EXERCISE-I (Conceptual Questions) **Build Up Your Understanding**

RATE OF REACTION

1. Consider the chemical reaction :

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

The rate of this reaction can be expressed in terms of concentration of $N_2(g)$, $H_2(g)$ or $NH_3(g)$. Identify the correct relationship amongst the rate expressions.

(1) Rate $= -\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

(2) Rate $= \frac{d[N_2]}{dt} = -\frac{3d[H_2]}{dt} = \frac{2d[NH_3]}{dt}$

(3) Rate $= \frac{d[N_2]}{dt} = \frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

(4) Rate $= -\frac{d[N_2]}{dt} = -\frac{d[H_2]}{dt} = \frac{d[NH_3]}{dt}$

2. In the formation of sulphur trioxide by the contact process $2SO_{2(g)} + O_2(g) \rightarrow 2SO_3(g)$; the rate of reaction is expressed as

$-\frac{d[O_2]}{dt} = 2.5\times10–4 \text{ mol } L^{-1}s^{-1}$

The rate of disappearance of (SO_2) will be

(1) 5×10^{-4} mol L^{-1} s^{-1}
(2) -2.25×10^{-4} mol L^{-1} s^{-1}
(3) 3.75×10^{-4} mol L^{-1} s^{-1}
(4) 50.0×10^{-4} mol L^{-1} s^{-1}

3. In a catalytic reaction involving the formation of ammonia by Haber's process $N_2 + 3H_2 \rightarrow 2NH_3$ the rate of appearance of NH_3 was measured as 2.5×10^{-4} mole L^{-1} s^{-1}. The rate of disappearance of H_2 will be -

(1) 2.5×10^{-4} mol L^{-1} s^{-1}
(2) 1.25×10^{-4} mol L^{-1} s^{-1}
(3) 3.75×10^{-4} mol L^{-1} s^{-1}
(4) 5×10^{-4} mol L^{-1} s^{-1}

4. Which following statement is correct for a reaction $X + 2Y \rightarrow$ Product.

(l) The rate of disappearance of X = twice the rate of disappearance of Y.
(2) The rate of disappearance of X = ½ rate of appearance of products.
(3) The rate of appearance of products = ½ the rate of disappearance of Y.
(4) The rate of appearance of products = ½ the rate of disappearance of X.

5. For the reaction, $N_2O_5 \longrightarrow 2NO_2 + 1/2O_2$

Given $-\frac{d[N_2O_5]}{dt} = K_1[N_2O_5]$, $\frac{d[NO_5]}{dt} = K_2[N_2O_5]$ $\frac{d[O_2]}{dt} = K_3[N_2O_5]$

The relation between K_1, K_2 and K_3 is-

(1) $2K_1 = K_2 = 4K_3$
(2) $K_1 = K_2 = K_3$
(3) $2K_1 = 4K_2 = K_3$
(4) None

6. Rate of formation of SO_3 according to the reaction $2SO_2 + O_2 \rightarrow 2SO_3$ is 1.6×10^{-3} kg min^{-1} Hence rate at which SO_2 reacts is :-

(1) 1.6×10^{-3} kg min^{-1} (2) 8.0×10^{-4} kg min^{-1}
(3) 3.2×10^{-3} kg min^{-1} (4) 1.28×10^{-3} kg min^{-1}

7. For a general chemical change $2A + 3B \rightarrow$ products, the rate of disappearance of A is r_1 and of B is r_2. The rates r_1 and r_2 are related as :-

(1) $3r_1 = 2r_2$ (2) $r_1 = r_2$ (3) $2r_1 = 3r_2$ (4) $2r_1^2 = 2r_2^2$

8. In a reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ the rate of appearance of NH_3 is 2.5×10–4 mol L^{-1} s^{-1}. The Rate of reaction & rate of disappearance of H_2 will be (In mol L^{-1} sec^{-1})

(1) 3.75×10^{-4}, 1.25×10^{-4} (2) 1.25×10^{-4}, 2.5×10^{-4}
(3) 1.25×10^{-4}, 3.75×10^{-4} (4) 5.0×10^{-4}, 3.75×10^{-4}

9. Which of the following statement is not correct for the reaction : $4A + B \rightarrow 2C + 2D$

(1) The rate of disappearance of B is twice the rate of appearance of C
(2) The rate of disappearance of B is one fourth the rate of disappearance of A
(3) The rate of formation of D is one half the rate of consumption of A
(4) The rate of formation of C and D are equal

10. For gaseous reaction, rate = k[A][B]. If volume of container is reduced to $\frac{1}{4}$ of initial, then the rate of the reaction will be…….. times of initial :-

(1) $\frac{1}{8}$ (2) 8 (3) $\frac{1}{16}$ (4) 16

11. $2A(g) + B(g) \rightleftharpoons$ Product is an elementary reaction. If pressure is increased three times of the initial pressure, the velocity of forward reaction will be ------ of the previous velocity:-

