DATA ANALYSIS:

What are the similarities and differences in the behavior of these compounds? Can you find out any generalization concerning all chemical reactions here? What conclusion can be drawn from these data?

Ans: The similarities of these compounds that they all dissolve in water. The differences of these compounds that where $NaNO_3$, NH_4NO_3 and NaCl absorve temperature when they dissolve in water and $CaCl_2 \cdot 2H_2O$ is realising temperature. From all those chemical reaction occured here, we can say that heats which maybe exothermic or endothermic are associated with chemical reaction.

Conclution: When reaction occure in aquaous condition, formation and dissociation of chemical bonds occure simultaneously.

PART II. QUANTITATIVE

DATA COLLECTION:

a. Accurately weigh a 3 to 5 gm sample of $MgSO_4$ on the analytical balance. Record the exact mass here. For 4 different trials below measure four different weight samples (e.g., 1,2, 4 & 5 grams respectively).

b. Suspend the thermometer into a polystyrene cup/coffee cup. Make sure of the thermometer is not touching the bottom of the cup. Measure 100 mL of distilled water by a volumetric cylinder into the cup and stir for 240 second. Record the temperature in every 30 seconds. After 240 seconds add $MgSO_4$ with vigorous mixing while continuing to record data for 5 minutes.

c. Determine the temperature change, ΔT, for the reaction. This can be done from the difference of the highest temperature minus the slope of the line go through the points from first 240 seconds of data.

d. Draw a temperature vs. time graph. Draw the best curve through the points and

d. CHANGES IN THIS EXPERIMENT (TO BE COMPLETED WHEN THE INSTRUCTOR DEMONSTRATE IN CLASS):

Answer :

In this experiment we can see that so many changes occured. This changes occurse when we change the quantity of compounds. When we dissolve $MgSO_4$ in water, it released heat. When we increase the quantity of water, the heat is ~~readi~~ released more. When we increase the quantity more, it released more heat. So, now we can say that, the quantity of compound is accociated with heat.

DATA ANALYSIS

a. Calculate the heat,Q, of the reaction from the equitation Q = C x M x ΔT. Assume C = 4.18 Joules/gram ^{0}C and M is the mass of water (take the water density as 1.00 grams/cm^3).

For trial 1, $Q_1 = (4.18 \times 30 \times 1)$ J = ~~12.54 J~~ 125.4 J

For trial 2, $Q_2 = (4.18 \times 30 \times 1.5)$ J = 188.1 J

For trial 3, $Q_3 = (4.18 \times 30 \times 0.1)$ J = 12.54 J

For trial 4, $Q_4 = (4.18 \times 30 \times 0.5)$ J = 62.7 J

b. Plot the collected data as moles vs.Q. Number of moles can be calculated as n = (mass of sample in gram) / (molecular weight in grams/mole). Try to find an algebraic equation.

Molar mass of $MgSO_4$ = 120.366 g/mol

For trial 1, $n_1 = (2/120.366) = 0.0167$ g mol^{-1}

For trial 2, $n_2 = (3/120.366) = 0.0249$ g/mol

For trial 3, $n_3 = (4/120.366) = 0.0332$ g/mol

For trial 4, $n_4 = (5/120.366) = 0.0415$ g mol^{-1}

Equation; $Q = C \times M \times \Delta T$

$= C \times M \times \frac{m}{M} \times \Delta T$

$= C \times M \times n \Delta \Delta T$

$= S \times n \times \Delta T$ [S molar Related Heat]

