Chapter 12 AP Questions Answers

1) $2\ NO_{(g)} + Br_{2(g)} \rightarrow 2\ NOBr_{(g)}$

The following results were obtained in experiments designed to study the reaction rate of the reaction above.

Experiment	Initial Concentration(mol L^{-1}) [NO]	[Br_2]	Initial Rate (mol $L^{-1}s^{-1}$)
1	0.02	0.02	$9.6 \bullet 10^{-2}$
2	0.04	0.02	$3.8 \bullet 10^{-1}$
3	0.02	0.04	$1.9 \bullet 10^{-1}$

A) Which of the following reaction mechanisms is consistent with the over all reaction? Why?

I. $NO + NO \rightarrow N_2O_2$ (fast)
$N_2O_2 + Br_2 \rightarrow 2NOBr$ (slow)

II. $Br_2 \rightarrow Br + Br$ (fast)
$2(NO + Br \rightarrow NOBr)$ (slow)

For a mechanism to be consistent it must meet two criteria:
1- The mechanism must sum to the overall reaction, both do.
2- The mechanism must have the same rate law as the experimental determined law. Only the first reaction has a consistent rate law. Rate = $k[NO]^2[Br_2]$

2) $2\ HgCl_{2(aq)} + C_2O_4^{2-} \text{--> } 2\ Cl^- + 2\ CO_{2(g)} + Hg_2Cl_{2(s)}$

The equation for the reaction between mercuric chloride and oxalate ion in hot aqueous solution is shown above. The reaction rate may be determined by measuring the initial rate of formation of chloride ion, at constant temperature, for various initial concentrations of mercuric chloride and oxalate as shown in the following table.

Experiment	Initial [$HgCl_2$]	Initial [$C_2O_4^{2-}$]	Initial Rate of Cl^- mol L^{-1} min^{-1}
1	0.0836 M	0.202 M	$0.52 \bullet 10^{-4}$
2	0.0836 M	0.404 M	$2.08 \bullet 10^{-4}$
3	0.0418 M	0.404 M	$1.06 \bullet 10^{-4}$
4	0.0316 M	?	$1.27 \bullet 10^{-4}$

(a) According to the data shown, what is the rate law for the reaction above?
Rate = $k\ [HgCl_2]\ [C_2O_4^{2-}]^2$

(b) On the basis of the rate law determined in part (a), calculate the specific rate constant. Specify the units.
0.52e-4=k[0.0836][0.202]^2
k=1.52e-2 $L^2mol^{-2}s^{-1}$

(c) What is the numerical value for the initial rate of disappearance of $C_2O_4^{2-}$ for Experiment 1?

$$0.52 \cdot 10^{-4} \cdot \frac{1C_2O_4^{2-}}{2Cl^-} = 0.26 \cdot 10^{-4}$$

(d) Calculate the initial oxalate ion concentration for Experiment 4.
1.27e-4=1.52e-2[0.0316]$[C_2O_4^{2-}]^2$
$[C_2O_4^{2-}]$*=0.514M*