CHEMISTRY CLASS 12 BATCH

CHEMICAL KINETICS

DPP-03

1. The mechanism of the reaction $2NO + O_2 \rightarrow 2NO_2$ is

$NO + NO \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} N_2O_2$ (fast) ;

$N_2O_2 + O_2 \xrightarrow{K_2} 2NO_2$ (slow)

The rate constant of the reaction is

(A) K_2 (B) K_2K_1 (K_{-1})

(C) K_2K_1 (D) $K_2\left(\frac{K_1}{K_{-1}}\right)$

2. Dinitrogen pentaoxide decomposes as

$2N_2O_5 \rightarrow 4NO_2 + O_2$

The rate can be given in three ways

$\frac{-d[N_2O_5]}{dt} = K_1[N_2O_5]$, $\frac{d[NO_2]}{dt} = K_2[N_2O_5]$,

$\frac{d[O_2]}{dt} = K_3[N_2O_5]$

The relation between the rate constant K_1, K_2 and K_3 is

(A) $K_2 = 2K_1$ and $K_3 = \frac{1}{2}K_1$ (B) $K_1 = 2K_2$ and $K_3 = 2K_1$

(C) $K_1 = K_2 = K_3$ (D) $K_1 = 2K_2 = 3K_3$

3. The mechanism of the reaction:

$A + 2B + C \rightarrow D$ is

(step 1) (fast) equilibrium $A + B \rightleftharpoons X$

(step 2) (slow) $X + C \rightarrow Y$

(step 3) (fast) $Y + B \rightarrow D$

Which rate law is correct?

(A) $r = k[C]$

(B) $r = k[A][B]^2[C]$

(C) $r = k[A][B][C]$

(D) $r = k[D]$

4. Mechanism of the reaction:

$2NO + Cl_2 \rightarrow 2NOCl$

May be written as

$2NO \underset{}{\overset{k}{\rightleftharpoons}} (NO)_2$ .....(fast)

$(NO)_2 + Cl_2 \xrightarrow{k} 2NOCl$ ....(slow)

Rate equation would be

(A) $kk[(NO)_2][Cl_2]$ (B) $kk[NO]^2[Cl_2]$

(C) $kk[Cl_2]$ (D) $kk[NO] \cdot [Cl_2]$

5. N_2O_5 decomposes are follows:

$N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$

If, $\frac{d[N_2O_5]}{dt} = k_1[N_2O_5]$;

$\frac{d[NO_2]}{dt} = k_2[N_2O_5]$;

$\frac{d[O_2]}{dt} = k_3[N_2O_5]$;

Which one of the following is correct for k_1, k_2 and k_3?

(A) $k_1 + k_2 = k_3$ (B) $k_1 = k_2 + k_3$

(C) $k_1 = 2k_2 + \frac{1}{2}K_3$ (D) $2k_1 = k_2 = 4k_3$

6. The possible mechanism for the reaction:

$2NO + Br_2 \rightarrow 2NOBr$ is

$NO + Br_2 \rightleftharpoons NOBr_2$ (fast);

$NOBr_2 + NO \rightarrow 2NOBr$ (slow). Rate law is

(A) $r = k[NO][Br_2]$

(B) $r = k[NO]^2[Br_2]^{-1}$

(C) $r = k[NOBr_2][NO]$

(D) $r = k[NO]_2[Br_2]$

7. The reaction: $2NO + 2H_2 \rightarrow N_2 + 2H_2O$ has been assigned to follow given mechanism:

I. $NO + NO \rightleftharpoons N_2O_2$ (fast)

II. $N_2O_2 + H_2 \rightarrow N_2O + H_2O$ (slow)

III. $N_2O + H_2 \rightarrow N_2 + H_2O$ (fast)

The rate constant of step II is 1.2×10^{-4} $mole^{-1}$ L min^{-1} while equilibrium constant of step I is 1.4×10^{-2}. What is the rate of reaction when concentration of NO and H_2 each is 0.5 mole L^{-1}.

(A) 2.1×10^{-7} mole L^{-1} min^{-1}

(B) 3.2×10^{-6} mole L^{-1} min^{-1}

(C) 3.5×10^{-4} mole L^{-1} min^{-1}

(D) None of these

8. A hypothetical reaction, $A_2 + B_2 \rightarrow 2AB$ follows the mechanism as given below:

$A_2 \rightleftharpoons A + A$ ....(fast)

$A + B_2 \rightarrow AB + B$ ....(slow)

$A + B \rightarrow AB$ .....(fast)

The order of the overall reaction is

(A) 2 (B) 1

(C) 1½ (D) zero

9. The chemical reaction, $2O_3 \rightarrow 3O_2$ proceeds as $O_3 \rightleftharpoons O_2 + [O]$ (fast)
$[O] + O_3 \rightarrow 2O_2$ (slow)
The rate law expression will be
(A) Rate = $k[O][O_3]$
(B) Rate = $k[O_3]^2[O_2]^{-1}$
(C) Rate = $k[O_3]^2$
(D) Rate = $k[O_2][O]$

10. Consider the reaction: $2N_2O_4 \rightleftharpoons 4NO_2$
If $-\frac{d[N_2O_4]}{dt} = k$ and $\frac{d[NO_2]}{dt} = k'$ then
(A) $2k' = k$ (B) $k' = 2k$
(C) $k' = k$ (D) $k = \frac{1}{4}k'$

11. For a reaction, $2NO + 2H_2 \rightarrow N_2 + 2H_2O$, the possible mechanism is
$2NO \rightleftharpoons N_2O_2$
$N_2O_2 + H_2 \xrightarrow{slow} N_2O + H_2O$
$N_2O + H_2O \xrightarrow{fast} N_2 + H_2O$
What is the rate law and order of the reaction?
(A) Rate = $[N_2O_2]$, order = 1
(B) Rate = $[N_2O_2][H_2]$, order = 2
(C) Rate = $[N_2O_2]^2$, order = 2
(D) Rate = $[N_2O_2]^2[H_2]$, order = 3

12. The reaction $2NO + Br_2 \rightarrow 2NOBr$, obeys the following mechanism:
$NO + Br_2 \xrightarrow{Fast} NOBr_2$; $NOBr_2 + NO \xrightarrow{Slow}$ 2NOBr
The rate expression of the above reaction can be written as
(A) $r = k[NO]^2[Br_2]$ (B) $r = k[NO][Br_2]$
(C) $r = k[NO][Br_2]^2$ (D) $r = k[NOBr_2]$

Answer Key

1. (D)
2. (A)
3. (C)
4. (B)
5. (D)
6. (D)
7. (A)
8. (C)
9. (B)
10. (B)
11. (B)
12. (A)