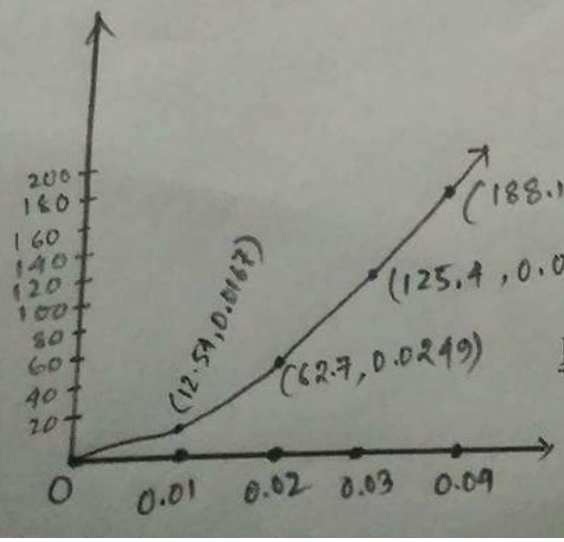


FIGURE: plot here

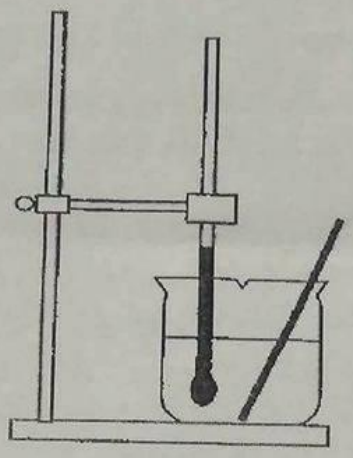


FIGURE 1: Experimental setup for dissolution reaction

Place a moderate amount (which would be 1. to 3 cm^3) of supplied anhydrous magnesium sulfate ($MgSO_4$) to the beaker. Mix vigorously with the glass rod for 5 minutes. Record your observations.

Room temperature : 22°C
After added $MgSO_4$, temperature is : 24°C
Here temperature is increasing.

Repeat this procedure with each of the following compounds:

	Initial	final
a. Sodium Nitrate, $NaNO_3$	22°C	20°C
b. Sodium Chloride, NaCl	22°C	19.8°C
c. Hydrated Calcium Chloride, $CaCl_2.2H_2O$	22°C	27°C
d. Ammonium Nitrate, NH_4NO_3	22°C	19°C

DATA TABLE:

TRAIL 1 TRAIL 2

a. mass of the beaker _____ a. mass of the beaker _____

b. mass of the beaker+ $MgSO_4$ _____ b. mass of the beaker +$MgSO_4$ _____

c. mass of $MgSO_4$ 2g c. mass of $MgSO_4$ 3g

Time	Temp	Time	Temp
30ml Water		30ml Water	
		0-30s	23°C
0-30s	23°C	30-60s	23°C
30-60s	23°C	60-90s	23°C
60-90s	23°C	90-120s	23°C
90-120s	23°C	120-150s	23°C
120-150s	23°C	150-180s	23°C
150-180s	23°C	180-210s	23°C
180-240s	23°C	210-240s	23°C
240-240s	23°C		
2g MgSO4		3g MgSO4	
0-30s	23°C		
30-60s	23°C	0-30s	23°C
60-90s	22.5°C	30-60s	23°C
90-120s	22.5°C	60-90s	22.5°C
120-150s	22°C	90-120s	22.5°C
150-180s	22°C	120-150s	22°C
180-210s	22°C	150-180s	21.5°C
240-240s	22°C	180-210s	21.5°C
		210-240s	21.5°C

TRAIL 3 TRAIL 4

a. mass of the beaker _____

b. mass of the beaker+ $MgSO_4$ _____

c. mass of $MgSO_4$ 4g

a. mass of the beaker _____

b. mass of the beaker +$MgSO_4$ _____

c. mass of $MgSO_4$ 5g

30ml water

Time	Temp
0-30s	22°C
30-60s	22°C
60-90's	22°C
90-120s	22°C
120-150s	22°C
150-180s	22°C
180-240s	22°C
210-240s	22°C

4g $MgSO4$

Time	Temp
0-30s	21°C
30-60s	21°C
60-90s	20.9°C
90-120s	20.9°C
120-150s	20.9°C
150-180s	20.9°C
180-210s	20.9°C
210-240s	20.9°C

30ml water

Time	Temp
~~0-30s~~	~~22°C~~
0-30s	22°C
30-60s	22°C
60-90s	22°C
90-120s	22°C
120-150s	22°C
150-180s	22°C
180-210s	22°C
210-240s	22°C

5g $MgSO4$

Time	Temp
0-30s	22°C
30-60s	22°C
60-90s	21.5°C
90-120s	21.5°C
120-150s	21.5°C
150-180s	21.5°C
180-210s	21.5°C
210-240s	21.5°C

TRAIL 3 TRAIL 4

a. mass of the beaker _____

b. mass of the beaker+ $MgSO_4$ _____

c. mass of $MgSO_4$ 4g

a. mass of the beaker _____

b. mass of the beaker +$MgSO_4$ _____

c. mass of $MgSO_4$ 5g

30ml water

Time	Temp
0-30s	22°C
30-60s	22°C
60-90's	22°C
90-120s	22°C
120-150s	22°C
150-180s	22°C
180-240s	22°C
210-240s	22°C