(1) 9 times (2) 27 times (3) $\frac{1}{9}$ times (4) $\frac{1}{27}$ times

RATE LAW/ORDER/MOLECULARITY

12. The rate of certain hypothetical reaction $A + B + C \rightarrow$ Product is given by

$r = \frac{-d[A]}{dt} = K[A]^{1/2}[B]^{1/3}[C]^{1/4}$ The order of the reaction –

(1) 1 (2) $\frac{1}{2}$ (3) 2 (4) $\frac{13}{12}$

13. Which of the following rate law has an overall order of 0.5 for reaction involving substances x, y and z ?

(1) Rate = $K (C_x) (C_y) (C_z)$ (2) Rate = $K (C_x)^{0.5}(C_y)^{0.5}(C)^{0.5}$
(3) Rate = $K (C_x)^{1.5} (C_y)^{-1}(C_z)^0$ (4) Rate = $K(C_x)(C_z)^0 /(C_y)_2$

14. A chemical reaction involves two reacting species. The rate of reaction is directly proportional to the concentration of one of them and inversely proportional to the concentration of the other. The order of reaction is -
(1) 1 (2) 2 (3) Zero (4) Unpredictable

15. For the reaction $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$, the experimental data suggests,
Rate = K $[H_2][Br_2]^{1/2}$ The order for this reaction is –
(1) 2 (2) $1\frac{1}{2}$ (3) 1 (4) $2\frac{1}{2}$

16. Select the rate law that corresponds to the data shown for the following reaction $A + B \rightarrow C$

Exp.	**[A]**	**[B]**	**Initial rate**
1.	0.012	0.035	0.10
2.	0.024	0.070	1.6
3.	0.024	0.035	0.20
4.	0.012	0.070	0.80

(1) Rate = $K[B]^3$ (2) Rate = $K[B]^4$
(3) Rate = $K[A][B]^3$ (4) Rate = $K[A]^2[B]^2$

17. In a certain gaseous reaction between X and Y, X + 3Y ® XY_3 the initial rates are reported as follows-

[X]	**[Y]**	**Rate**
0.1 M	0.1 M	$0.002 Ms^{-1}$
0.2 M	0.1 M	$0.002 Ms^{-1}$
0.3 M	0.2 M	$0.0008 Ms^{-1}$
0.4 M	0.3 M	$0.018 Ms^{-1}$

The rate law is -
(1) $r = K[X][Y]^3$ (2) $r = K[X]^0[Y]^2$
(3) $r = K[X][Y]$ (4) $r = [X]^0[Y]^3$

18. Select the law that corresponds to data shown for the following reaction $2A + B \rightarrow C + D$:-

Exp.	**[A]**	**[B]**	**Initial rate (mol L^{-1} min^{-1})**
1.	0.1	0.1	7.5×10^{-3}
2.	0.3	0.2	9.0×10^{-2}
3.	0.3	0.4	3.6×10^{-1}
4.	0.4	0.1	3.0×10^{-2}

(1) Rate = $K[A]^2[B]$ (2) Rate = $K[A][B]^2$
(3) Rate = $K[A][B]^3$ (4) Rate = $K[A][B]$

19. For a hypothetical reaction : $A + B \rightarrow C$ the following data were obtained in three different experiments :-

[A] (mol L^{-1})	[B] (mol L^{-1})	Rate of reaction (mol L^{-1} min^{-1})
0.01	0.01	1.0×10^{-4}
0.01	0.03	9.0×10^{-4}
0.03	0.03	2.70×10^{-3}

The rate law will be :

(1) $r = K[A]^2[B]$ (2) $r = K[A][B]^2$

(3) r = K[Al[B] (4) None of these

20. Calculate the order of the reaction w.r.t. A and B:

[A] (mol L^{-1})	[B] (mol L^{-1})	Rate
0.05	0.05	1.2×10^{-3}
0.10	0.05	2.4×10^{-3}
0.05	0.10	1.2×10^{-3}

(1) 1 and 0 (2) 1 and 1 (3) 0 and 1 (4) None

21. For a chemical reaction A + B ® product, the order is one with respect to each A and B. value of x and y from the given data is :-

Rate (mol $L^{-1}s^{-1}$)	[A]	[B]
0.10	0.20 M	0.05 M
0.40	C	0.05 M
0.80	0.40 M	y

(1) 0.20, 0.80 (2) 0.80, 0.40

(3) 0.80, 0.20 (4) 0.40, 0.20

22. Time required to complete a half fraction of a reaction varies inversely to the concentration of reactant then the order of reaction is -

(1) Zero (2) 1 (3) 2 (4) 3

23. The rate law for the single step reaction $2A + B \rightarrow 2C$, is given by -

(1) Rate = K[A][B] (2) Rate = $K[A]^2[B]$

(3) Rate = K[2A][B] (4) Rate = $K[A]^2[B]^0$

24. For a reaction of the type $A + B \rightarrow$ products, it is observed that doubling the concentration of A causes the reaction rate to be four times as great, but doubling the amount of B does not effect the rate. The rate equation is -

(1) Rate = K [A][B] (2) Rate = K $[A]^2$

(3) Rate = $K[A]^2[B]$ (4) Rate = $K[A]^2[B]^2$

25. Point out incorrect statement.

(1) Rate law is an experimental value

(2) Law of mass action is a theoretical proposal

(3) Rate law is more informative than law of mass action for developing mechanism
(4) Rate law is always different from the expression of law of mass action.

