

# WORKSHEET 7 KEY

1. RATE =  $-\frac{1}{2} \frac{d[\text{CH}_2\text{CO}]}{dt} = -\frac{d[\text{CO}_2]}{dt} = \frac{1}{2} \frac{d[\text{CO}]}{dt} = \frac{1}{2} \frac{d[\text{CH}_2\text{O}]}{dt}$

2. a) RATE =  $K[\text{SO}_2][\text{SO}_3]^{-1/2} = K \frac{[\text{SO}_2]}{[\text{SO}_3]^{1/2}}$

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

THE REACTION IS  $1/2$  OVERALL.

b) THE ACCELERATING EFFECT OF THE LARGER CONCENTRATION OF  $\text{SO}_2$  IS EXACTLY OFFSET BY THE DECELERATING EFFECT OF THE LARGER CONCENTRATION OF  $\text{SO}_3$ . THEREFORE THE RATE DOES NOT CHANGE.

3. a) INCREASING  $[\text{Fe}^{2+}]$  BY A FACTOR OF  $\sim 1.6$  AND KEEPING  $[\text{Ce}^{4+}]$  CONSTANT, THE CHANGE IN THE RATE IS A FACTOR OF  $\sim 1.6$ .  $\therefore \text{Fe}^{2+}$  IS 1<sup>st</sup> ORDER.  
 INCREASING  $[\text{Ce}^{4+}]$  BY A FACTOR OF  $\sim 3$  AND KEEPING  $[\text{Fe}^{2+}]$  CONSTANT, THE CHANGE IN THE RATE IS A FACTOR OF  $\sim 3$ .  $\therefore \text{Ce}^{4+}$  IS 1<sup>st</sup> ORDER  
 $\text{rate} = K[\text{Fe}^{2+}][\text{Ce}^{4+}]$

b)  $K = 1.01 \times 10^{-3} \text{ L/mol} \cdot \text{s}$        $\frac{(\text{mol})}{\text{L} \cdot \text{s}} \quad \frac{\text{mol}}{\text{L}^2} \quad \frac{\text{mol}}{\text{L} \cdot \text{s}} \cdot \frac{\text{L}^2}{\text{mol}^2}$

c)  $\text{rate} = (1.01 \times 10^{-3})(2.6 \times 10^{-5})(1.3 \times 10^{-5})$   
 $\text{rate} = 3.41 \times 10^{-3} \text{ mol/L} \cdot \text{s}$

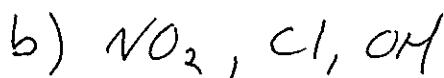
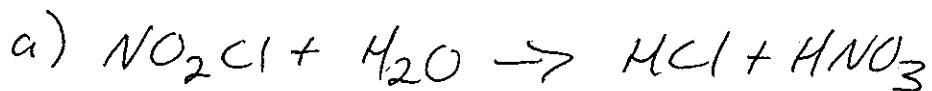
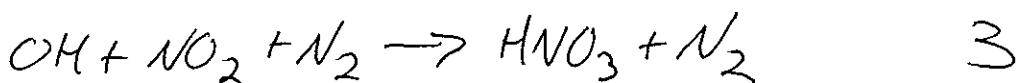
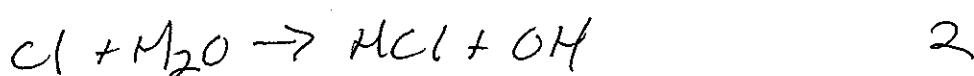
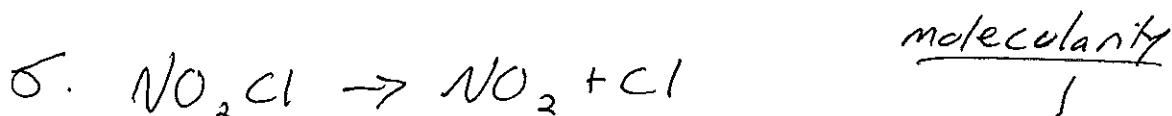
$$4. K = 1.9 \times 10^{-4} \text{ } \text{Vs} \quad P_0 = 0.078 \text{ atm} \quad T = 600 \text{ K}$$

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

$$\ln P = -K\epsilon + \ln P_0$$

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

$$P = 0.01 \text{ atm}$$



6. a) IS CONSISTENT w/ OBSERVED RATE LAW

$$\text{rate} = K_1 [\text{Cl}_2][\text{CH}_2\text{S}]$$

b) DOES NOT

$$\text{rate} = K_2 K_1 [\text{Cl}_2] \frac{[\text{H}_2\text{S}]}{[\text{H}^+]} \quad \begin{matrix} \text{2st order overall but} \\ \text{doesn't fit the original} \\ \text{rate} \end{matrix}$$

c) DOES NOT

$$\text{rate} = K_1 K_2 \frac{[\text{H}_2\text{S}][\text{Cl}_2]}{[\text{H}^+][\text{Cl}^-]} \quad \text{zero order overall}$$