WORKSHEET 7 KEY

1. $\text{RATE} = -\frac{1}{2}\frac{d[H_2CO]}{dt} = -\frac{d[CO_2]}{dt} = \frac{1}{2}\frac{d[CO]}{dt} = \frac{1}{2}\frac{d[H_2O]}{dt}$

2. a) $\text{RATE} = K[SO_2][SO_3]^{-1/2} = K\frac{[SO_2]}{[SO_3]^{1/2}}$

units of K are $mol^{1/2} \cdot L^{-1/2} \cdot s^{-1}$

THE REACTION IS 1/2 OVERALL.

b) THE ACCELERATING EFFECT OF THE LARGER CONCENTRATION OF SO_2 IS EXACTLY OFFSET BY THE DECELERATING EFFECT OF THE LARGER CONCENTRATION OF SO_3. THEREFORE THE RATE DOES NOT CHANGE.

3. a) INCREASING $[Fe^{2+}]$ BY A FACTOR OF ~1.6 AND KEEPING $[Ce^{4+}]$ CONSTANT, THE CHANGE IN THE RATE IS A FACTOR OF ~1.6. ∴ Fe^{2+} IS 1st ORDER. INCREASING $[Ce^{4+}]$ BY A FACTOR OF ~3 AND KEEPING $[Fe^{2+}]$ CONSTANT, THE CHANGE IN THE RATE IS A FACTOR OF ~3. ∴ Ce^{4+} IS 1st ORDER

$$\text{rate} = K[Fe^{2+}][Ce^{4+}]$$

b) $K = 1.01 \times 10^{-3}\ L/mol \cdot s$

$$\frac{\left(\frac{mol}{L \cdot s}\right)}{\frac{mol^2}{L^2}} \quad \frac{mol}{L \cdot s} \cdot \frac{L^2}{mol^2}$$

c) $\text{rate} = (1.01 \times 10^{-3})(2.6 \times 10^{-5})(1.3 \times 10^{-5})$

$\text{rate} = 3.41 \times 10^{-3}\ mol/L \cdot s$

4. $K = 1.9 \times 10^{-4}\ 1/s$ $\quad P_0 = 0.078\ atm$ $\quad T = 600\ K$

$$t = 3.0\ hrs \times \frac{60\ min}{1\ hr} \times \frac{60\ s}{1\ min} = 1.08 \times 10^4\ s$$

$$\ln P = -kt + \ln P_0$$

$$\ln P = -(1.9 \times 10^{-4}\ 1/s)(1.08 \times 10^4\ s) + \ln 0.078\ atm$$

$$P = 0.01\ atm$$

5.

	molecularity
$NO_2Cl \rightarrow NO_2 + Cl$	1
$Cl + H_2O \rightarrow HCl + OH$	2
$OH + NO_2 + N_2 \rightarrow HNO_3 + N_2$	3

a) $NO_2Cl + H_2O \rightarrow HCl + HNO_3$

b) NO_2, Cl, OH

6. a) IS CONSISTENT w/ OBSERVED RATE LAW

$$rate = K_1[Cl_2][H_2S]$$

b) DOES NOT

$$rate = K_2 K_1 [Cl_2] \frac{[H_2S]}{[H^+]}$$

1st order overall but doesn't fit the original rate

c) DOES NOT

$$rate = K_1 K_1 K_2 \frac{[H_2S][Cl_2]}{[H^+][Cl^-]}$$

zero order overall