26. For an elementary process $2X + Y \rightarrow Z + W$, the molecularity is -
(1) 2 (2) 1 (3) 3 (4) Unpredictable

27. For a reaction $A + B \rightarrow$ products, the rate of the reaction was doubled when the concentration of A was doubled, the rate was again doubled when the concentration of A & B were doubled the order of the reaction with respect to A & B are:-
(1) 1, 1 (2) 2, 0 (3) 1, 0 (4) 0, 1

28. For the reaction A + B ® products, it is found that the order of A is 1 and the order of B is $\frac{1}{2}$.
When the concentration of both A and B are increased four times, the rate will increase by a factor of :-
(1) 16 (2) 8 (3) 6 (4) 4

29. The rate law for a reaction $A + B \rightarrow$ product is rate = $K[A]^1[B]^2$. Then which one of the following statement is false :-
(1) If [B] is held constant while [A] is doubled, the reaction will proceed twice as fast
(2) If [A] is held constant while [B] is reduced to one quarter, the rate will be halved
(3) If [A] and [B) are both doubled, the reaction will proceed 8 times as fast
(4) This is a third order reaction

30. For a chemical reaction A~ B, the rate of reaction doubles when the concentration of A is increased 8 times. The order of reaction w.r.t. A is :-
(1) 3 (3) $\frac{1}{2}$ (3) $\frac{1}{3}$ (4) Zero

31. The specific rate constant of a first order reaction depends on the :-
(1) Concentration of the reactant (2) Concentration of the product
(3) Time (4) Temperature

PSEUDO FIRST ORDER REACTION MECHANISM OF REACTION

32. Following mechanism has been proposed for a reaction $2A + B \rightarrow D + E$
$A + B \rightarrow C + D$ .... (slow)
$A + C \rightarrow E$ .... (fast)
The rate law expression for the reaction is - ;
(1) $r = K[A]^2[B]$ (2) $r = K[A][B]$
(3) $r = K[A]^2$ (4) $r = K[A][C]$

33. The chemical reaction $2O_3 \rightarrow 3O_2$ produced as follows.
$O_3 \rightleftharpoons O_2 + O$ .... (fast)

$O + O_3 \longrightarrow 2O_2$ .... (slow)

The rate law expression should be-

(1) $r = K[O_3]^2$ (2) $r = k[O_3]^2[O_2]^{-1}$

(3) $r = K[O_3][O_2]$ (4) Unpredictable

34. The 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 over all reaction is-

(1) 2 (2) 1 (3) 1½ (4) Zero

35. The rate for the reaction

$RCl + NaOH\ (aq) \rightarrow ROH + NaCl$ is given by rate = $k_1[RCl]$. The rate of the reaction is -

(1) Doubled on doubling the concentration of NaOH .

(2) Halved on reducing the concentration of RCl to half

(3) Decreased on increasing the temperature of reaction

(4) Unaffected by increasing the temperature of the reaction.

36. For reaction $NO_2 + CO_4 \rightarrow CO_2 + NO$, the rate expression is, Rate = $k[NO_2]^2$ The number of molecules of CO involved in the slowest step will be - .

(1) 0 (2) l (3) 2 (4) 3

37. The rate law of the reaction A + 2B $\rightarrow$ product is given by $\frac{d[P]}{dt} = k[A]^2[B]$. If A is taken in large excess, the order of the reaction will be -

(1) Zero (2) l (3) 2 (4) 3

38. The acid hydrolysis of ester is -

(1) Psuedo 151 order reaction (2) Bimolecular reaction

(3) Pseudo unimolecular reaction (4) All

39. In the sequence of reaction.

$A \xrightarrow{K_1} B \xrightarrow{K_2} C \xrightarrow{K_3} D$; $K_3 > K_2 > K_1$, then the rate determining step of the reaction is :

(1) $A \rightarrow B$ (2) $C \rightarrow D$ (3) $B \rightarrow G$ (4) $A \rightarrow D$

40. The reaction mechanism for the reaction $P \rightarrow R$ is as follows :-

$P \overset{K_1}{\rightleftharpoons} 2$(fast); $2Q + P \xrightarrow{K_2} R$(slow) the rate law for the main reaction ($P \rightarrow R$) is [where K_1 is an equilibrium constant]

