Name: _____( ) Class: 4E____ Date: _____

Experiment R3: Effect of Temperature and Qualitative Analysis

Aim: To investigate the effect of temperature on the speed of reaction and to determine identity of the acid used.

Description: The time taken for a metal to react with an acid at a certain temperature is a measure of the rate of reaction between the metal and the acid at that temperature.

In this experiment, you are to investigate the effect of temperature on the speed of reaction between magnesium ribbon and acid **A**.

Apparatus: and Chemicals

Boiling tube	Bunsen burner
250 cm^3 beaker	Tripod stand
25 cm^3 measuring cylinder	Wire gauze
Thermometer	Lighter
Stop watch	Magnesium ribbon (5 pieces)
Test tubes (5)	Acid A
Test tube rack	Usual lab bench reagents
Test tube holder	Litmus paper
Delivery tube and stopper	

Safety Warning:

- Aqueous ammonia is an irritant.
- Aqueous sodium hydroxide and aqueous silver nitrate are corrosive.

Read through the following instructions before starting the experiment. Record and present all your readings/measurements in an appropriate manner.

Part I :

To investigate the effect of temperature on the speed of reaction between magnesium and acid **A.**

1 Measure 20 cm^3 of acid **A** and place it into a boiling tube.

2 Measure and record the initial temperature of acid **A**.

3 Add a piece of magnesium ribbon to the acid and start timing immediately. Gently stir the mixture in the boiling tube with the thermometer. Record the time when the magnesium has just completely dissolved in the acid.

4 Wash the boiling tube with distilled water.

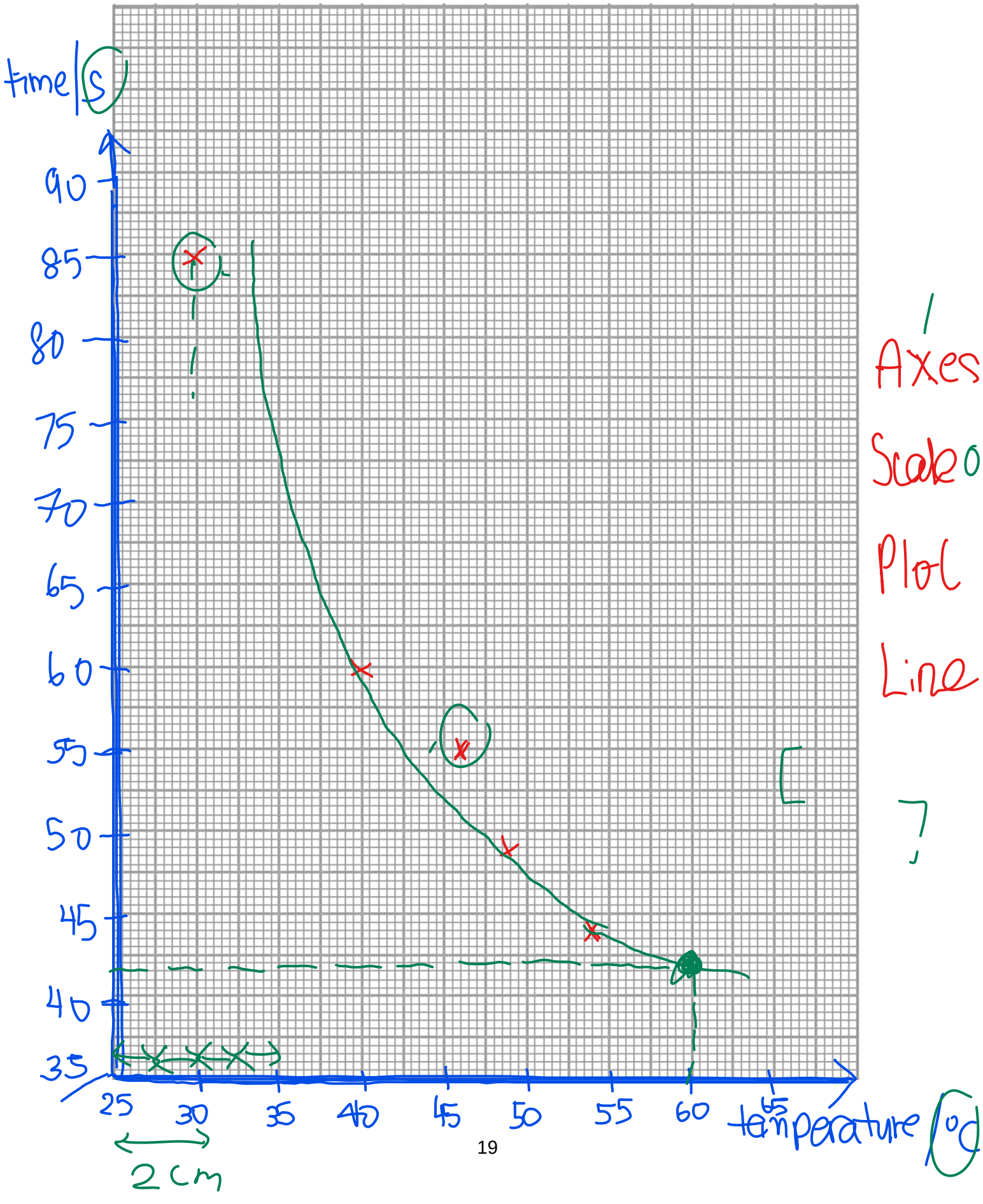
5 Repeat the experiment 4 more times at various temperatures not higher than 55°C. Place the boiling tube in a beaker of water and heat the beaker with a Bunsen burner. When the acid **A** reaches the desired temperature, remove the boiling tube from the beaker. Measure and record the temperature of acid. Then add a piece of magnesium ribbon to the acid **A**. Gently stir the mixture in the boiling tube with the thermometer. Record the time when the magnesium has just completely dissolved in the acid.

