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.

$$2Al(s) + 3CuSO_4(aq) \Rightarrow 3Cu(s) + Al_2(SO_4)_3(aq) \quad \Delta H = ?$$

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 $CuSO_4(aq)$ 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 $CuSO_4(aq)$	50.0 mL	80.0 mL
Initial temperature of the $CuSO_4(aq)$	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 °C = 20.0

D °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 X mass X ΔT

E = 4.20 X 50.0 X 52.8

E = 11.1 kJ

c) Calculate the ΔH of the reaction

Energy/mol of zinc = 11.1 / 0.05 = 222 kJ

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

$$2Al(s) + 3CuSO_4(aq) \Rightarrow 3Cu(s) + Al_2(SO_4)_3(aq)\ \Delta H = -444\ kJ.mol^{-}$$

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

$$A(g) + 2B\ (g) \rightleftharpoons AB_2(g)\ \Delta H = +22\ kJ.mol^{-}$$

Indicate whether the statements below are True of 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 $\frac{[AB_2]}{[A]}$ increases at equilibrium

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

c) The reaction changes to $A(g) + 2B\ (g) \rightleftharpoons AB_2(g)\ \Delta H = -22\ kJ.mol^{-}$

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.