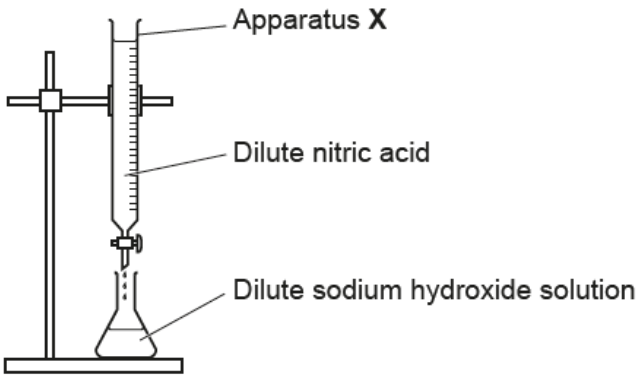
Monitoring chemical reactions – 2021/20 GCSE Gateway Chemistry A

1. Nov/2021/Paper_J248/02/No.4

Look at the diagram of a titration experiment.



What is the name of apparatus **X**?

A Burette

B Conical flask

C Gas syringe

D Pipette

Your answer ☐ **[1]**

2. Nov/2021/Paper_J248/02/No.13

Look at the results of a titration experiment.

	Titration 1 (rough)	**Titration 2**	**Titration 3**	**Titration 4**
Volume of acid used (cm^3)	26.00	25.20	25.50	25.60

What is the **accurate average volume of acid** used in the titration?

A 25.35 cm^3

B 25.43 cm^3

C 25.55 cm^3

D 25.58 cm^3

3. Nov/2021/Paper_J248/02/No.19(d)

(d) The student made 0.073 g of carbon dioxide in their experiment.

They predicted that they should have made 0.088 g.

Calculate the **percentage yield**.

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

Percentage yield = ... % **[3]**

4. Nov/2021/Paper_J248/02/No.21(d)

(d) Ethanol, C_2H_5OH, can be dehydrated to make ethene, C_2H_4.

$C_2H_5OH \longrightarrow C_2H_4 + H_2O$

Calculate the atom economy for the production of ethene from ethanol.

(The relative formula mass, M_r, of C_2H_5OH is 46.0 and of C_2H_4 is 28.0).

Atom economy = ... % **[2]**

5. Nov/2020/Paper_J248/02/No.15

Hydrogen gas, H_2, reacts with oxygen gas, O_2, to make water, H_2O.

$2H_2 + O_2 \rightarrow 2H_2O$

What is the **atom economy** for this reaction?

M_r: $H_2 = 2$, $O_2 = 32$, $H_2O = 18$.

A 50%

B 53%

C 89%

D 100%

Your answer ☐ **[1]**

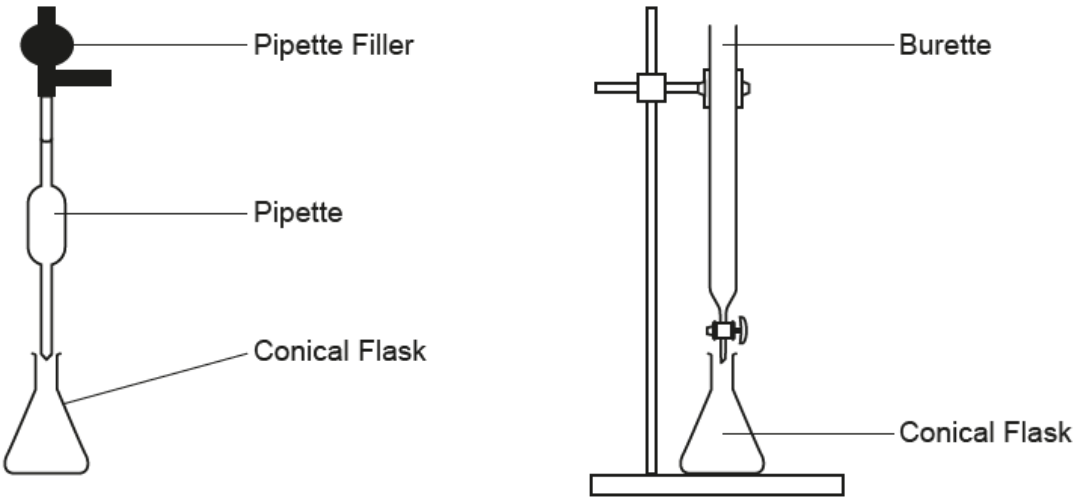
6. Nov/2020/Paper_J248/02/No.20

A student neutralises an alkali with an acid in a titration experiment.