Results for Part I: temp 1 dp. [4]

temperature of acid / °C	time taken for magnesium to react / s
30.0	85
40.0	60
46.0	55
49.0	49
53.0	43

[4]

6(a) Plot a graph of the time taken for magnesium to react with acid **A** against temperature and give a conclusion on the effect of temperature on the rate of reaction between magnesium and acid.



Conclusion:

The higher the temperature of the acid, the shorter the time taken for the magnesium to completely dissolve [1]. The speed of reaction increases with increasing temperature [1].

(b) Explain the conclusion in **(a)**. theory

As the temperature increases, the reacting particles gain more kinetic energy and the particles move faster, colliding more frequently. As such, there is an increase in the number of reacting particles colliding with energy equals to or greater than activation energy and the frequency of effective collisions increases, increasing the rate of reaction.

7. **From your graph**, deduce the time for magnesium to react with acid A at 60ºC.
Show clearly **on the grid** how you worked out your answer.

Time taken = 49.6 s ref

8. Identify one key source of experimental error and explain how it affects the results.

There is a layer of oxide formed from magnesium. As such, not all the magnesium reacted and the reaction time taken would be shorter than expected. /

The temperature throughout the reaction was not able to be held constant. As such, the time recorded for the reaction is affected, with a higher temperature leading to a shorter time and a lower temperature leading to a longer time. /

Human reaction time due to the delay in starting the stopwatch. As such, the time taken recorded will be shorter than expected. /

Human reaction time due to the delay in stopping the stopwatch. As such, the time taken recorded will be longer than expected. /

There is inconsistent stirring leading to an inaccurate time recorded.

Part II :

To determine the identity of the acid **A**
Carry out the following tests on acid **A** and record your observations. You should test and name any gas evolved

9. To a portion of **A** in a test tube, add aqueous barium nitrate, followed by nitric acid.

Solution remains colourless / No visible change.

10. To another portion of **A** in a test tube, add aqueous silver nitrate, followed by nitric acid.

White precipitate formed.

11. To another portion of **A** in a test tube, add 1 cm^3 of dilute sodium hydroxide and a piece of aluminium foil. Warm the test tube gently. Identify any gas given off.

Solution remains colourless. On warming, no effervescence is observed and both moist litmus papers remained the same colour.

12. Using your results in Part II, identity the cation and anion present in **A** and hence name the acid present in **A**.

cation is hydrogen ion / H^+, anion is chloride ion / Cl^-.

Name of acid: hydrochloric acid