Worksheet 7

1. Consider the following reaction between mercury(II) chloride and oxalate ion:

$$2\ HgCl_2\ (aq)\ +\ C_2O_4^{2-}\ (aq)\ \rightarrow\ 2\ Cl^-\ (aq)\ +\ 2\ CO_2\ (g) + Hg_2Cl_2\ (s)$$

The initial rate of this reaction was determined for several concentrations of $HgCl_2$ and $C_2O_4^{2-}$, and the following rate data were obtained for the rate of disappearance of $C_2O_4^{2-}$:

Experiment	$[HgCl_2]$ (M)	$[C_2O_4^{2-}]$ (M)	Rate (M/s)
1	0.164	0.15	3.2×10^{-3}
2	0.164	0.45	2.9×10^{-4}
3	0.082	0.45	1.4×10^{-4}
4	0.246	0.15	4.8×10^{-5}

a) What is the rate law for this reaction? b)What is the value of the rate constant? c) What is the reaction rate when the concentration of $HgCl_2$ is 0.050 M and that of $C_2O_4^{2-}$ is 0.10 M, if the temperature is the same as that used to obtain the data shown?

2. The first-order rate constant for the decomposition of N_2O_5, $2\ N_2O_5\ (g)\ \rightarrow 4\ NO_2\ (g) + O_2\ (g)$, at 70 °C is $6.82 \times 10^{-3}\ s^{-1}$. Suppose we start with 0.0250 mol of N_2O_5 (g) in a volume of 2.0 L. a) How many moles of N_2O_5 will remain after 2.5 min? b) How many minutes will it take for the quantity of N_2O_5 to drop to 0.010 mol? c) What is the half-life of N_2O_5 at 70 °C?

3. $Cl\ (g)\ +\ HBr\ (g)\ \rightarrow HCl\ (g)\ + Br\ (g)$ has an overall enthalpy change of –66 kJ. The activation energy for the reaction is 7 kJ. a) Sketch the energy profile for the reaction, and label E_a and ΔH. b) What is the activation energy for the reverse reaction?