GCSE
CHEMISTRY

Chemistry Test 2: Chemical changes (Foundation)
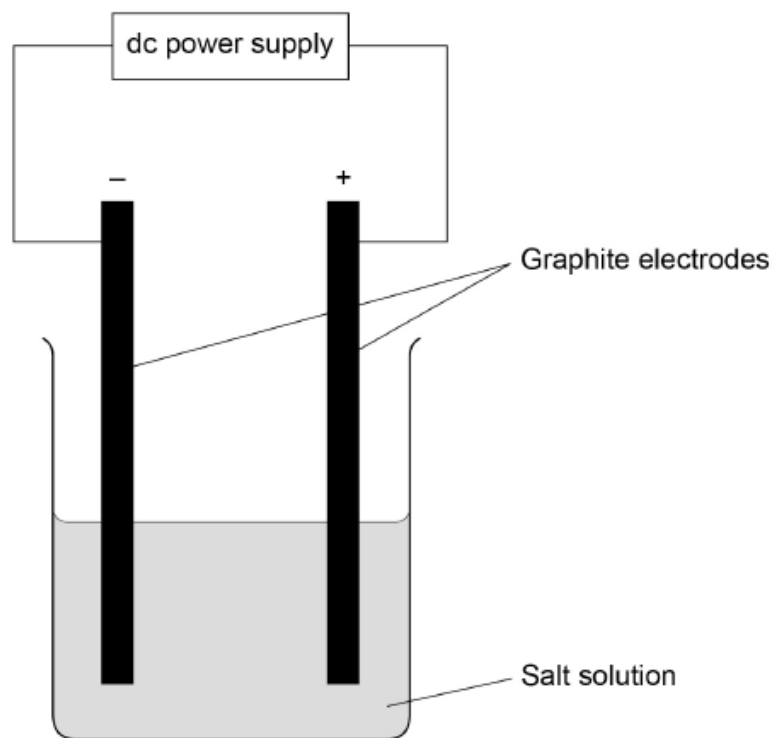
Total number of marks: 36

0 4   This question is about electrolysis.

A student investigated the hypothesis:

'The electrolysis of a salt solution produces a metal at the negative electrode and a gas at the positive electrode.'

Figure 4 shows the apparatus used.

Figure 4

0 4 . 1   What observation would be made at each electrode if the hypothesis is correct?

[2 marks]

Observation if metal produced at the negative electrode _solid formed_

_____

Observation if gas produced at the positive electrode _bubbles of gasses_

released

Table 3 shows the student's results.

Table 3

Salt solution	Product at the negative electrode	Product at the positive electrode
Copper chloride	Copper	Chlorine
Potassium nitrate	Hydrogen	Oxygen
Silver nitrate	Silver	Oxygen

0 4 . 2 Which salt solution in **Table 3** does **not** match the student's hypothesis?

Give **one** reason why.

[2 marks]

Salt solution potassium nitrate

Reason potassium is more reactive than hydrogen

0 4 . 3 Give **two** reasons why graphite is used for the electrodes.
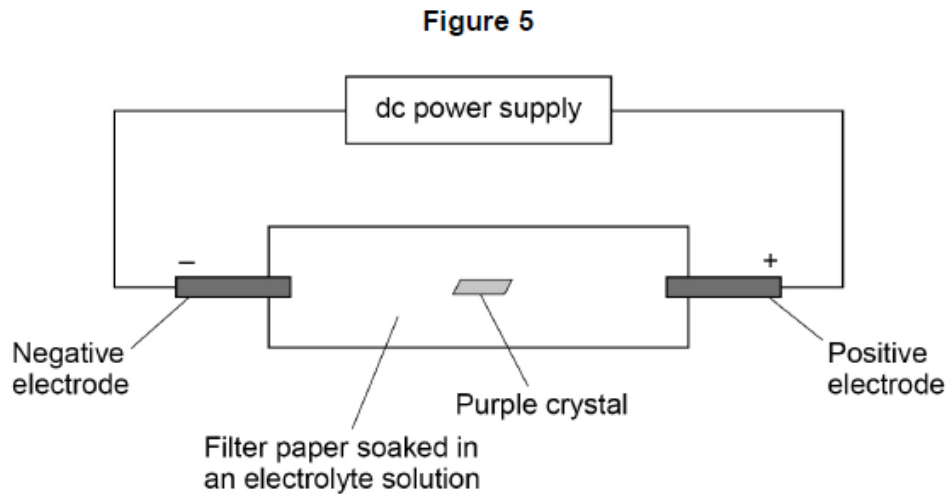
[2 marks]

