Types of Reactions (H)

1. Magnesium powder reacts with copper(II) oxide. Magnesium oxide and copper are made.

$Mg + CuO \rightarrow MgO + Cu$

Which substance is the **reducing agent**?

A Magnesium
B Copper oxide
C Magnesium oxide
D Copper

Your answer ☐ **[1]**

2. Magnesium reacts with copper oxide.

Magnesium oxide and copper are made.

magnesium + copper oxide → magnesium oxide + copper

Which substance is the **reducing agent**?

A Copper
B Copper oxide
C Magnesium
D Magnesium oxide

Your answer ☐ **[1]**

3. * A student has unlabelled samples of three liquids.

The student knows that the three liquids are:

- pentane, C_5H_{12}
- pentene, C_5H_{10}
- ethanoic acid, CH_3COOH.

Describe tests that the student should do to identify each of the three liquids.

Include **balanced symbol** equations for the reactions described.

[6]

4. Sodium is in Group 1 of the Periodic Table.

Sodium ions, Na^+, are formed when sodium reacts with water.

Look at the equation. It shows how a sodium ion is formed from a sodium atom.

$Na - e^- \rightarrow Na^+$

The symbol e^- means an electron.

The formation of a sodium ion from a sodium atom is an example of **oxidation**.

Explain why.

[1]

5.

i. Sodium oxide reacts with water.

An aqueous solution of sodium hydroxide is made.

Write the **balanced symbol equation** for this reaction, including **state symbols**.

[3]

ii. Sodium hydroxide neutralises acids. It is an alkali.

Which ion do solutions of alkalis contain?

[1]

iii. A salt is made when sodium hydroxide neutralises sulfuric acid.

Name this salt.

[1]

iv. A sample of hydrochloric acid has a pH of 1.04.

A student adds water to the hydrochloric acid until the pH is 3.04.

The concentration of hydrogen ions decreases.

Calculate the factor by which the hydrogen ion concentration has decreased.

Decrease in hydrogen ion concentration = ... **[2]**

6. A farmer wants to test the pH of soil samples. He researches information about different pH test kits.

Look at the information he finds.

pH test kit	Price	pH of soil sample				
		pH 2	pH 4	pH 7	pH 9	pH 14
A	£4.95	Red	Yellow	Green	Blue	Purple
B	£10.99	Yellow	Yellow	Pink	Pink	Pink
C	£11.50	Pink	Orange	Yellow	Blue	Blue
D	£2.99	Colourless	Colourless	Colourless	Pink	Pink
E	£12.75	Red	Orange	Yellow	Yellow	Yellow

* Evaluate the advantages and disadvantages of the pH test kits and suggest which pH test kit the farmer should use.

[6]

7 (a). Hydrochloric acid, HC*l* (aq), is a strong acid. Ethanoic acid, CH_3COOH (aq), is a weak acid.

Explain the difference between a strong and a weak acid.

---**[2]**

(b).

i. Nitric acid, HNO_3, is another strong acid.

Nitric acid has a pH of 2.

The teacher adds enough water to reduce the concentration of the nitric acid by a factor of 100.

Calculate the new pH of the nitric acid.

pH = ... **[2]**

ii. Nitric acid, HNO_3, can also neutralise sodium hydroxide, NaOH.

Sodium nitrate, $NaNO_3$, and water are made.

Write a **balanced symbol** equation for this reaction.

---**[1]**

iii. Describe how dry sodium nitrate crystals can be made using this reaction.

---**[2]**

(c). A teacher investigates neutralisation. She uses hydrochloric acid, HC*l*, and sodium hydroxide, NaOH.