(1) $k_1[P][Q]$ (2) $k_1k_2[P]$ (3) $k_1k_2[P]^2$ (4) $k_1k_2[a]$

41. The reaction $2A + B \rightarrow P$, follow the mechanism

$2A \rightleftharpoons A_2$ (fast)

$A_2 + B \rightarrow P$ (slow)
The order of the reaction is :-
(1) 1.5 (2) 3 (3) 1 (4) 2

42. For the reaction $2NO + Cl_2 \rightarrow NOCl$ the following mechanism has been proposed
$NO + Cl_2 \rightleftharpoons NOCl_2$ (fast)
$NOCl_2 + NO \rightarrow 2NOCl$ (slow) the rate law for the reaction is:
(1) Rate = $K[NO]2[Cl_2]$
(2) Rate = $K[NO][Cl_2]^2$
(3) Rate= $K[NOCl_2]$
(4) Rate = $K[NOCl]^2$

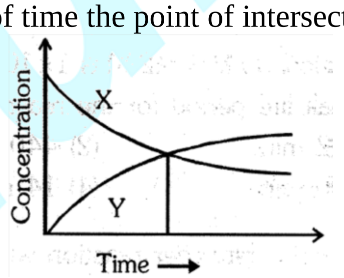
ZERO/ FIRST/ nth ORDER REACTIONS

43. The rate constant is numerically the same for three reactions of first, second and third order respectively. Which one is true at a moment for rate of all three reactions if concentration of reactants. is same and greater than 1.M.
(1) $r_1 = r_2 = r_3$
(2) $r_1 > r_2 > r_3$
(3) $r_1 < r_2 < r_3$
(4) All

44. K for a zero order reaction is
2×10^{-2} mol L^{-1} s^{-1}. If the concentration of the reactant after 25s is 0.5M, the initial concentration must have been.
(1) 0.5 M. (2) 1.25 M (3) 12.5 M (4) 1.0 M

45. The decomposition of N_2O_5 occurs as, $2N_2O_5 \rightarrow 4NO_2 + O_2$, and follows first order kinetics; hence
(1) The reaction is bimolecular
(2) The reaction is unimolecular
(3) $t_{1/2}$ a a^0
(4) $t_{1/2}\ \alpha\ a^2$

46. The accompanying figure depicts the change in concentration of species X and Y for the reaction $X \rightarrow Y$ as a function of time the point of intersection of the two curves reperesents.



(1) $t_{1/2}$
(2) $t_{3/4}$
(3) $t_{2/3}$
(4) Data are insufficient to predict

47. If the first order reaction involves gaseous reactants and gaseous products the unit of its rate is -
(1) atm (2) atm – s (3) atm - s^{-1} (4) $atm^2\ s^2$

48. Plot of log(a–x) vs time t is straight line. This indicates that the reaction is of -
(1) Second order (2) First order (3) Zero order (4) third order

49. The rate constant of a first order reaction is 4×10^{-3} s^{-1}. At a reactant concentration of 0.02 M, the rate of reaction would be-
(1) 8×10^{-5} M s^{-1}
(2) 4×10^{-3} M s^{-1}

(3) 2×10^{-1} M s^{-1} (4) 4×10^{-1} M s^{-1}

50. In a first order reaction the concentration of the reactantis decreased from 1.0 M to 0.25 M in 20 min. The rate constant of the reaction would be-

(1) 10 min^{-1} (2) 6.931 min^{-1}
(3) 0.6931 min^{-1} (4) 0.06931 min^{-1}

51. In a first order reaction the a/(a - x) was found to be 8 after 10 minute. The rate constant is

(1) $\frac{(2.303\times3\log 2)}{10}$ (2) $\frac{(2.303\times2\log 3)}{10}$
(3) 10×2.303×2log3 (4) 10×2.303×3log2

52. 75% of a first order reaction was found to complete in 32 min. When will 50% of the same reaction complete-

(1) 24 min (2) 16 min (3) 8 min (4) 4 min

53. A first order reaction has a half life period of 69.3 s. At 0.10 mol L^{-1} reactant concentration, the rate will be -

(1) 10^{-4} M s^{-1} (2) 10^{-3} M s^{-1}
(3) 10^{-1} M s^{-1} (4) 6.93×10^{-1} M s^{-1}

54. For a first order reaction A $\rightarrow$ products, the rate of reaction at [A] = 0.2 M is 1×10^{-2} mol $L^{-1}min^{-1}$.

(1) 832 min. (2) 440 s
(3) 416 min. (4) 14 min.

55. 99 % of a first order reaction was completed in 32 min. when will 99.9 % of the reaction complete?

(1) 50 min. (2) 46 min. (3) 49 min. (4) 48 min.

56. The half life for the first order reaction $N_2O_5 \rightarrow 2NO_2 + ½O_2$ is 24 hours at 30°C. Starting with 10 g of N_2O_5 how many grams of N_2O_5 will remain after a period of 96 hours ?

