

GCSE Chemistry

Worksheet: Titrations

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Titrations

NAME _____ **CLASS** _____ **DATE** _____

- 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

A student used a pipette to transfer 25.0 cm^3 of potassium hydroxide solution into a conical flask and added a few drops of a suitable indicator. The student added 0.200 mol/dm^3 hydrochloric acid from a burette until the indicator changed colour, then repeated the titration.

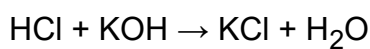


Table 1 shows the burette readings.

Table 1

Titration	Rough	1	2	3
Final burette reading in cm^3	29.00	28.75	28.55	28.45
Initial burette reading in cm^3	0.25	0.50	0.30	0.25

0 1 . 1

Calculate the titre for each of titrations 1, 2 and 3.

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.....

.....

[3 marks]

0 1 . 2

Concordant titres are within 0.10 cm^3 of each other. The rough titration is not used.

Calculate the mean titre, using only concordant titres.

Give your answer to 2 decimal places.

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.....

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Mean titre = cm^3

[2 marks]

0 1 . 3

Name the piece of apparatus used to measure the 25.0 cm^3 of potassium hydroxide solution accurately.

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.....

.....

.....
[1 mark]

0 1 . 4

Explain why the student swirled the conical flask as the acid was added.

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.....

[1 mark]

0 2

A student uses a titration to find the volume of dilute hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution. The student uses phenolphthalein indicator and adds the acid from a burette. Table 2 shows the burette readings for the rough titration and for titration 1.

Table 2

Burette reading in cm^3	Rough	Titration 1
Final reading	24.60	23.40
Initial reading	0.00	0.50

0 2 . 1

Name the piece of apparatus the student should use to measure 25.0 cm^3 of sodium hydroxide solution into the conical flask.

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.....

[1 mark]

0 2 . 2

What is the colour change at the end point?

Tick (✓) **one** box.

Colourless to pink

☐

Pink to colourless

☐

Red to yellow

☐

Yellow to red

☐

[1 mark]

0 2 . 3

Why does the student stand the conical flask on a white tile?

.....

.....

[1 mark]

0 2 . 4

Calculate the titre for titration 1.

.....

.....

.....

Titre = cm³

[1 mark]

0 2 . 5

Suggest why the rough titre is larger than the titre for titration 1.

.....

.....

[1 mark]

0 3

A titration uses an indicator to show the exact point of neutralisation (the end point).

0 3 . 1

Which indicator is commonly used in an acid–alkali titration to give a sharp colour change at the end point?

Tick (✓) **one** box.

Universal indicator

☐

Phenolphthalein

☐

Red litmus paper

☐

Damp blue litmus paper

☐

[1 mark]

0 3 . 2

What is meant by the ‘titre’ in a titration?

.....

.....

[1 mark]

0 4

A student carried out a titration to find the volume of sulfuric acid that reacts exactly with 25.0 cm^3 of potassium hydroxide solution. The acid was added from a burette to the alkali in a conical flask.

0 4 . 1

Why did the student rinse the burette with some of the sulfuric acid before filling it?

[1 mark]

0 4 . 2

Why did the student place the conical flask on a white tile?

[1 mark]

0 4 . 3

Why did the student swirl the flask during the titration?

[1 mark]

0 4 . 4

Why did the student add the acid one drop at a time near the end point?

[1 mark]

0 4 . 5

Describe how the student should read the burette.

[1 mark]

0 5

In a titration, a student first carries out a quick, rough titration, adding the acid rapidly until the colour change is seen.

0 5 . 1

Explain why this rough titration is not accurate enough to use in a final calculation of concentration.

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.....

[1 mark]

0 5 . 2

Explain why carrying out a rough titration first is still useful.

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[2 marks]

0 6

A student's five titre volumes were 24.20, 26.80, 23.10, 25.90 and 24.60 cm³ — none of the titrations gave concordant results.

0 6 . 1

Suggest **two** things the student may have done during the titrations that could cause such widely varying results.

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.....

[2 marks]

0 7

A student used a pipette to transfer 25.0 cm^3 of sodium hydroxide solution into a conical flask and added a few drops of a suitable indicator. The student added 0.100 mol/dm^3 hydrochloric acid from a burette until the indicator changed colour, then repeated the titration.

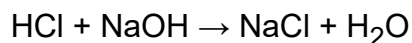


Table 3 shows the burette readings.

Table 3

Titration	Rough	1	2	3
Final burette reading in cm^3	26.55	26.10	26.00	25.80
Initial burette reading in cm^3	0.50	0.35	0.35	0.30

0 7 . 1

Calculate the titre for each of titrations 1, 2 and 3.

.....

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.....

.....

[3 marks]

0 7 . 2

Concordant titres are within 0.10 cm^3 of each other. The rough titration is not used.

Calculate the mean titre, using only concordant titres.

Give your answer to 2 decimal places.

.....

.....

.....

.....

Mean titre = cm^3

[2 marks]

0 7 . 3

Calculate the concentration of the sodium hydroxide solution in mol/dm³.
Give your answer to 3 significant figures.