(a) Complete the word equation for the reaction of an acid with an alkali.

acid + alkali ⟶ ..... + ... **[2]**

(b) Look at the student's method for her experiment.



- Measure 25.0 cm^3 of alkali solution into a conical flask using a pipette.
- Add a few drops of universal indicator to the alkali solution.
- Fill the burette to above the 0.0 cm^3 line with acid.
- Quickly add the acid to alkali until the indicator changes colour.
- Repeat the experiment until consistent results are obtained.

Describe and explain **one** improvement the student should make to her method to get a more accurate titration result.

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..... **[2]**

(c) The student repeats the experiment three times.

Look at the student's results.

Titration number	1	2	3
Volume of acid (cm^3)	25.75	23.60	23.70

Calculate the **accurate** volume of the acid that reacts with the alkali.

Accurate volume of acid = ... cm^3 **[2]**

7. Nov/2021/Paper_J248/04/No.5

A scientist predicts that they should make 96 tonnes of product in a reaction.

They only actually make 81 tonnes of product.

What is the **percentage yield**?

A 15%

B 19%

C 84%

D 119%

Your answer ☐ **[1]**

8. Nov/2021/Paper_J248/04/No.7

The concentration of a solution of sodium hydroxide, NaOH, is 0.725 mol/dm^3.

What is the concentration of this solution in **g/dm^3**?

(The relative atomic mass, A_r, of H is 1.0, of Na is 23.0 and of O is 16.0).

A 0.018 g/dm^3

B 29.0 g/dm^3

C 55.2 g/dm^3

D 725.0 g/dm^3

Your answer ☐ **[1]**

9. Nov/2021/Paper_J248/04/No.16(d)

(d) Ethanol, C_2H_5OH, can be dehydrated to make ethene, C_2H_4.

$$C_2H_5OH \rightarrow C_2H_4 + H_2O$$

Calculate the atom economy for the production of ethene from ethanol.

(The relative formula mass, M_r, of C_2H_5OH is 46.0 and of C_2H_4 is 28.0).

Atom economy = ... % **[2]**

10. Nov/2021/Paper_J248/04/No.22(a)

A company makes hydrogen iodide, HI, gas by reacting hydrogen gas with iodine gas.

Look at the equation for the reaction.

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(a) (i) What is the volume of hydrogen gas, in dm^3, needed to react with $150\,dm^3$ iodine at room temperature and pressure?

Use the balanced symbol equation to help you.

Volume of hydrogen = ... dm^3 **[1]**

(ii) Calculate the volume of hydrogen iodide formed, in dm^3, when $150\,dm^3$ of iodine completely reacts with hydrogen at room temperature and pressure.

Use the balanced symbol equation to help you.

Volume of hydrogen iodide = ... dm^3 **[1]**

(iii) Calculate the mass, **in kilograms**, of $150\,dm^3$ of iodine at room temperature and pressure.

One mole of any gas occupies $24\,dm^3$.

Give your answer to **1** decimal place.

(The relative molecular mass, M_r, of I_2 is 253.8).

Mass of iodine = ... kg **[4]**

11. Nov/2020/Paper_J248/03/No.12

Sodium hydroxide reacts with hydrochloric acid. Sodium chloride and water are made.

$NaOH + HCl \longrightarrow NaCl + H_2O$

What mass of sodium hydroxide would be needed to make 46.8 g of sodium chloride?

A 16 g

B 32 g

C 50 g

D 64 g

Your answer ☐ **[1]**

12. Nov/2020/Paper_J248/04/No.2

Hydrogen gas, H_2, reacts with oxygen gas, O_2, to make water, H_2O.

$2H_2 + O_2 \longrightarrow 2H_2O$

What is the **atom economy** for this reaction?

M_r: $H_2 = 2$, $O_2 = 32$, $H_2O = 18$

A 50%

B 53%

C 89%

D 100%

Your answer ☐ **[1]**

13. Nov/2020/Paper_J248/04/No.8

In the Haber process, nitrogen reacts with hydrogen to make ammonia.

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

What is the maximum volume of ammonia, NH_3, that can be made from 150 cm^3 of hydrogen, H_2?

