Rate of a Chemical Reaction

1. The reaction $NO_2 + CO \rightarrow NO + CO_2$ takes place in two steps. Find the rate law.

$2NO_2 \rightarrow NO + NO_3$ (k_1) – slow

$NO_3 + CO \rightarrow CO_2 + NO_2$ (k_2) – fast

a) $R = k_1 [NO_2]^3$

b) $R = k_2 [NO_3] [CO]$

c) $R = k_1 [NO_2]$

d) $R = k_1 [NO_2]^2$

Answer: $R = k_1 [NO_2]^2$

2. For the reaction $A + H_2O \rightarrow$ products, find the rate of the reaction when [A] = 0.75 M, k= 0.02.

a) 0.077 s^{-1}

b) 0.085 s^{-1}

c) 0.015 s^{-1}

d) 0.026 s^{-1}

Answer: 0.015 s^{-1}

3. What is the rate law for acid hydrolysis of an ester such as $CH_3COOC_2H_5$ in aqueous solution?

a) k $[CH_3COOC_2H_5]$

b) k $[CH_3COOC_2H_5]$ $[H_2O]$

c) k $[CH_3COOC_2H_5]^2$

d) k

Answer: k $[CH_3COOC_2H_5]$

4. What is the concentration of the reactant in a first order reaction when the rate of the reaction is 0.6 s^{-1} and the rate constant is 0.035?

a) 26.667 M

b) 17.143 M

c) 26.183 M

d) 17.667 M

Answer: 17.143 M

5. How many times will the rate of the elementary reaction $3X + Y \rightarrow X_2Y$ change if the concentration of the substance X is doubled and that of Y is halved?

a) $r_2 = 4.5r_1$

b) $r_2 = 5r_1$

c) $r_2 = 2r_1$

d) $r_2 = 4r_1$

Answer: $r_2 = 4r_1$

6. What is the rate law for the reaction $C_2H_4 + I_2 \rightarrow C_2H_4I_2$?

a) $R = [C_2H_4]\ [I_2]^{3/2}$

b) $R = [C_2H_4]\ [I_2]^3$

c) $R = [C_2H_4]\ [I_2]^2$

d) $R = [C_2H_4]\ [I_2]$

Answer: $R = [C_2H_4]\ [I_2]^{3/2}$

7. The rate law for the reaction involved in inversion of cane sugar is $R=k\ [C_{12}H_{22}O_{11}]\ [H_2O]$.

a) True

b) False

Answer: False

8. For a second-order reaction, what is the unit of the rate of the reaction?

a) s^{-1}

b) $mol\ L^{-1}s^{-1}$

c) $mol^{-1}\ L\ s^{-1}$

d) $mol^{-2}\ L^2\ s^{-1}$

Answer: $mol^{-1}\ L\ s^{-1}$

9. The rate constant of a reaction is $k=3.28 \times 10^{-4}\ s^{-1}$. Find the order of the reaction.

a) Zero order

b) First order

c) Second order

d) Third order

Answer: First order

10. For a reaction $A + B \rightarrow C$, the experimental rate law is found to be $R=k[A]^1[B]^{1/2}$. Find the rate of the reaction when $[A] = 0.5\ M$, $[B] = 0.1\ M$ and $k=0.03$.

a) $4.74 \times 10^{-2}\ (L/mol)^{1/2}\ s^{-1}$

b) $5.38 \times 10^{-2}\ (L/mol)^{1/2}\ s^{-1}$

c) $5.748 \times 10^{-2}\ (L/mol)^{1/2}\ s^{-1}$

d) $4.86 \times 10^{-2}\ (L/mol)^{1/2}\ s^{-1}$

Answer: $4.74 \times 10^{-2}\ (L/mol)^{1/2}\ s^{-1}$