(1) 1.25 g (2) 0.63 g (3) 1.77 g (4) 0.5 g

57. What is the half life of a radioactive substance if 87.5% of any given amount of the substance disintegrate in 40 minutes ?

(1) 160 min (2) 10 min
(3) 20 min (4) 13 min 20 sec.

58. For a given reaction of first order it takes 20 minute for the concentration to drop from 1M to 0.6 M. The time required for the concentration to drop from 0.6 M to 0.36 M will be :

(1) More than 20 min (2) Less than 20 min
(3) Equal to 20 min (4) Infinity

59. A first order reaction is carried out with an initial concentration of 10 mol per litre and 80% of the reactant changes into the product. Now if the same reaction is carried out with an initial concentration of 5 mol per litre for the same period the percentage of the reactant changing to the product is.

(1) 40 (2) 80 (3) 160 (4) Cannot be calculated

60. In the following first order reactions, A + Reagent $\rightarrow$ Product, B + Reagent $\rightarrow$ Product Calculate the ratio of K_1 K_2, 50% of B has been reacted, when 94% of A has been reacted-

(1) 4.06 (2) 0.246 (3) 2.06 (4) 0.06

61. The reaction L $\rightarrow$ M is started with 10 g/L. After 30 minute and 90 minute, 5 g/L and 1.25 g/L are left respectively. The order of reaction is

(1) 0 (2) 2 (3) 1 (4) 3

62. The doubling the initial concentration of reactant doubles $t_{1/2}$, of the reaction, then order of the reaction

(1) 3 (2) 1 (3) 2 (4) 0

63. The half life period for catalytic of AB_3 at 50 mm is found to be 4 hours and at 100 mm it is 2 hours. The order of reaction is-

(1) 3 (2) 1 (3) 2 (4) 0

64. The rate constant for a reaction is 10.8×10^{-5} mol L^{-1} s^{-1} The reaction obeys -

(1) First order (2) Zero order
(3) Second order (4) All are wrong

65. A substance 'A' decomposes in solution following the first order kinetics flask I contains 1 L of 1M. solution of A and flask II contains. 100 ml of 0.6 M solution. After 8 hr. the concentration of A in flask. I become 0.25 M, what will be the time for concentration of A in flask II to become 0.3 M.

(1) 0.4 hr.
(2) 2.4 hr.
(3) 4.0 hr.
(4) Unpredictable as rate constant is not given

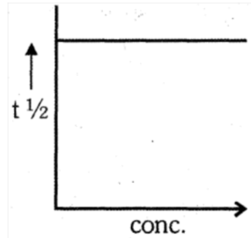
66. The rate constant (K) for the reaction 2A + B $\rightarrow$ product, was found to be 2.5×10^{-5} L mol^{-1} s^{-1} after 15 s, 2.60×10^{-5} L mol^{-1} s^{-1} after 30 s and 2.55×10^{-5} L mol^{-1} s^{-1} after 50s. The order of reaction is

(1) 2 (2) 3 (3) Zero (4) 1

67. The rate constant for a second order reaction is 8×10^{-5} M^{-1} min^{-1} : How long will it take a 1M solution to be reduced to 0.5 M.

(1) 8.665×10^{3} min (2) 8×10^{-3} min
(3) 1.25×10^{4} min (4) 4×10^{-5} min

68. A graph between t112 and concentration for n^{th} order reaction is a straight line. Reaction of this nature is completed 50% in 10 minutes when concentration is 2 mol L^{-1}. This is decomposed 50% in t minutes at 4 mol L^{-1}, n and t are respectively.



(1) 0, 20 min. (2) 1, 10 min.
(3) 1, 20 min. (4) 0, 5 min.

69. In the first order reaction, 75% of the reactant disappeared in 1.388 h. Calculate the rate constant of the reaction :-
(1) 1 s^{-1} (2) 2.8×10^{-4} s^{-1}
(3) 17.2×10^{-3} s^{-1} (4) 1.8×10^{-3} s^{-1}

70. In the case of first order reaction, the ratio of time required for 99.9 % completion to 50% completion is :-
(1) 2 (2) 5
(3) 10 (4) None

71. From different sets of data of $t_{1/2}$ at different initial concentrations say 'a' for a given reaction, the $[t_{1/2} \times a]$ is found to be constant. The order of reaction is :-
(1) 0 (2) 1
(3) 2 (4) 3

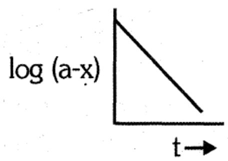
72. The reaction

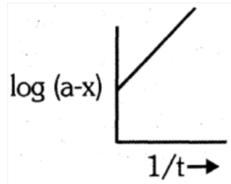
$$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$$

