CH # 12 HOME WORK SOLUTIONS

16/18: All of these choices would affect the rate of the reaction, but b and c affect the rate by affecting the value of rate const.

Q. 22/24: (a) Rate: $K[I^-]^x[S_2O_8^{2-}]^y$; $\frac{12.5\times10^{-6}}{6.25\times10^{-6}} = \frac{k(0.080)^x(0.040)^y}{K(0.040)^x(0.040)^y}$

$2.0 = 2.0^x$, $\boxed{x=1}$

$\frac{12.5\times10^{-6}}{6.25\times10^{-6}} = \frac{K(0.080)^x(0.040)^y}{K(0.080)(0.020)^y} = 2.0 = 2.0^y = \boxed{y=2}$

(b) For the first experiment:

$\frac{12.5\times10^{-6}\,mol}{L\,s} = K\left(0.080\,\frac{mol}{L}\right)\left(0.040\,\frac{mol}{L}\right)$, $\boxed{k = 3.9\times10^{-3}\ L/mol.s}$

Q. 28/30 (a) plot $\ln[A]$ vs time → straight line → First order rexn.

Rate $= K[A]$; $\ln[A] = -kt + \ln[A]_0$; slope $= -k$

$k = 2.97\times10^{-2}\,min^{-1}$

(b) Half life for first-order is $t_{1/2} = \frac{\ln 2}{K} = \boxed{\frac{0.6931}{K}}$

$t_{1/2} = \frac{0.6931}{2.97\times10^{-2}\,min^{-1}} = \boxed{23.3\ min}$

(c) $\ln\left[\frac{[A]}{[A]_0}\right] = -kt$; $\ln\left(\frac{2.50\times10^{-3}M}{2.00\times10^{-2}M}\right) = (2.97\times10^{-2}\,min^{-1})t$

$t = \frac{\ln(0.125)}{-2.97\times10^{-2}\,min^{-1}} = \boxed{70.0\ min}$

Or.

How much % complet 87.5%, How much left $\boxed{12.5\%}$

$100 \xrightarrow{t_{1/2}} 50.0\% \xrightarrow{t_{1/2}} 25.0\% \xrightarrow{t_{1/2}} \boxed{12.5\%}$ 3 half life

$3\times 23.3\ min$ $\boxed{= 69.9\ min}$

Q. 48: Since rate of slowest step equal to the rate of a reaction, then: $\boxed{\text{Rate} = \text{rate of step 1} = K[NO_2]^2}$

The sum of all steps in a plausible must give the overall balanced reaction:

$NO_2 + NO_2 \rightarrow NO_3 + NO$

$NO_3 + CO \rightarrow NO_2 + CO_2$

$NO_2 + CO \rightarrow NO + CO_2$

Q.56 For two conditions: $\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$ ≠ T ≠ independent

$$\ln\left(\frac{8.1 \times 10^{-2}\, s^{-1}}{4.6 \times 10^{-2}\, s^{-1}}\right) = \frac{E_a}{8.3145\ J/mol \cdot K}\left(\frac{1}{273\,K} - \frac{1}{293\,K}\right)$$

$$0.57 = \frac{E_a}{8.3145}\left(2.5 \times 10^{-4}\right), \quad \boxed{E_a = 1.9 \times 10^{4}\ J/mol} = \boxed{19\ kJ/mol}$$