1 graphite conducts electricity

2 graphite is inert so it does not interfere with the
electrolysis reactions

A different student investigated what happens during electrolysis.

Figure 5 shows the apparatus.

Figure 5

The purple crystal contained:

- colourless positive ions
- purple coloured negative ions.

The purple crystal dissolved in the electrolyte solution.

| 0 | 4 | . | 4 | What happens to the purple coloured ions?

Give **one** reason for your answer.

[2 marks]

Tick (✓) **one** box.

The ions do not move. ☐

The ions move towards the negative electrode. ☐

The ions move towards the positive electrode. ✓

Reason negatively charged ions will be attracted to the positive electrode

| 0 | 5 |

This question is about aluminium.

Aluminium is extracted by electrolysis.

The aluminium oxide is mixed with cryolite and melted.

The mixture is then electrolysed.

| 0 | 5 |.| 6 |

What is the reason for adding cryolite to the aluminium oxide?

[1 mark]

Tick (✓) **one** box.

To increase the amount of aluminium extracted ☐

To lower the melting point of the mixture ✓

To reduce the amount of aluminium oxide needed ☐

| 0 | 5 |.| 7 |

Complete the sentences.

Choose answers from the box.

[2 marks]

aluminium	carbon	fluorine
oxygen	sodium	

When the molten aluminium oxide and cryolite mixture is electrolysed the product

at the positive electrode is ___oxygen___.

This product reacts with the positive electrode because the positive electrode is

made of ___carbon___.

| 0 | 5 | . | 8 | A sample of bauxite contains 25% aluminium.

Calculate the maximum mass of aluminium that can be extracted from 300 000 kg of the sample of bauxite.

Give your answer in standard form.

[3 marks]

$0.25 \times 300\,000 = 75000$ kg

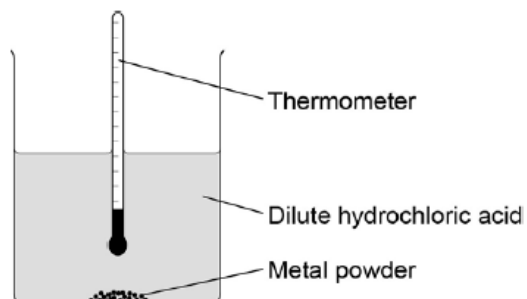$= 7.5 \times 10^4$ kg

Maximum mass (in standard form) = _____ 7.5×10^4 _____ kg

| 0 | 4 | A student investigated the reactivity of different metals.

The student used the apparatus shown in **Figure 7**.

Figure 7

Thermometer

Dilute hydrochloric acid

Metal powder

The student used four different metals.

The student measured the temperature rise for each metal three times.

The student's results are shown in **Table 3**.

Table 3

Metal	Temperature rise in °C			Mean temperature rise in °C
	Test 1	Test 2	Test 3	
Calcium	17.8	16.9	17.5	
Iron	6.2	6.0	6.1	6.1
Magnesium	12.5	4.2	12.3	12.4
Zinc	7.8	8.0	7.6	7.8

0 4 . 2   One of the results for magnesium is anomalous.

Which result is anomalous?

Suggest **one** reason why this anomalous result was obtained.

[2 marks]

Result   4.2 °C

Reason   the temperature was taken before the reaction has been completed.

