

Show all work to receive credit.

1. (3 Pts) The reaction $A + 2B \rightarrow \text{products}$ has been found to have the rate law, $\text{rate} = k[A][B]^2$. If the concentration of A is tripled and the concentration of B is tripled. Predict by what factor the rate of reaction increases.

$$\text{rate} = k [3] [3]^2 = \text{27 fold increase}$$

2. (3 Pts) $\text{Rate} = k[A][B][C]$, what are appropriate units for the rate constant k (Use seconds for time)?

$$k = \frac{\text{rate}}{[A][B][C]} = \frac{M}{s \cdot M \cdot M \cdot M} = s^{-1} \cdot M^{-2}$$

3. (6 Pts) What is the rate law that corresponds to the data shown for the reaction $2A + B \rightarrow C$?

Exp.	Initial [A]	Initial [B]	Initial rate
1	0.015	0.022	0.125
2	0.030	0.044	0.500
3	0.060	0.044	0.500
4	0.060	0.066	1.125

$$\text{rate} = k[A]^x[B]^y$$

For A: use Exp. 3 + 2

$$\frac{0.500}{0.500} = \left(\frac{0.060}{0.030} \right)^x \quad x = 0$$

for B: since [A] is 0 order, use any pair where [B] changes.

i.e. 1 + 2

$$\frac{0.500}{0.125} = \frac{k}{k} \left(\frac{0.030}{0.015} \right)^0 \left(\frac{0.044}{0.022} \right)^y$$

$$4 = (1)(2)^y \quad y = 2$$

$$\text{rate} = k[B]^2$$

More questions on back.

4. (10 Pts) At a certain temperature, the data below were collected for the reaction below.



Initial concentrations (M)		Initial Rate of Formation of I ₂
[ICl]	[H ₂]	Mol/L·s
0.10	0.10	0.0015
0.20	0.10	0.0030
0.10	0.050	0.00075

- a. (2 Pts) Write the general rate law expression for the reaction.

$$\text{rate} = k [\text{ICl}]^x [\text{H}_2]^y$$

- b. (4 Pts) Determine the rate law for the reaction (find the orders).

For [ICl]: $\left(\frac{0.20}{0.10}\right)^x = \frac{0.0030}{0.0015}$

$$2^x = 2 \quad \boxed{x = 1}$$

For [H₂]: $\left(\frac{0.10}{0.050}\right)^y = \frac{0.0015}{0.00075}$

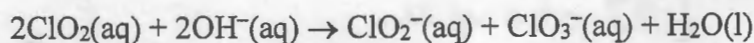
$$2^y = 2 \quad \boxed{y = 1}$$

$$\text{rate} = k [\text{ICl}] [\text{H}_2]$$

- c. (4 Pts) Determine the value of the rate constant and its UNITS.

$$k = \frac{\text{rate}}{[\text{ICl}][\text{H}_2]} = \frac{0.0015}{[0.10][0.10]} = \boxed{0.15 \text{ M}^{-1}\text{s}^{-1}}$$

5. (3 Pts) Chlorine dioxide reacts in basic water to form chlorite and chlorate according to the following chemical equation:



Under a certain set of conditions, the initial rate of disappearance of chlorine dioxide was determined to be $2.30 \times 10^{-1} \text{ M/s}$. What is the initial rate of appearance of chlorite ion under those same conditions?

note the 2:1 ratio

$$2.30 \times 10^{-1} \div 2 = \boxed{1.15 \times 10^{-1} \frac{\text{M}}{\text{s}}}$$