

Friday Worksheet

Name:

Enthalpy and rate worksheet 2

- 1) To determine the enthalpy change of the reaction between aluminium metal and copper ions, as shown below, a student conducted an experiment.



This involved adding a known mass of powdered aluminium to 1.50 M copper (II) sulfate solution in a calorimeter and then measuring the temperature change.

Two separate experiments, A and B, were conducted under the same conditions. In experiment **B** a greater volume of $\text{CuSO}_4\text{(aq)}$ was used than in **A**. In both experiments, copper sulfate was always in excess. The results of experiment A are shown below.

Temperature °C	Time (seconds)
20.0	0
23.1	2
28.2	4
38.2	8
60.5	15
66.6	17
68.2	18
70.4	19
72.2	20
72.8	21
71.5	22
70.2	23
70.0	24
69.8	25

	Experiment A	Experiment B
Amount of aluminium metal used	0.0500 mol	0.0500 mol
Volume of 1.50 M $\text{CuSO}_4\text{(aq)}$	50.0 mL	80.0 mL
Initial temperature of the $\text{CuSO}_4\text{(aq)}$	Y °C	20 °C
Temperature of solution after the reaction's completion	D °C	X °C

- a) Give the temperature of Y °C and D °C

$$Y \text{ } ^\circ\text{C} = 20.0$$

$$D \text{ } ^\circ\text{C} = 72.8$$

- b) Assume that 4.20 J is needed to raise the temperature of 1.00 mL of solution by 1.00 °C. Use the results of **Experiment A** to calculate the energy released, in kJ, by the reaction between the aluminium metal and the copper (II) sulfate solution.

$$E = 4.20 \times \text{mass} \times \Delta T$$

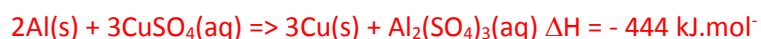
$$E = 4.20 \times 50.0 \times 52.8$$

$$E = 11.1 \text{ kJ}$$

- c) Calculate the ΔH of the reaction

$$\text{Energy/mol of zinc} = 11.1 / 0.05 = 222 \text{ kJ}$$

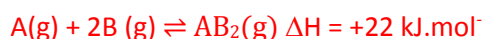
Since the equation accounts for two mol of aluminium then the $\Delta H = -444 \text{ kJ.mol}^{-1}$



- d) Is the temperature reached by the solution in experiment B greater, less than or equal to that of experiment A? Explain.

It is less since there is a greater volume of solution to absorb the heat energy given out.

- 2) Reactants A and B react according to the equation below.



Indicate whether the statements below are True or False? Offer an explanation

- a) The amount of AB_2 present at equilibrium increases.

False. A catalyst does not impact on the yield.

- b) The expression $\frac{[\text{AB}_2]}{[\text{A}]}$ increases at equilibrium

False. A catalyst does not alter the amount of product present at equilibrium.

- c) The reaction changes to $\text{A(g)} + 2\text{B(g)} \rightleftharpoons \text{AB}_2(\text{g}) \quad \Delta H = -22 \text{ kJ.mol}^{-1}$

False. A catalyst does not alter the enthalpy change.

- d) Lowers the value of the equilibrium constant thus allowing more particles to react and increasing the rate at which the reaction proceeds.

False. A catalyst does not affect the equilibrium position of a reaction.