.....

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.....

Concentration = mol/dm³

[3 marks]

.....

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: Titrations · 32 marks

Question 1 (7 marks)

01.1 [3 marks]

Answer: 1: 28.25 cm³; 2: 28.25 cm³; 3: 28.20 cm³

- titration 1: $28.75 - 0.50 = 28.25 \text{ (cm}^3\text{)}$ (1)
 - titration 2: $28.55 - 0.30 = 28.25 \text{ (cm}^3\text{)}$ (1)
 - titration 3: $28.45 - 0.25 = 28.20 \text{ (cm}^3\text{)}$ (1)
-

01.2 [2 marks]

Answer: 28.23 cm³

- titrations 1, 2 and 3 are concordant (1)
- mean = $(28.25 + 28.25 + 28.20) \div 3 = 28.23 \text{ (cm}^3\text{)}$ (1)

Notes: Allow ECF from incorrect titres.

01.3 [1 mark]

Answer: pipette

- (volumetric) pipette (1)

Notes: Do not accept burette, measuring cylinder or dropping pipette.

01.4 [1 mark]

- to mix the acid and alkali, so that the indicator changes colour only when the alkali has been completely neutralised (the end point is not overshoot) (1)
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Question 2 (5 marks)

02.1 [1 mark]

Answer: A (volumetric) pipette.

- (volumetric) pipette (1)

Notes: Allow burette. Do not accept measuring cylinder.

02.2 [1 mark]

Correct: Pink to colourless

02.3 [1 mark]

Answer: So that the colour change is easier to see.

- so that the colour change (at the end point) is easier to see (1)
-

02.4 [1 mark]

Answer: 22.90 cm^3

- $23.40 - 0.50 = 22.90 \text{ (cm}^3\text{)} (1)$
-

02.5 [1 mark]

Answer: In the rough titration the acid is added quickly, so the end point is overshoot.

- the acid is added quickly (not drop by drop) in the rough titration, so the end point is overshoot / more acid is added than is needed (1)
-

Question 3 (2 marks)

03.1 [1 mark]

Correct: Phenolphthalein

03.2 [1 mark]

- the volume of solution run out from the burette to reach the end point, in one titration (1)
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Question 4 (5 marks)

04.1 [1 mark]

- to remove any water / other substances that would dilute (or react with) the acid (1)

04.2 [1 mark]

- so the colour change of the indicator is easier to see (1)

04.3 [1 mark]

- to mix the acid and alkali (so they react completely) (1)

04.4 [1 mark]

- so the end point is not overshoot / to find the exact volume needed (1)

04.5 [1 mark]

- with the eye level with the liquid, reading the bottom of the meniscus (1)
-

Question 5 (3 marks)

05.1 [1 mark]

- the acid is added quickly, so the exact end point is easily overshoot, making the titre value unreliable (1)

05.2 [2 marks]

- it gives an approximate volume, showing roughly where the end point is (1)
 - in later, accurate titrations the acid can then be added dropwise only as this approximate volume is approached, saving time while still finding the end point precisely (1)
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Question 6 (2 marks)

06.1 [2 marks]

- an air bubble may have been present in the burette tip at the start of one or more titrations (and escaped during it) (1)
- the student may not have read the burette at eye level each time (parallax error) (1)
- the student may have added the acid too quickly near the end point and overshot the colour change by a different amount each time (1)
- the student may not have rinsed splashes of solution back into the flask each time (1)
- the volume of alkali pipetted into the flask may not have been the same each time (not filled exactly to the line) (1)
- the student may not have swirled the flask, so the colour change was judged too early or too late (1)

Any 2 of the points above.

Question 7 (8 marks)

07.1 [3 marks]

Answer: 1: 25.75 cm^3 ; 2: 25.65 cm^3 ; 3: 25.50 cm^3

- titration 1: $26.10 - 0.35 = 25.75 \text{ (cm}^3\text{)}$ (1)
 - titration 2: $26.00 - 0.35 = 25.65 \text{ (cm}^3\text{)}$ (1)
 - titration 3: $25.80 - 0.30 = 25.50 \text{ (cm}^3\text{)}$ (1)
-

07.2 [2 marks]

Answer: 25.70 cm^3

- titrations 1 and 2 are concordant (titration 3 is not) (1)
- mean = $(25.75 + 25.65) \div 2 = 25.70 \text{ (cm}^3\text{)}$ (1)

Notes: Allow ECF from incorrect titres.

07.3 [3 marks]

Answer: 0.103 mol/dm^3

- moles of HCl = $0.100 \times 25.70 \div 1000 = 0.00257 \text{ (mol)}$ (1)
- moles of NaOH = 0.00257 (mol) (1 : 1 ratio) (1)
- $0.00257 \div 0.0250 = 0.103 \text{ (mol/dm}^3\text{)}$ (1)

Notes: Allow ECF from the mean titre. An answer that is correct but not given to 3 significant figures scores one mark fewer.