A 50 cm^3

B 100 cm^3

C 225 cm^3

D 450 cm^3

Your answer ☐ **[1]**

14. Nov/2020/Paper_J248/04/No.12

Which is the correct expression for calculating the concentration of a solution in g/dm^3?

A $\text{Concentration} = \dfrac{\text{volume of solution in dm}^3}{\text{mass of solute in g}}$

B $\text{Concentration} = \dfrac{\text{amount of solute in mol}}{\text{mass of solute in g}}$

C $\text{Concentration} = \dfrac{\text{mass of solute in g}}{\text{volume of solution in cm}^3 \times 1000}$

D $\text{Concentration} = \dfrac{\text{mass of solute in g}}{\text{volume of solution in dm}^3}$

Your answer ☐ **[1]**

15. Nov/2020/Paper_J248/04/No.17(c ii)

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

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

His percentage yield is 80%.

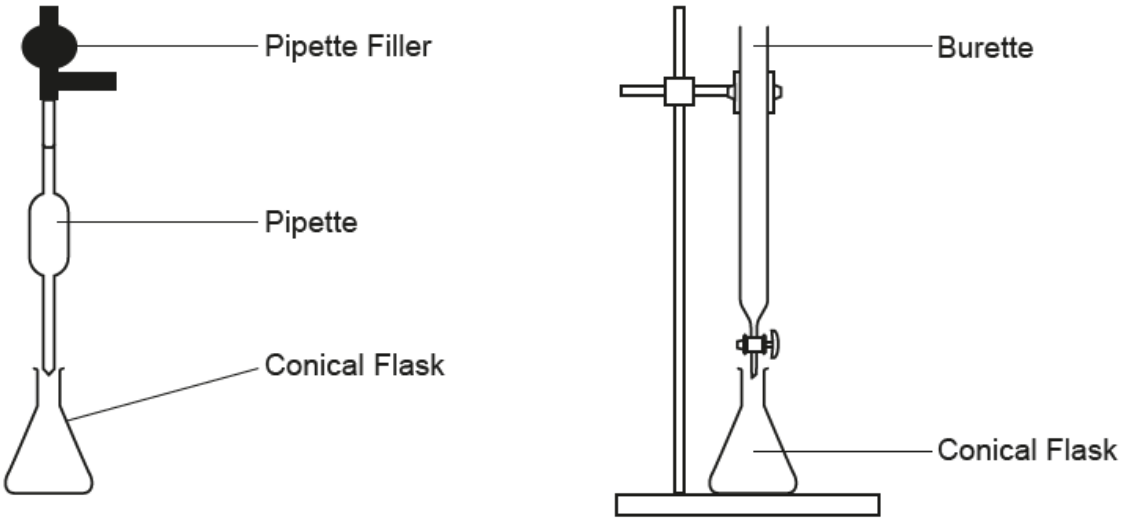
Calculate the **actual mass** of ammonium nitrate that the student makes.

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

16. Nov/2020/Paper_J248/04/No.21

A student neutralises potassium hydroxide with dilute sulfuric acid in a titration experiment.

(a) Look at the student's method for her experiment.



- Measure 25.0 cm^3 of 0.200 mol/dm^3 potassium hydroxide into a conical flask using a pipette.
- Add a few drops of universal indicator to the potassium hydroxide.
- Fill the burette to above the 0.00 cm^3 line with dilute sulfuric acid.
- Quickly add the dilute sulfuric acid to the potassium hydroxide until the indicator changes colour.
- Repeat the experiment.

Describe and explain **one** improvement the student should make to her method to get a more accurate titration result.

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..... **[2]**

(b) The student repeats the experiment four times.

Look at the student's results.

Titration number	1	2	3	4
Volume of acid (cm^3)	25.75	23.60	23.70	23.65

(i) Calculate the **accurate** volume of the acid that reacts with the alkali.

Accurate volume of acid = ... cm^3 **[2]**

(ii) Look at the equation for the reaction between sulfuric acid and potassium hydroxide.

$$H_2SO_4 + 2KOH \longrightarrow K_2SO_4 + 2H_2O$$

Use your answer from part **(b)(i)** to calculate the concentration of the dilute sulfuric acid, H_2SO_4, that reacted with the 25.0 cm^3 of 0.200 mol/dm^3 potassium hydroxide.

Give your answer to **3** significant figures.

Concentration of dilute sulfuric acid = ... mol/dm^3 **[4]**