

1. (2 Pts) The reaction $A + 2B \rightarrow \text{products}$ has the rate law, $\text{rate} = k[A][B]^3$. If the concentration of B is doubled while that of A is unchanged, by what factor will the rate of reaction increase?

$$[1] [2]^3 = 8$$

2. a) (2 Pts) Concerning the rate law, $\text{Rate} = k[A]^2[B]$, what are appropriate units for the rate constant k?

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

- b) (1 Pt) What is the overall order of the reaction?

3rd

3. (3 Pts) A reaction has the following rate law:

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

In experiment 1, the concentrations of A and B are both 0.10 mol L^{-1} ; in experiment 2, the concentrations are both 0.30 mol L^{-1} . If the temperature stays constant, what is the value of the ratio, $\text{Rate}(2)/\text{Rate}(1)$?

- (A) 27 B) 9.0 C) 18 D) 3.0 E) 6.0

$$\frac{\text{rate 2}}{\text{rate 1}} = \frac{k [0.3] [0.3]^2}{[0.1] [0.1]^2} = 27$$

4. (4 Pts) The kinetics of the decomposition of dinitrogen pentoxide is studied at 50°C and at 75°C . Which of the following statements concerning the studies is correct?

- A) The rate at 75°C will be greater than the rate at 50°C because the activation energy will be higher at 75°C than at 50°C .
- B) The rate at 75°C will be greater than at 50°C because the concentration of a gas increases with increasing temperature.
- (C) The rate at 75°C will be greater than the rate at 50°C because the number of molecules with enough energy to react increases with increasing temperature.
- D) The rate at 75°C will be less than the rate at 50°C because the molecules at higher speeds do not interact as well as those at lower speeds.
- E) The rate at 75°C will be greater than the rate at 50°C because the activation energy will be lower at 75°C than at 50°C .

5. For the reaction



the following data were collected at constant temperature.

a) (4 Pts) Determine the correct rate law for this reaction.

Trial	Initial [A] (mol/L)	Initial [B] (mol/L)	Initial Rate (mol/(L·min))
1	0.200	0.100	6.00×10^{-2}
2	0.100	0.100	1.50×10^{-2}
3	0.200	0.200	1.20×10^{-1}
4	0.300	0.200	2.70×10^{-1}

General rate law:
rate = $k[A]^x[B]^y$

For A use 1+2

$$\left(\frac{0.200}{0.100}\right)^x = \frac{6 \times 10^{-2}}{1.5 \times 10^{-2}}$$

$$2^x = 4 \quad \boxed{x=2}$$

For B use 1+3

$$\left(\frac{0.2}{0.1}\right)^y = \frac{12}{6}$$

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

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

b) (3 Pts) Determine the value and the units of the rate constant.

$$k = \frac{\text{rate}}{[A]^2[B]} = \frac{\text{M}}{\text{min} \cdot \text{M}^2} = \text{min}^{-1} \cdot \text{M}^{-2}$$
 From any Trial

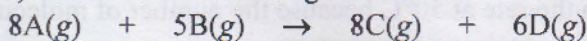
$$(15 \text{ M}^{-2} \cdot \text{min}^{-1})$$

6. (2 Pts) Which one of the following sets of units is appropriate for a second-order rate constant?

- A) $\text{L mol}^{-1} \text{s}^{-1}$ B) $\text{mol}^2 \text{L}^{-2} \text{s}^{-1}$ C) $\text{mol L}^{-1} \text{s}^{-1}$ D) $\text{L}^2 \text{mol}^{-2} \text{s}^{-1}$ E) s^{-1}

2nd order: $\text{rate} = k[A]^2$ $k = \frac{\text{rate}}{[A]^2} = \frac{\text{M}}{\text{s} \cdot \text{M}^2} = \text{s}^{-1} \cdot \text{M}^{-1}$

7. (4 Pts) Consider the following reaction



If [C] is increasing at the rate of $4.0 \text{ mol L}^{-1} \text{s}^{-1}$, at what rate is [B] changing?

CAN ignore for the question if you decide

$$\frac{-\Delta[B]}{5t} = \frac{\Delta[C]}{8t}$$

$$\frac{\Delta[B]}{t} = \frac{-5 \Delta[C]}{8t} = \frac{5}{8} [4.0] = \boxed{2.5}$$