HC*l* + NaOH → NaC*l* + H_2O

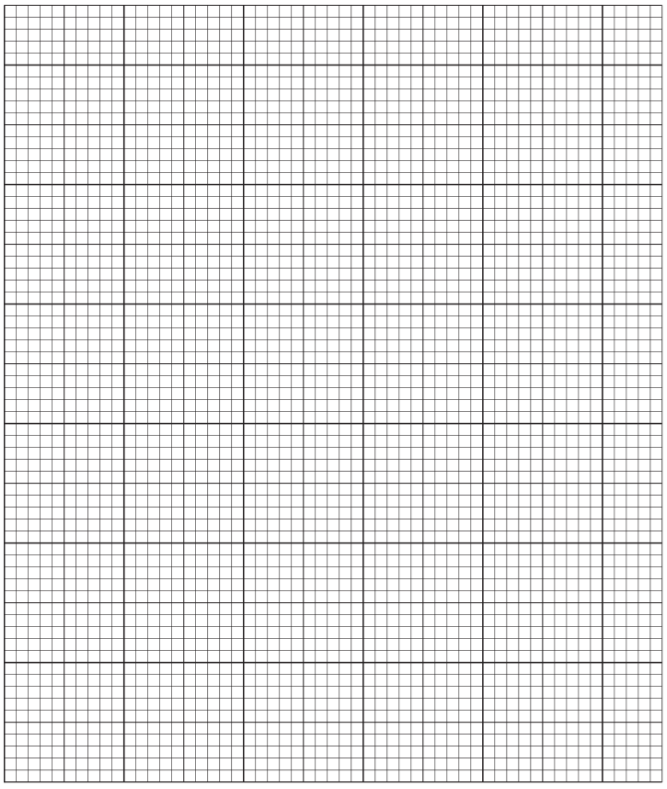
She slowly adds 1.0 cm^3 portions of the hydrochloric acid to 20.0 cm^3 of 1.0 mol / dm^3 sodium hydroxide.

She records the pH until she has added an excess of acid.

Look at her results.

Volume of hydrochloric acid added (cm^3)	pH
0	12.0
1	11.8
2	11.6
3	11.4
4	11.2
5	7.0
6	3.0
7	2.8
8	2.5
9	2.3
10	2.3

i. Plot a graph of the pH value against the amount of hydrochloric acid added and draw a line of best fit.



[3]

ii. Use your graph to estimate the **volume of hydrochloric acid** when the pH is 10.

Volume of hydrochloric acid = ... cm^3 **[1]**

iii. What happens to the **concentration of hydroxide ions**, OH^-, as the hydrochloric acid is added to the sodium hydroxide?

_____ **[1]**

iv. Acidic solutions contain hydrogen ions, H^+. Alkaline solutions contain hydroxide ions, OH^-.

Write the **balanced ionic** equation for neutralisation.

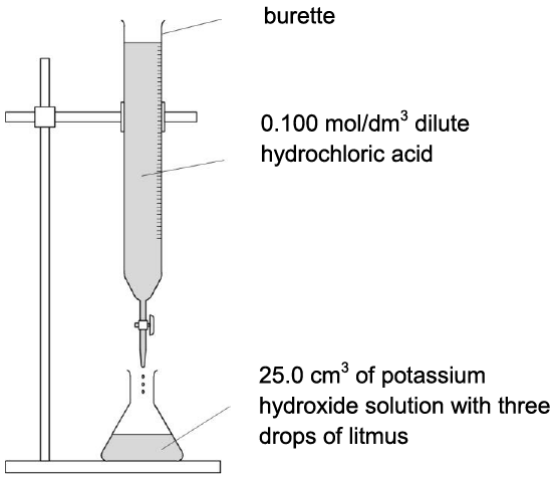
_____ **[1]**

8 (a). Sarah does three titrations with dilute hydrochloric acid and potassium hydroxide solution.

Hydrochloric acid neutralises the alkali potassium hydroxide.

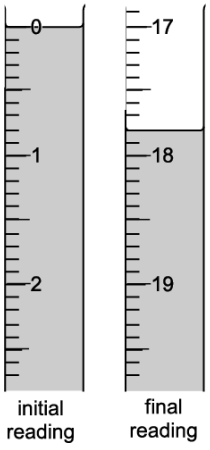
$$HCl(aq) + KOH(aq) \rightarrow KCl(aq) + H_2O(l)$$

Look at the apparatus she uses.



Look at the diagrams. They show parts of the burette during the first titration.

