PROVISIONAL MARKING KEY

CHEMISTRY II

1. Describe an experiment that could be carried out to prepare nitric acid in the laboratory.

Procedure:

a. Set up (1 mark) the apparatus where a retort flask is connected (1 mark) to round bottomed flask.

b. Put (1 mark) 25g of potassium nitrate, $KNO_{3(s)}$ in the retort flask (1 mark).

c. Add (1 mark) $30cm^3$ of concentrated sulphuric acid to cover (1 mark) the potassium nitrate in the retort flask.

d. Run (1 mark) the tap water to the round-bottomed flask to condense (1 mark) the acid vapour produced.

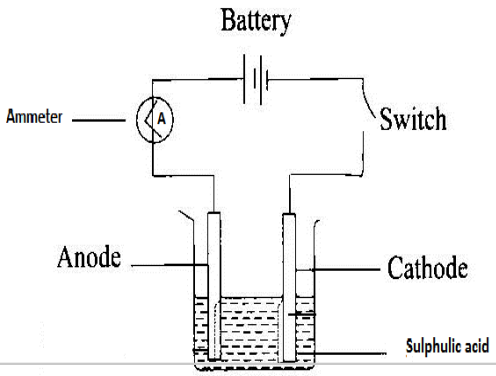
e. Heat (1 mark) the retort flask gently.

f. Observe (1 mark) the colour of the liquid acid produced in round-bottomed flask.

(Total 10 marks)

(Amounts of different substances can be any, provided they are matching with laboratory activities).

2.



- **1 mark** for correct diagram
- **1 mark** for correct label
- ions present in the solution are H^+ and SO_4^{2-} from sulphuric acid and

  H^+ and OH^- from water. **(1 mark)**

- Both SO_4^{2-} and OH^- move to the anode to discharge (lose the charge) but it is OH^- that discharges in preference to SO_4^{2-} (**1 mark**) forming 2 molecules of water, one molecule of oxygen and 4 electrons according to the equation:

  $4OH^-_{(aq)} \rightarrow 2H_2O(l) + O_2(g) + 4e^-$ **(1 mark)**

- Oxygen gas produced is liberated at the anode while the 4 electrons move **(1 mark)** to the cathode via external circuit.
- H^+ move to the cathode to discharge by 4 electrons producing hydrogen gas **(1 mark)** according to the equation:

  $4H^+_{(aq)} + 4e^- \rightarrow 2H_{2(g)}$ **(1 mark)**

- Hydrogen gas produced is liberated at the cathode. **(1 mark)**
- Therefore, it can be said that electrolysis of dilute sulphuric acid is simply electrolysis of water since $H_{2(g)}$ and $O_2(g)$ are produced at the electrodes in the ratio of 2:1 similar to chemical composition of the water molecule. **(1 mark)**

3.

Liquid in test tube	Initial Temperature(°C)	Substance added	Final Temperature(°C)	Temperature change (°C)
Water		Sodium hydroxide		
water		Ammonium nitrate		

Any suitable / applicable temperature change

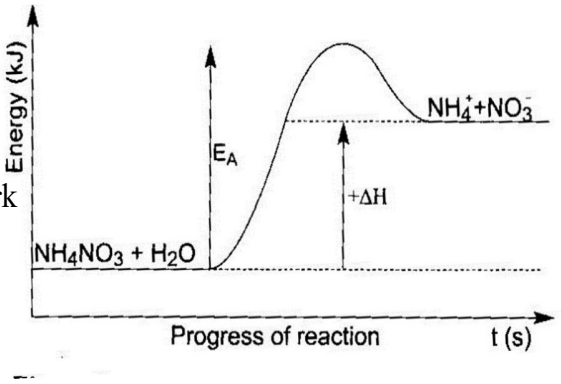
1 mark for both initial temperatures

1 for each final temperature

(5 marks)

Exothermic reaction:	dissolving of sodium hydroxide	1
Endothermic reaction:	dissolving of ammonium nitrate	1

i.



1 mark

1 mark

- Part of activation energy is optional
- 1 mark for arrow or positive ΔH
- 1 mark for labelled axis
- 1 mark for correct position of reactants and products

4. Initial volume: 0ml

Final volume:	10ml	2
Volume used:	10ml	2

$2\,NaOH(aq) + H_2SO_{4(l)} \rightarrow Na_2SO_4(aq) + 2H_2O(l)$ 1 equation

1 balancing

$$\frac{Concentration \times volume}{no.\,of\ moles}\ (\text{acid}) = \frac{Concentration \times volume}{no.\,of\ moles}\ (\text{base})$$

$$\frac{concentration \times 10\,ml}{1\,mole} = \frac{0.1\,M \times 10\,ml}{2\,moles}\ (\text{acid})$$

1 substitution

$$\text{Concentration} = \frac{0.1\,M \times 10\,ml \times 1\,mole}{10\,ml \times 2\,moles}$$

1 simplification

Concentration = 0.05 M 1 answer

End of marking key