Enthalpy of Solution

Investigating the solubility of a salt.

Aim: To ~~investigate~~ determine the heat of solution of salt O1 and X when dissolved in water.

Hypothesis: Salt O1 and X dissolve in water liberating heat hence endothermically but salt O1 dissolves more endothermically than salt X

Variables:

Independent - Time (s)

Dependent - Temperature of the solution (°C)

Controlled. - Mass of the Salt (g)
Volume of water (cm^3)

Apparatus.

Measuring cylinder 100mL
Plastic beaker 250mL
Thermometer
Spatula
Weighing scale (mass 6g)
Salts O1 and X
Stop watch

Procedures.

a) Using a measuring cylinder, measure $100cm^3$ of distilled w into a plastic beaker.
b) Read and record the initial temperature of the water.
c) Add salt O1 and stir continously with the thermometer
d) Read and record temperature of the solution every after 1

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Weighing scale (mass 6g)
Salts O1 and X
Stop watch

Procedures.

a) Using a measuring cylinder, measure 100cm^3 of distilled water into a plastic beaker.
b) Read and record the initial temperature of the water.
c) Add salt O1 and stir continously with the thermometer to disso
d) Read and record temperature of the solution every after ½ minu

for 5 minutes.
e) Record your results in the table below.
f) Repeat procedure from (a) to (e) using salt X
g) Plot a graph of temperature (°C) against time (min)

Risks and mitigations.
Breakage of thermometer
X

Table of results.

Time(min)		0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Temperature of solution (°C)	Q									
	X									

exothermic ΔH = (-ve)
endothermic ΔH = (+ve)

Heat evolved = MCΔθ

Mass = Mass of salt + Mass of water.

Density = $\frac{M}{V}$

m = ΔxV

= 100x1

= 100g

Mass = 100+6

= 106g

Δθ = Final temp - Initial temp

= 34.0 - 26.0

= 8.0°C

ΔH=MCΔθ

100x4.2x8

ΔH = 3561.6J

Salt X

ΔH=MCΔθ

= 106x4.2x10

= 4452 J

Δθ = 36.0 - 26.0

= 10.0°C

Con

From the results, Salt X is seen to have dissolved in water endothermically thus not matching/agreeing with the hypoth

11th October, 2024

During the manufacture of soap, Sodium hydroxide soln is on
of the requirements for making soap. Workers noticed a chang
in temp of the container that was being used to dissolve So
hydroxide into soln. The workers do not understand the chang
of the temp change of the container and still could no
often determine when the Sodium hydroxide would fully b
dissolved.

You are provided with distilled water and 4g of NaO
Carry out a scientify investigate when the dissolved sodium
hydroxide would be ready for use

Aim: An experiment to investigate when the dissolved sodiu
hydroxide would be ready for use.

Hypotheris: Sodium hydroxide dissolves in water liberating
heat thus dissolves exothermically.

Variables:

Independent - Time (min)

Dependent - Temperature of the Solution (°c)

Controlled - Mass of NaOH
Volume of water

Apparatus used
Measuring cylinder 100ml
Plastic beaker 250ml
Thermometer
Mass of salt 4g
Stop watch.

Procedures.

a) Using a measuring cylinder, measure 60cm³ of distilled water and pour it into a clean plastic beaker
b) Read and record the initial temperature of the water.
c) Add Sodium hydroxide into the plastic beaker with Constant stirring using a thermometer.
d) Record the temperature of the solution every after 3 minutes for 15minutes.
e) Record your results in the table of results.
f) Plot a graph of temperature (°C) against time (minutes)

Risks and Mitigations.

Breakage of the thermometer

Mitigation - Handle with care.
- Put it in this case after use.

Skin burns or irritation due to the mixed solution.

Mitigation - Use of personal protective gears for example lab coats and gloves.

Spill Spillage of the solution on the working surface.

Mitigation - Dry the working place thoughlourly.

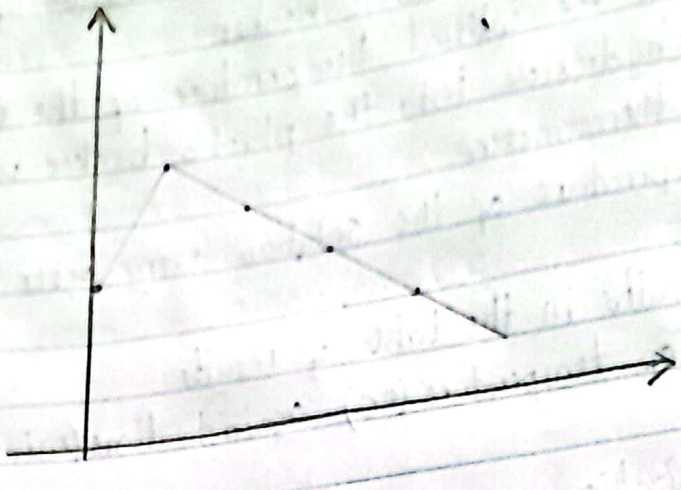
Initial temperature = 22.0 °C

Volume of water = 60cm³

Mass of NaOH = 4.0g

~~Time (minutes) 0 3 6 9 12~~
~~Temperature (°C)~~

Time (minutes)	0	3	6	9	12	15
Temperature (°C)	22.0					



Heat evolved: $MC\Delta\theta$

$M = D \times V$

$= 1 \times 60$

$= 60g$

Mass $= 60 + 4$

$= 100g$

$\Delta\theta = 20.0 - 22.0$

$= -2\,^{\circ}C$

$\Delta H = 100 \times 4.2 \times -2$

$\Delta H = \frac{-840\ J}{1000}$

$= -0.84\ kJ$

Conclusion : When Sodium hydroxide is dissolved, it liberates $-0.84\ kJ$ which is in line with hypothesis-mak it ready for use.

Enthalpy of displacement

$CuSO_{4(aq)} + Mg_{(s)} \longrightarrow MgSO_{4(aq)} + Cu_{(s)}$

Is the enthalpy change that occurs when 1 mole of a metal cation is displaced from it's solution by a more reactive metal.

Aim: To investigate the heat of displacement of a reaction between Copper(II) sulphate and Magnesium metal.

Hypothesis: The reaction between Copper(II) sulphate and Magnesium liberates heat

Variables:

Independent - Time of the reaction (minutes)

Dependent - Temperature of the solution

Controlled - volume of water (cm^3)
- Mass of magnesium (g)
- Mass of Copper (II) sulphate (g)

Apparatus.

Plastic beaker 250 ml
Spatula
Thermometer
Copper (II) sulphate solution
Magnesium metal
Measuring cylinder

Procedure

Using a measuring cylinder, measure 70cm^3 of distilled wate

and add it into the beaker containing 6g of Copper (II) Sulphate.

b) Stir with spatula until the the solid dissolves.

c) 6g of magnesium metal were added into the solution and stired using a thermometer.

d) Read and and record the temperature of the solution for 16 minutes for every 2 minutes.

e) Plot a graph of temperature (°C) against time (minutes)

Table of results.

Time (minutes)	0	2	4	6	8	10	12	14	16
Temperature (°C)	26.0	28.0	30.0	32.0	34.0	36.0	40.0	42.0	44.0

Heat evolved = MCΔΘ

Density = $\frac{M}{V}$

m = ΔXV

= 70X1

= 70g

ΔΘ = Final temp - Initial temp

= 38.0 - 26.0

= 12.00c

ΔH = 70X4.2X12.0

= $\frac{3,528}{1000}$ J

ΔH = -3.528 kJ

Conclusion