First titration



Here is Sarah's results table:

Titration number	1	2	3
final reading (cm^3)		37.5	32.1
initial reading (cm^3)		20.4	15.0
titre (volume of acid added) (cm_3)		17.1	17.1

Use the diagrams and table to help you calculate the mean titre.

Explain your answer.

Mean titre = ... cm^3 **[2]**

(b). Sarah uses 25.0 cm^3 of potassium hydroxide solution, KOH.

She also uses hydrochloric acid with a concentration of 0.100 mol/dm^3.

Calculate the concentration, in mol/dm^3, of the KOH(aq).

Concentration of KOH(aq) = ... mol/dm^3 **[2]**

(c). Use your answer to **(b)** to calculate the concentration of the KOH(aq) in g/dm^3.

Concentration of KOH(aq) = ... g/dm^3 **[2]**

9. Ammonium sulfate is a salt.

It is made using the reaction between the alkali ammonia and sulfuric acid.

$$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$$

i. Describe how a sample of solid ammonium sulfate is prepared in a laboratory.

Explain why this method is not suitable to be used industrially.

_____

_____

_____

_____

_____

_____ **[4]**

ii. Predict the maximum mass of ammonium sulfate that can be made from 51 tonnes of ammonia.

Maximum mass = ... tonnes **[2]**

10. A student adds calcium to dilute hydrochloric acid. The mixture begins to fizz.

Write a balanced symbol equation for this reaction.

_____ **[2]**

11. Magnesium burns in oxygen to make magnesium oxide.

The reaction involves both oxidation and reduction.

$$2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$$

magnesium + oxygen ⟶ magnesium oxide

Complete the sentence.

During this reaction, the oxidising agent is ..... and the

reducing agent is .....

[1]

12 (a). Zinc nitrate can be made by reacting zinc oxide with nitric acid, HNO_3.

Paul suggests this method for preparing zinc nitrate.

1. Measure 50cm^3 of dilute nitric acid into a beaker. 2. Add one spatulaful of zinc oxide. 3. Heat the mixture until crystals of zinc nitrate are made.

Paul's method will not make a pure dry sample of zinc nitrate.

What improvements should Paul make to the method to make sure that:

- the reaction is complete
- the zinc nitrate can be separated from the nitric acid and the zinc oxide?

Explain your answer.

_____

_____

_____

_____

_____

_____ **[4]**

(b). Describe why this reaction is a neutralisation reaction.

_____

_____

_____ **[2]**

13. Which of these is the **best** explanation of what is meant by a strong acid?

A. There is a large amount of acid and a small amount of water.
B. There is a small amount of acid and a large amount of water.
C. The acid is completely ionised in solution in water.
D. The acid is partially ionised in solution in water.

Your answer ☐

[1]

14. Ann neutralises nitric acid with potassium hydroxide solution.

Which of these shows the **ionic** equation for neutralisation?

A. $HNO_3 + KOH \longrightarrow KNO_3 + H_2O$
B. $H^+ + OH^- \longrightarrow H_2O$
C. $NO_3^- + K^+ \longrightarrow KNO_3$
D. $H^+ + NO_3^- \longrightarrow HNO_3$

Your answer ☐

[1]

15. A student investigates some acids.

She has a solution of hydrochloric acid of concentration 0.01 mol/dm^3.

This solution has a pH of 2.

She increases the concentration of hydrochloric acid from 0.01 mol/dm^3 to 0.1 mol/dm^3.

What is the pH of this new solution?

A. 0
B. 1
C. 3
D. 12

Your answer ☐

[1]

16. Hardeep does some experiments with acids and alkalis.

He measures the pH of a sample of acid and a sample of alkali.

He adds magnesium metal to a sample of the acid and to a sample of the alkali.

What results should Hardeep expect?

	Results for acid experiments	**Results for alkali experiments**
A ☐	pH below 7 no reaction with magnesium	pH above 7 magnesium fizzes
B	pH below 7 magnesium fizzes	pH above 7 no reaction with magnesium
C	pH above 7 magnesium fizzes	pH above 7 no reaction with magnesium
D	pH above 7 no reaction with magnesium	pH below 7 magnesium fizzes

Your answer

[1]

END OF QUESTION PAPER