

1. A newly discovered element represented by the symbol X is suspected to belong to group I of the periodic table.

- i. Describe an experiment you would do to prove that the element belongs to group I.

Procedure

1. Place all the requirements on demonstration bench.
2. Remove a small piece of element X and place it on ceramic tile covered with filter paper using a pair of tongs.
3. Cut a small piece of element X using sharp razor blade or scapel and return the rest into the bottle.
4. Observe the reaction.
5. Test the solution with red litmus paper (5 marks)

Observation

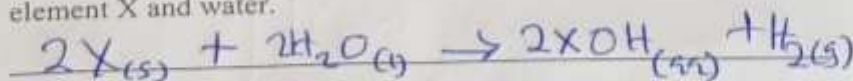
The reaction may be slow, vigorous or explosive and turn red litmus blue or remain the same. (1 mark)

Conclusion

If the reaction is vigorous/explosive and changes red litmus blue, the element X is an alkali metal. If the reaction is slow and red litmus paper maintains its colour, then X is not a group I element. (2 marks)

(8 marks)

- ii. Write a balanced chemical equation for the reaction between element X and water.



(2 marks)

2. Describe an experiment that could be done to find the concentration of HCl using 0.1 M of NaOH by titration.

1. Put all the requirements on a bench. (1 mark)
2. Pour the acid into the burette ~~up to~~ to zero (1 mark) mark.
3. Put a measured volume of NaOH in (1 mark) a conical flask.
4. Add few drops of phenolphthalein (1 mark) indicator in the flask and observe the colour change.
5. Add the HCl into the flask gradually (1 mark) while swirling the flask.
6. Stop where there is colour change (1 mark) is observed in the flask.
7. Record the reading of the HCl (1 mark) in the burette.
8. Find the volume of the acid used (1 mark)
9. Write a balanced chemical equation (1 mark)

$$\text{NaOH}_{(aq)} + \text{HCl}_{(aq)} \rightarrow \text{NaCl}_{(aq)} + \text{H}_2\text{O}_{(l)}$$
10. Work out the concentration of HCl (1 mark) using the formula:

$$C_1 V_1 = C_2 V_2 \text{ or } M_1 V_1 = M_2 V_2$$

(10 mark)

3. You are provided with 3 pieces of aluminum foil, 3 pieces of copper foil, 3 iron nails, copper sulphate (CuSO_4) solution, aluminium nitrate ($\text{Al}(\text{NO}_3)_3$) solution, iron sulphate (FeSO_4) solution, a measuring cylinder, distilled water in a wash bottle and 3 test tubes in a test tube rack.

- Put 3cm^3 of each of the solution into separate test tubes.
- Put a piece of aluminum foil in each test tube.
- Leave the pieces of aluminum foil in the solutions for a minute.
- Observe any changes and record your observation in table 1.

Table 1

Solution Metal	Copper Sulphate	Aluminium Nitrate	Iron Sulphate
Copper		No reaction	No reaction
Aluminium	Reaction		Reaction
Iron	Reaction	No reaction	

(6 marks)

- Rinse the test tubes with distilled water.
- Repeat steps a to e using copper foil and iron nails.
- How did you know whether a reaction took place or not.

- production of bubbles / change of colour / coating
(1 mark)

- Arrange the metals in order of reactivity, with the most reactive metal at the top.

↑ Aluminium (Al)
Iron (Fe)
Copper (Cu)

(3 marks)

4. You are provided with sodium hydroxide (NaOH) pellets, ammonium chloride (NH₄Cl), distilled water, a thermometer, stirring rod, a measuring cylinder, a spatula, test tube and test tube rack.
- Fill the test tube half-full of distilled water.
 - Measure the initial temperature of the water and record it in the table of results.
 - Add 5 pellets of NaOH to the distilled water and stir until the pellets dissolve.
 - Measure the temperature of the solution and record it in the table of results.
 - Repeat steps a to d using half a spatula of NH₄Cl and state whether the reaction is 'exothermic' or 'endothermic' in the table provided.

Table of Results

SOLUTION	Initial Temp (°C)	Final Temp (°C)	Type of reaction
NaOH _(s) + H ₂ O _(l)			Exothermic
NH ₄ Cl _(s) + H ₂ O _(l)			Endothermic

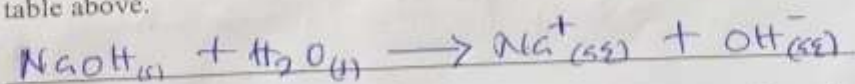
(6 marks)

- f. Explain the difference between exothermic and endothermic reaction in terms of temperature change.

Exothermic reaction releases heat which raises temperature of the surrounding while endothermic reaction absorbs heat from the surrounding hence lowering temperature.

(2 marks)

- g. Write the chemical equation for the exothermic reaction stated in the table above.



(2 marks)

End of question paper