0 4 . 3   Calculate the mean temperature rise for calcium.

[1 mark]

$$\frac{17.8+16.9+17.5}{3} = \frac{52.2}{3}$$

$$= 17.4$$

Mean temperature rise   =   17.4   °C

0 4 . 4   The temperature rose when the metals were added to sulfuric acid.

Give **one** other observation that might be made when the metal was added to sulfuric acid.
How would this observation be different for the different metals?

Bubbles are released. This is more vigorous in metals with higher reactivity. when the gas is tested with a **[2 marks]** lighted splint, a pop sound is produced.

0 4 . 5   Aluminium is more reactive than iron and zinc but less reactive than calcium and magnesium.

Predict the temperature rise when aluminium is reacted with dilute hydrochloric acid.

[1 mark]

_____

Temperature rise = _____10_____ °C

0 7   This question is about acids, bases and salts.

Zinc nitrate is a salt.

A student produces zinc nitrate using an acid and a base.

A student investigated how pH changes during a titration.

This is the method used.

1. Pour 25.0 cm^3 of hydrochloric acid into a beaker.

2. Measure the pH of the hydrochloric acid with a pH probe.

3. Add 1.0 cm^3 of sodium hydroxide solution from a burette.

4. Swirl the mixture.

5. Measure the pH of the mixture.

6. Repeat steps 3 to 5 until a total of 30.0 cm^3 of sodium hydroxide solution has been added.

Figure 10 shows the student's results.

Figure 10
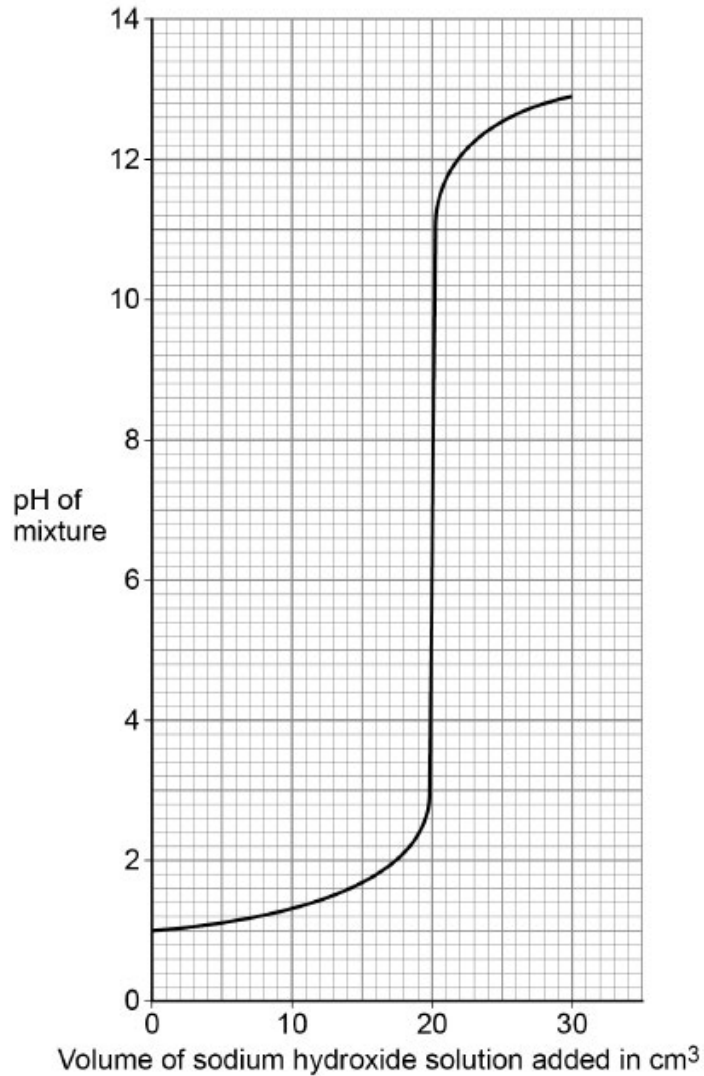
0 7 . 4 Describe how the pH of the mixture changes as sodium hydroxide solution is added to hydrochloric acid.

