass of the product was 5.0 g.

Calculate the percentage yield.

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.....

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Percentage yield = %

[2 marks]

0 2 . 2

Give **two** reasons why the percentage yield of a reaction is often less than 100%.

.....

.....

.....

.....

[2 marks]

0 3

In a required practical, a student made hydrated copper(II) sulfate crystals by reacting excess copper(II) oxide with dilute sulfuric acid, filtering, then evaporating and crystallising the solution.

The maximum theoretical mass of crystals was 3.75 g. The student obtained 3.30 g of crystals.

0 3 . 1

Calculate the percentage yield.

.....

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.....

.....

Percentage yield = %

[2 marks]

0 3 . 2

Describe **one** step in this practical where some of the product could be lost, reducing the yield.

.....

.....

[1 mark]

0 3 . 3

Suggest why the student evaporated the solution slowly in a warm place, rather than boiling it rapidly to dryness.

.....

.....

[1 mark]

0 4

A student made crystals of zinc sulfate from zinc oxide and dilute sulfuric acid.
The maximum theoretical mass of zinc sulfate crystals was 16.1 g. The student made 11.3 g of crystals.

0 4 . 1

Calculate the percentage yield.
Give your answer to 3 significant figures.

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.....

.....

.....

Percentage yield = %

[2 marks]

0 4 . 2

Suggest **two** ways in which some of the zinc sulfate could have been lost during the practical.

.....

.....

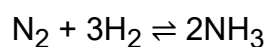
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.....

[2 marks]

0 4 . 3

Ammonia is made by the Haber process:



Explain why the yield of ammonia can never be 100%.

.....

.....

[1 mark]

0 5

Two students each attempted to make crystals of potassium sulfate from potassium hydroxide and dilute sulfuric acid. Table 1 shows their results.

Table 1

Student	Theoretical mass in g	Actual mass in g
Amir	5.80	4.64
Bella	5.80	4.06

0 5 . 1

Calculate the percentage yield for Amir and for Bella.

.....

.....

.....

.....

.....
[2 marks]

0 5 . 2

Suggest **one** reason why Amir's percentage yield was higher than Bella's.

.....

.....

[1 mark]

0 6

An ester used as a fruit flavouring is made by reacting an alcohol with a carboxylic acid. This reaction is reversible. The maximum theoretical mass of ester from a batch of reactants is 45.0 g.

0 6 . 1

The reaction produced 38.7 g of ester.
Calculate the percentage yield.

.....

.....

.....

.....

Percentage yield = %

[2 marks]

0 6 . 2

Suggest why the reversibility of this reaction limits the percentage yield that can be achieved, even under ideal conditions.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: Percentage yield · 22 marks

Question 1 (3 marks)

01.1 [1 mark]

Correct: $(\text{actual mass} \div \text{theoretical mass}) \times 100$

01.2 [2 marks]

Answer: 75%

- $9.0 \div 12.0 \times 100$ (1)
 - 75 (%) (1)
-

Question 2 (4 marks)

02.1 [2 marks]

Answer: 84%

- $(4.2 \div 5.0) \times 100$ (1)
 - 84 (%) (1)
-

02.2 [2 marks]

- the reaction may be reversible / may not go to completion (1)
- some of the product may be lost when it is separated from the reaction mixture (1)
- some of the reactants may react in ways different from the expected reaction / side reactions (1)

Any 2 of the points above.

Question 3 (4 marks)

03.1 [2 marks]

Answer: 88%

- $3.30 \div 3.75 \times 100$ (1)
 - 88 (%) (1)
-

03.2 [1 mark]

- allow: some solution or crystals may be left behind on the filter paper during filtration / some product may be lost during transfer between containers / crystals may be lost scraping them from the evaporating basin (1)
-

03.3 [1 mark]

- boiling rapidly to dryness could decompose the crystals or drive off all the water of crystallisation and cause spitting (losing product); slow evaporation allows large, pure crystals to form (1)
-

Question 4 (5 marks)

04.1 [2 marks]

Answer: 70.2%

- $(11.3 \div 16.1) \times 100$ (1)
 - 70.2 (%) (1)
-

04.2 [2 marks]

- some solution left in the beaker / soaked into the filter paper during filtering (1)
- some solution spat out / splashed during heating / evaporation (1)
- some crystals left on the filter paper or stuck to the apparatus (1)
- not all of the zinc sulfate crystallised / some stayed dissolved in the remaining solution (1)

Any 2 of the points above.

04.3 [1 mark]

- the reaction is reversible, so it does not go to completion / some ammonia breaks down back into nitrogen and hydrogen (1)
-

Question 5 (3 marks)

05.1 [2 marks]

Answer: Amir: 80%; Bella: 70%

- Amir: $4.64 \div 5.80 \times 100 = 80$ (%) (1)
 - Bella: $4.06 \div 5.80 \times 100 = 70$ (%) (1)
-

05.2 [1 mark]

- allow: Amir may have transferred the solution or crystals more carefully, losing less / Bella may have spilled some solution or left the crystals to dry for an unsuitable time (1)
-

Question 6 (3 marks)

06.1 [2 marks]

Answer: 86%

- $38.7 \div 45.0 \times 100$ (1)
 - 86 (%) (1)
-

06.2 [1 mark]

- some of the ester product can react in the reverse direction to re-form the alcohol and carboxylic acid, so the reaction reaches a dynamic equilibrium rather than going to completion, limiting the yield (1)
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