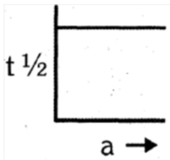
is first order with respect to N_2O_5
Which of the following graph would yield a straight line :-
(1) $\log\left(P_{N_2O_5}\right)$ v/s time with negative slope
(2) $P_{N_2O_5}^{-1}$ v/s time
(3) $P_{N_2O_5}$ v/s time
(4) $\log\left(P_{N_2O_5}\right)$ v/s time with positive slope

73. Which of the following statement is not correct for the reaction whose rate is r = k (rate constant)
(1) rate of reaction is independent of concentration of reactant
(2) $t_{1/2}$ of reaction is not depends upon concentration of reactant
(3) rate constant is independent of concentration of reactant
(4) this is zero order reaction

74. Which of the following curves represents a 1st order reaction :-

(1) 

(2) 

(3) 

(4) 1 & 3 both

75. The following data were obtained at a certain temperature for the decomposition of ammonia

p (mm)	50	100	200
$t_{1/2}$	3.64	1.82	0.91

The order of the reaction is :-

(1) 0 (2) 1
(3) 2 (4) 3

76. A reaction is found to have the rate constant x s^{-1} by what factor the rate is increased if initial concentration of A is tripled

(1) 3 (2) 9
(3) x (4) Remains same

77. Which is incorrect :-

(1) Half life of a first order reaction is independent of initial concentration
(2) Rate of reaction is constant for first order reaction
(3) Unit of K for second order reaction is mol^{-1} L s^{-1}
(4) Half life of zero order is proportional to initial concentration

78. Hydrolysis of ester in alkaline medium is :-

(1) First order reaction with molecularity one
(2) Second order reaction with molecularity two
(3) First order reaction with molecularity two
(4) Second order reaction with molecularity one

79. The expression which gives 1/4th life of 1st order reaction is:-

(1) $\frac{K}{2.303}\log\frac{4}{3}$ (2) $\frac{2.303}{K}\log 3$
(3) $\frac{2.303}{K}\log\frac{3}{4}$ (4) $\frac{2.303}{K}\log\frac{4}{3}$

80. The rate constant of a zero order reaction is 0.2 mol $dm^{-3}h^{-1}$. If the concentration of the reactant after 30 minutes is 0.05 mol dm^{-3}. Then its initial concentration would be :-

(1) 6.05 mol dm^{-3} (2) 0.15 mol dm^{-3}
(3) 0.25 mol dm^{-3} (4) 4.00 mol dm^{-3}

81. A reaction is of first order. After 100 minutes 75 gm of the reactant A are decomposed when 100 gm are taken initially, calculate the time required when 150 gm of the reactant A are decomposed, the initial weight taken is 200 gm :-

(1) 100 minutes (2) 200 minutes
(3) 150 minutes (4) 175 minutes

82. For which of the following, the unit of rate and rate constant of the reaction are identical :-

(l) First order reaction (2) Zero order reaction
(3) Second order reaction (4) fractional order of reaction

83. $2A \rightarrow$ Product, follows the first order kinetics. If the half life period of the reaction at $[A]_{Initial} = 0.2$ mol L^{-1} is 20 min. then the value of rate constant would be :-

(1) 4 s^{-1} (2) 20 s^{-1}
(3) 4 lit. mol^{-1} min^{-1} (4) 0.34 min^{-1}

84. Correct statement about first order reaction :-

(1) $t_{completion}$ = finite (2) $t^{1/2} \propto \frac{1}{a}$
(3) Unit of K is mole lit^{-1} s^{-1} (4) $t^{1/2} \times K$ = at constant temperature

COLLISION THEORY AND FACTORS AFFECTING RATE OF REACTION

85. According to collision theory of reaction rates

(1) Every collision between reactants leads to chemical reaction
(2) Rate of reaction is proportional to velocity of molecules
(3) All reactions which occur in gaseous phase are zero order reaction
(4) Rate of reaction is directly proportional to collision frequency .

86. Activation energy of a reaction is -

(1) The energy released during the reaction
(2) The energy evolved when activated complex is formed
(3) Minimum extra amount of energy needed to overcome the potential barrier of reaction
(4) The energy needed to form one mole of the product

87. The minimum energy for molecules to enter into chemical reaction is called.

(1) Kinetic energy
(2) Potential energy
(3) Threshold energy
(4) Activation energy

88. The rate constant k_1 of a reaction is found to be double that of rate constant k_2 of another reaction. The relationship between corresponding activation energies of the two reactions at same temperature (E_1 & E_2) can be represented as

(1) $E_1 > E_2$
(2) $E_l < E_2$
(3) $E_1 = E_2$
(4) $E_1 = 4E_2$

89. At room temperature the reaction between NO and O_2 to give NO_2 is fast while that between CO and O_2 is slow it is due to -
(1) CO is smaller in size than that of NO
(2) CO is poisonous
(3) The activation energy for the reaction
$2NO + O_2 \rightarrow 2NO_2$ is less than
$2CO + O_2 \rightarrow 2CO_2$
(4) NO_2 is poisonous