Use data from **Figure 10** in your answer.

[3 marks]

The pH of HCl is 1. When NaOH is added, the pH of the mixture increases gradually. When 20cm³ of NaOH has been added, the end point is reached and pH increases significantly.

0 7 . 5 What volume of sodium hydroxide solution is needed to neutralise 25.0 cm³ of hydrochloric acid?
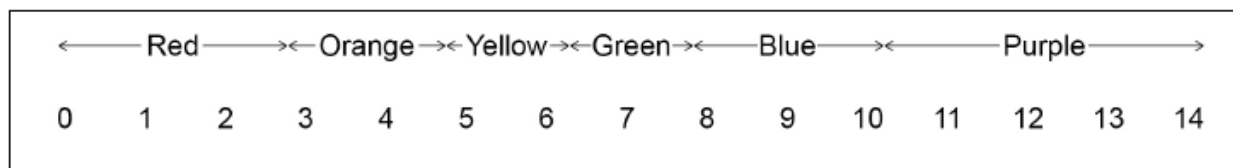
Use **Figure 10**.

[1 mark]

Volume = _____20_____ cm³

pH continues to increase as more NaOH is added. When 30cm³ of NaOH has been added, the mixture has a pH of about 12.9.

0 7 . 6   **Figure 11** shows the colour of universal indicator at different pH values.

Figure 11

← Red →	← Orange →	← Yellow →	← Green →	← Blue →	← Purple →

0   1   2   3   4   5   6   7   8   9   10   11   12   13   14

The student could have used universal indicator instead of a pH probe.

Determine the colour of universal indicator when 10.0 cm³ of
sodium hydroxide solution has been added to 25.0 cm³ of hydrochloric acid.

Use **Figure 10** and **Figure 11**.

[1 mark]

Colour = ___red___

0 7 . 7   The student used a pipette to measure 25.0 cm³ of hydrochloric acid.

Figure 12 shows a pipette.

Figure 12

Pipette

The pipette is labelled 25.0 ± 0.06 cm³

Calculate the percentage uncertainty in the volume measured using this pipette.

Use the equation:

$$\text{percentage uncertainty} = \frac{\text{uncertainty}}{\text{volume measured}} \times 100$$

[2 marks]

$$\frac{2 \times 0.06}{25} \times 100 = 0.48\%$$

Percentage uncertainty = ___0.48___ %

0 7 . 8 Give **one** advantage of using a pipette rather than using a measuring cylinder to measure the volume of hydrochloric acid.

[1 mark]

more accurate

**0 8** Soluble salts are formed by reacting metal oxides with acids.

0 8 . 1 Give **one** other type of substance that can react with an acid to form a soluble salt.

[1 mark]

metal hydroxide

0 8 . 2 Calcium nitrate contains the ions Ca^{2+} and NO_3^-

Give the formula of calcium nitrate.

[1 mark]

$Ca(NO_3)_2$

0 8 . 3 Describe a method to make pure, dry crystals of magnesium sulfate from a metal oxide and a dilute acid.

[6 marks]

$MgO (s) + H_2SO_4 (aq) \rightarrow MgSO_4 (aq) + H_2O$
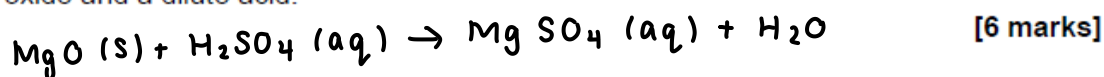
1. Place MgO in excess into a beaker containing H_2SO_4. Stir the mixture until MgO does not dissolve anymore.
2. Filter the mixture to remove excess MgO.
3. Place the solution in an evaporating basin. Warm the solution by placing the evaporating basin in a boiling water bath until the cystallisation point is reached.
4. Dry the crystals using filter paper.