

1. You are provided with the following solutions;
M: Containing 0.1M hydrochloric acid solution.
N: Containing 2.65g of X_2CO_3 per 0.5dm³ of solution.
MO: Methyl orange indicator.

Questions:

- (a) (i) Titrate **M** (in burette) against **N** (in a conical flask) using two drops of your indicator and obtain three titre values. Record your results in tabular form.
- (b) (i). _____ cm³ of **N** required _____ cm³ of **M** for complete reaction.
- (ii) Write a balanced chemical equation between **N** and **M** and the corresponding ionic equation with state symbols.
- (iii). Showing your procedures clearly, calculate the molar mass of X_2CO_3 and hence identify element **X**.
- (iv). Write down an electronic configuration of element **X**.
- (v). Identify the group and periodic number of an element **X**.

2. You are provided with the following;

Solution **BB:** 0.25Moldm⁻³ of sodium thiosulphate ($Na_2S_2O_3$).

Solution **DD:** 2M hydrochloric acid (HCl).

Distilled water, Stop watch, Thermometer and a sheet of white paper marked **X**.

Procedures:

Place 150cm³ of water in the 250cm³ beaker and use this as your water bath, heat the water to 80°C. Measure 10cm³ of **BB** and 25cm³ of water and pour the contents into 100cm³ beaker. Put the beaker with the contents into a hot water bath, When the contents attain a temperature of 70°C place the beaker on the top of the mark **X** on the paper provided. Add 10cm³ of **DD** and immediately start the stop watch. Swirl the beaker twice and look vertically on top of the beaker so as to see **X** through the bottom of the beaker. Stop the clock when **X** is invisible.

Record the time taken for **X** to disappear completely. Repeat the experiment at different temperatures as shown in the table.

Table 1

Experiment No.	Temperature (°C)	Time (sec)	Rate 1/t (S ⁻¹)
1	70		
2	60		
3	50		
4	40		
5	Room Temperature		

Questions

- (a) Complete filling table 1.
- (b) Write down a balanced chemical equation for the reaction between **BB** and **DD**.
- (c) Which product causes the solution to cloud the letter **X**.
- (d) Plot the graph of rate 1/t against temperature.
- (e) What conclusion can you draw on your graph?