90. Chemical reaction occurs cis a result of collision between reacting molecules. Therefore the reaction rate is given by
(1) Total number of collisions occuring in a unit volume per second
(2) Fraction of molecules which possess energy less than the threshold energy.
(3) Total number of effective collisions
(4) Temperature

91. An endothermic reaction $A \rightarrow B$ have an activation energy 15 kCal/mol and the heat of the reaction is 5 k cal/mol. The activation energy of the reaction $B \rightarrow A$ is-
(1) 20 kCal/mol (2) 15 kCal/mol
(3) 10 kCal/mol (4) Zero

92. A large increase in the rate of a reaction for a rise in temperature is due to -
(1) Increase in the number of collisions
(2) Increase in the number of activated molecules
(3) Lowering of activation energy
(4) Shortening of the mean free path

93. Rate of which reactions increases with temperature
(1) Of any reaction
(2) Of exothermic reaction
(3) Of endothermic reaction
(4) Can't be predicted

94. The rate of a chemical reaction doubles for every 10°C rise in temperature. If the temp is increased by 60°C the rate of reaction increases by :
(1) 20 times (2) 32 times (3) 64 times (4) 128 times

95. According to the Arrhenius equation a straight line is to be obtained by plotting the logarithm of the rate constant of chemical reaction (log k) against.
(1) (T) (2) log T (3) 1/T (4) log $^1/_T$

96. Which plot will give the value of activation energy.
(1) k v/s T (2) $^1/_k$ v/s T (3) lnk v/s T (4) lnk v/s $^1/_T$

97. Given that k is the rate constant for some order of any reaction at temp T then the value of $\lim_{T\to\infty} \log k$ ________

(1) A/2.303 (2) A (3) 2.303 A (4) log A

98. From the following data; the activation energy for the reaction (Cal/mol) $H_2 + I_2 \rightarrow 2HI$

T(in K)	1/T(in K^{-1})	$\log_{10}k$
769	1.3×10^{-3}	2.9
667	1.5×10^{-3}	1.1

(1) 4×10^4
(2) 2×10^4
(3) 8×10^4
(4) 3×10^4

99. The rate constant, the activation energy and the arrhenius parameter of a chemical reaction at 25°C are 3×10^{-4} s^{-1}; 104.4 kJ mol^{-1} and 6.0×10^{14} s^{-1} respectively, the value of the rate constant as $T \rightarrow \infty$ is.

(1) 2×10^8 s^{-1}
(2) 6×10^{14} s^{-1}
(3) Infinity
(4) 3.6×10^{30} s^{-1}

100. For an endothermic reaction where ΔH represents the enthalpy of the reaction in kJ/mol ; the minimum value for the energy of activation will be

(1) Less than ΔH
(2) Zero
(3) More than ΔH
(4) Equal to ΔH

101. The rate of reaction increases to 2.3 times when the temperature is raised from 300 K to 310 K If K is the rate constant at 300 K then the rate constant at 310 K will be equal to -

(1) 2 k (2) k (3) 2.3 k (4) 3 k^2

102. If concentration of reactants is increased by 'x' then the k becomes –

(1) $\ln\frac{k}{x}$ (2) $\frac{k}{x}$ (3) k + x (4) k

103. If the concentration units are reduced by n times then the value of rate constant of first order will

(1) Increases by n times
(2) Decreases by factor of n
(3) Remain constant
(4) Decrease 1/n times

104. Which is used in the determination of reaction rates.

(1) Reaction Temperature
(2) Reaction Concentration
(3) Specific rate constant
(4) All of these.

105. The rate constant of a first order reaction depends on the :-

(1) Concentration of the reactant
(2) Concentration of the product
(3) Time
(4) Temperature

106. For the decomposition of $N_2O_5(g)$ it is given that-

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ activation energy = Ea

$N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2} O_2(g)$ activation energy = Ea' then

(1) Ea = 2Ea' (2) Ea > Ea' (3) Ea < Ea' (4) Ea = Ea'

107. For a reaction in which case the activation energies of forward and reverse reactions are equal:-

(1) $\Delta H = 0$ (2) $\Delta S = 0$ (3) The order is zero (4) There is no catalyst

108. The energy of activation of a forward reaction is 50 kCal. The energy of activation of its backward reaction is:-

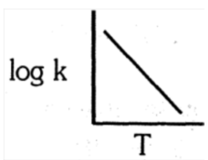
(1) Equal to 50 kCal. (2) Greater than 50 kCal.

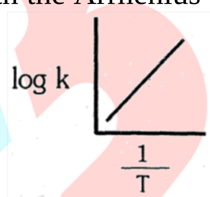
(3) Less than 50 kCal. (4) Either greater or less than 50 kCal.

