

CHM 152 Group Work 1 Summer 2009 Crib

1. What is the rate law for this reaction? $\text{H}_3\text{BO}_3 + 3 \text{HCl} \rightarrow \text{BCl}_3 + 3 \text{H}_2\text{O}$ **rate = $k[\text{H}_3\text{BO}_3]^x [\text{HCl}]^y$**
2. If the concentration of a reactant is doubled and the corresponding rate quadruples, what is the order with respect to that reactant? **2**
3. To graphically find the rate constant for a first order reaction you should plot **$\ln A_t$** versus time.
4. What is the half-life for a first order reaction if the initial concentration of reactant is 1.25M and after 69.2 seconds the concentration has dropped to 0.955M?

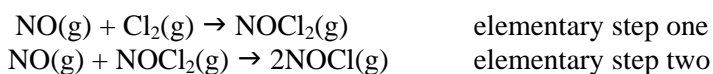
$$\ln (.955 / 1.25) = -k (69.2\text{s}) \quad \text{solve for } k = 3.89 \times 10^{-3} \text{ s}^{-1} \quad \text{then } t_{1/2} = .693 / k = 178 \text{ s}$$

5. What percentage of a sample remains after 5 half lives? **3.125%**
6. What is the rate law for a zero order overall reaction? **rate = k**
7. If an elementary step has two reactants, what is its molecularity? **bimolecular**
8. The slow step in a mechanism is also called the **rate determining** step.
9. According to the following balanced equation, if the rate of appearance of oxygen gas is $4.00 \times 10^{-2} \text{ M/s}$, what is the rate of disappearance of $\text{KClO}_3(\text{s})$? $2 \text{KClO}_3(\text{s}) \rightarrow 2 \text{KCl}(\text{s}) + 3 \text{O}_2(\text{g})$

a. **$2.67 \times 10^{-2} \text{ M/s}$** b. $6.00 \times 10^{-2} \text{ M/s}$ c. $2.00 \times 10^{-2} \text{ M/s}$ d. $3.00 \times 10^{-2} \text{ M/s}$ e. $5.33 \times 10^{-2} \text{ M/s}$

$$\Delta \text{O}_2 / 3 \Delta t = -\Delta \text{KClO}_3 / 2 \Delta t \quad \text{solve for } \Delta \text{KClO}_3 / \Delta t = \text{choice a}$$

10. For this reaction: $2\text{NO}(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{NOCl}(\text{g})$ the **real** rate law is $\text{rate} = k [\text{NO}] [\text{Cl}_2]$
If the following steps are the mechanism, which one must be the rate determining step? **1**
What is the intermediate in this mechanism? **$\text{NOCl}_2(\text{g})$** What is the overall order? **2**



11. Name one factor that can increase the success of reactant collisions. Explain **how** it increases the reaction rate.

- **Temp: increase temp, molecules move faster, more collisions so rate increases**
- **Concentration: increase [], more molecules, more collisions so rate increases**
- **180° angle of impact: more energy, greater chance of surpassing E_a , rate increases**

12. What is the reactant concentration after 78.9 seconds for a second order reaction with a half-life of 3.10 minutes if the initial concentration was 0.555M?

$$k = 1 / (3.10\text{min})(.555\text{M}) = .581226 \text{ min}^{-1}\text{M}^{-1}$$
$$1/ A_t = (.581226 \text{ min}^{-1}\text{M}^{-1})(78.9 \text{ s})(\text{min}/60 \text{ s}) + 1/.555\text{M}$$
$$A_t = .390\text{M}$$