4g $MgSO4$

Time	Temp
0-30s	21°C
30-60s	21°C
60-90s	20.9°C
90-120s	20.9°C
120-150s	20.9°C
150-180s	20.9°C
180-210s	20.9°C
210-240s	20.9°C

30ml water

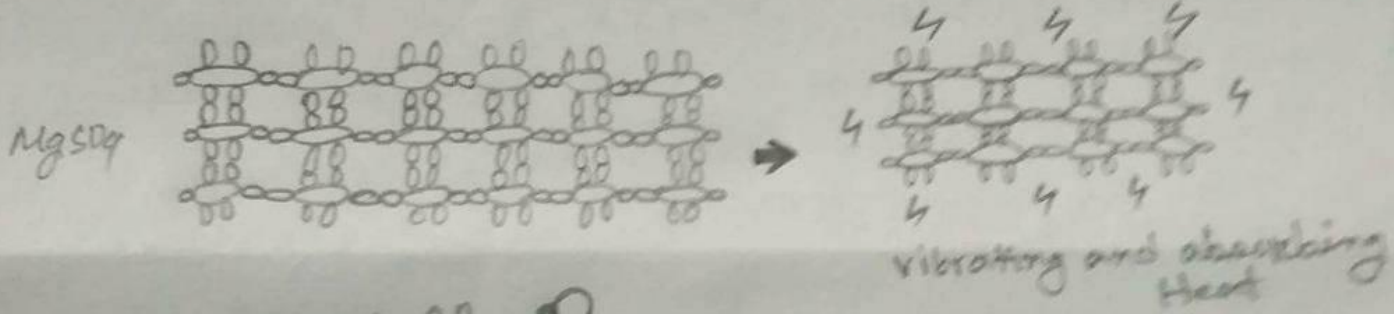
Time	Temp
~~0-30s~~	~~22°C~~
0-30s	22°C
30-60s	22°C
60-90s	22°C
90-120s	22°C
120-150s	22°C
150-180s	22°C
180-210s	22°C
210-240s	22°C

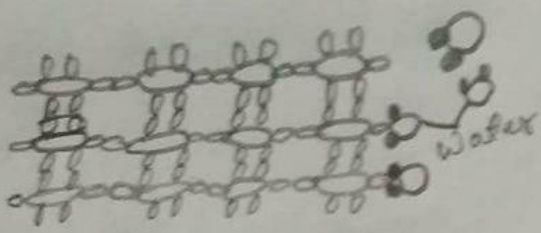
5g $MgSO4$

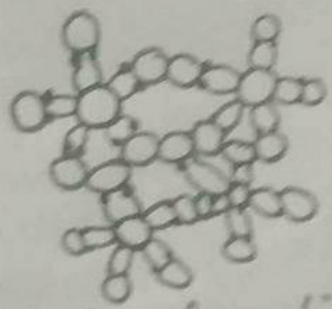
Time	Temp
0-30s	22°C
30-60s	22°C
60-90s	21.5°C
90-120s	21.5°C
120-150s	21.5°C
150-180s	21.5°C
180-210s	21.5°C
210-240s	21.5°C

c. **MENTAL MODEL:** Use the chemical equation given above to represent the dissolution reaction in this experiment. Draw a picture(s) which describes what is happening in atomic or in molecular level. How heat release or absorbed can be described from these pictures?

$MgSO_{4(s)} + H_2O_{(l)} \longrightarrow Mg^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} + H_2O_{(l)}$



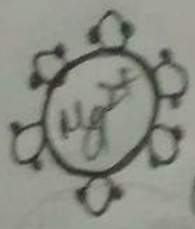




water has dissolved MgSO4

- oxygen

water



water

d. CHANGES IN THIS EXPERIMENT (TO BE COMPLETED WHEN THE INSTRUCTOR DEMONSTRATE IN CLASS):

Answer :

In this experiment we can see that we many changes occured. This changes occure when we change the quantity of compounds. When we dissolve $MgSO_4$ in wates, it release heat. when we increase the quantity of water, the heat is ~~reale~~ released more. When we increase the quantity more, it released more heat. So, now we can say that, the quantity of compound is accociated with heat.