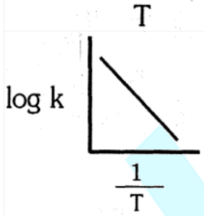
109. An exothermic reaction $X \rightarrow Y$ has an activation energy 30 kJ mol^{-1}. If energy change (ΔE) during the reaction is –20 kJ, then the activation energy for the reverse reaction is :-

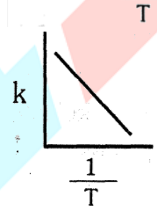
(1) 10 kJ (2) 20 kJ (3) 50 kJ (4) –30 kJ

110. Which of the following plot is in accordance with the Arrhenius equation :-

(1) 

(2) 

(3) 

(4) 

111. The rate of reaction increases by the increase of temperature because :-

(1) Collision is increased

(2) Energy of products decreases

(3) Fraction of molecules possessing energy $\geq E_T$.
(Threshold energy) increases

(4) Mechanism of a reaction is changed

112. For a certain gaseous reaction rise of temperature from 25°C to 35°C doubles the rate of reaction. What is the value of activation energy :-

(1) $\frac{10}{2.303R \times 398 \times 308}$ (2) $\frac{2.303 \times 10}{298 \times 308R}$

(3) $\frac{0.693R \times 10}{290 \times 308}$ (4) $\frac{0.693R \times 298 \times 308}{10}$

113. The activation energy for the forward reaction $X \rightarrow Y$ is 60 kJ mol^{-1} and ΔH is –20kJ mol^{-1}. The activation energy for the backward reaction $Y \rightarrow X$ is:-

(1) 80 kJ mol^{-1} (2) 40 kJ mol^{-1}
(3) 60 kJ mol^{-1} (4) 20 kJ mol^{-1}

114. For producing the effective collisions, the colloiding molecules must posses:-

(1) A certain minimum amount of energy
(2) Energy equal to or greater than threshold energy
(3) Proper orientation
(4) Threshold energy as well as proper orientation of collision

115. The half life for a reaction is ------ of temperature :-

(1) Independent (2) Increased with increase
(3) Decreased with increase (4) Increased or decreased with increase

116. The activation energy for a chemical reaction depends upon :-

(1) Temperature (2) Nature of reacting species
(3) Concentration of the reacting species (4) Collision frequency

ANSWER KEY

EXERCISE-I (Conceptual Questions)

1.	(1)	**2.**	(1)	**3.**	(3)	**4.**	(3)	**5.**	(1)	**6.**	(4)	**7.**	(1)
8.	(3)	**9.**	(1)	**10.**	(4)	**11.**	(2)	**12.**	(4)	**13.**	(3)	**14.**	(3)
15.	(2)	**16.**	(3)	**17.**	(2)	**18.**	(2)	**19.**	(2)	**20.**	(1)	**21.**	(3)
22.	(3)	**23.**	(2)	**24.**	(2)	**25.**	(4)	**26.**	(3)	**27.**	(3)	**28.**	(2)
29.	(2)	**30.**	(3)	**31.**	(4)	**32.**	(2)	**33.**	(2)	**34.**	(3)	**35.**	(2)
36.	(1)	**37.**	(2)	**38.**	(4)	**39.**	(1)	**40.**	(3)	**41.**	(2)	**42.**	(1)
43.	(3)	**44.**	(4)	**45.**	(3)	**46.**	(1)	**47.**	(3)	**48.**	(2)	**49.**	(1)
50.	(4)	**51.**	(1)	**52.**	(2)	**53.**	(2)	**54.**	(4)	**55.**	(4)	**56.**	(2)
57.	(4)	**58.**	(3)	**59.**	(2)	**60.**	(1)	**61.**	(3)	**62.**	(4)	**63.**	(3)
64.	(2)	**65.**	(3)	**66.**	(1)	**67.**	(4)	**68.**	(2)	**69.**	(2)	**70.**	(3)
71.	(3)	**72.**	(1)	**73.**	(2)	**74.**	(4)	**75.**	(3)	**76.**	(1)	**77.**	(2)
78.	(2)	**79.**	(4)	**80.**	(2)	**81.**	(1)	**82.**	(2)	**83.**	(4)	**84.**	(4)
85.	(4)	**86.**	(3)	**87.**	(3)	**88.**	(2)	**89.**	(3)	**90.**	(3)	**91.**	(3)
92.	(2)	**93.**	(1)	**94.**	(3)	**95.**	(3)	**96.**	(4)	**97.**	(4)	**98.**	(1)
99.	(2)	**100.**	(3)	**101.**	(3)	**102.**	(4)	**103.**	(3)	**104.**	(4)	**105.**	(4)
106.	(4)	**107.**	(1)	**108.**	(4)	**109.**	(3)	**110.**	(3)	**111.**	(3)	**112.**	(4)
113.	(1)	**114.**	(4)	**115.**	(3)	**116.**	(2)						