20. Chemical Kinetics – Multiple Choice Questions

1. Rate of a Reaction

1. The rate of a reaction that does not involve gases is not dependent on

(a) Pressure (b) Temperature

(c) Concentration (d) Catalyst

2. In a catalytic conversion of N_2 to NH_3 by Haber's process, the rate of reaction was expressed as change in the concentration of ammonia per time is $40 \times 10^{-3}\ mol\ litre^{-1} s^{-1}$. If there are no side reaction, the rate of the reaction as expressed in terms of hydrogen is (in $mol\ litre^{-1} s^{-1}$)

(a) 60×10^{-3} (b) 20×10^{-3}

(c) 1.200 (d) 10.3×10^{-3}

3. The rate of a gaseous reaction is given by the expression $K[A][B]$. If the volume of the reaction vessel is suddenly reduced to 1/4th of the initial volume, the reaction rate relating to original rate will be

(a) 1/10 (b) 1/8

(c) 8 (d) 16

4. The rate of disappearance of SO_2 in the reaction $2SO_2 + O_2 \rightarrow 2SO_3$ is $1.28 \times 10^{-3} g/sec$ then the rate of formation of SO_3 is

(a) $0.64 \times 10^{-3} g/sec$ (b) $0.80 \times 10^{-3} g/sec$

(c) $1.28 \times 10^{-3} g/sec$ (d) $1.60 \times 10^{-3} g/sec$

5. A catalyst increases the rate of a chemical reaction by

(a) Increasing the activation energy

(b) Decreasing the activation energy

(c) Reacting with reactants

(d) Reacting with products

6. Which of the following statements is false in relation to enzyme

(a) pH affects their functioning

(b) Temperature affects their functioning

(c) They always increase activation energy

(d) Their reactions are specific

7. The initial rate, $-\frac{d[A]}{dt}$ at $t = 0$ was found to be $2.6 \times 10^{-2} mol\,L^{-1}s^{-1}$ for the reaction

$A + 2B \rightarrow$ Products

The initial rate, $-\frac{d[B]}{dt}$, at $t = 0$ is

(a) $0.10\,mol\,L^{-1}s^{-1}$ (b) $2.6 \times 10^{-2} mol\,L^{-1}s^{-1}$

(c) $5.2 \times 10^{-2} mol\,L^{-1}s^{-1}$ (d) $6.5 \times 10^{-3} mol\,L^{-1}s^{-1}$

8. Which of these does not influence the rate of reaction

(a) Nature of the reactants

(b) Concentration of the reactants

(c) Temperature of the reaction

(d) Molecularity of the reaction

9. Consider the following reaction for $2NO_2(g) + F_2(g) \longrightarrow 2NO_2F(g)$. The expression for the rate of reaction in terms of the rate of change of partial pressures of reactant and product is/are

(a) Rate $= -1/2[dp(NO_2)/dt]$

(b) Rate $= 1/2[dp(NO_2)/dt]$

(c) Rate $= -1/2[dp(NO_2F)/dt]$

(d) Rate $= 1/2[dp(NO_2F)/dt]$

10. Which of the following statements is correct

(a) The rate of a reaction decreases with passage of time as the concentration of reactants decreases

(b) The rate of a reaction is same at any time during the reaction

(c) The rate of a reaction is independent of temperature change

(d) The rate of a reaction decreases with increases in concentration of reactant (s)

11. Which of the following expressions is correct for the rate of reaction given below

$$5Br^-(aq) + BrO_3^-(aq) + 6H^+(aq) \rightarrow 3Br_2(aq) + 3H_2O(l)$$

(a) $\frac{\Delta[Br^-]}{\Delta t} = 5\frac{\Delta[H^+]}{\Delta t}$ (b) $\frac{\Delta[Br^-]}{\Delta t} = \frac{6}{5}\frac{\Delta[H^+]}{\Delta t}$

(c) $\frac{\Delta[Br^-]}{\Delta t} = \frac{5}{6}\frac{\Delta[H^+]}{\Delta t}$ (d) $\frac{\Delta[Br^-]}{\Delta t} = 6\frac{\Delta[H^+]}{\Delta t}$

12. Rate law for the reaction $A + 2B \longrightarrow C$ is found to be

$$Rate = k[A][B]$$

Concentration of reactant 'B' is doubled, keeping the concentration of 'A' constant, the value of rate constant will be.......

(a) The same (b) Doubled

(c) Quadrupled (d) Halved

13. Compounds 'A' and 'B' react according to the following chemical equation

$$A(g) + 2B(g) \longrightarrow 2C(g)$$

Concentration of either 'A' or 'B' were changed keeping the concentrations of one of the reactants constant and rates were measured as a function of initial concentration. Following results were obtained. Choose the correct option for the rate equations for this reaction

Experiment	**Initial concentration of [A]mol L^{-1}**	**Initial concentration of [B]/mol L^{-1}**	**Initial concentration of [C]/mol L^{-1}**
1.	0.30	0.30	0.10
2.	0.30	0.60	0.40
3.	0.60	0.30	0.20

(a) Rate $= k[A]^2[B]$

(b) Rate $= k[A][B]^2$

(c) Rate $= k[A][B]$

(d) Rate $= k[A]^2[B]^0$

14. Which reaction characteristics are changing by the addition of a catalyst to a reaction at constant temperature

(i) Activation energy

(ii) Equilibrium constant

(iii) Reaction entropy

(iv) Reaction enthalpy

(a) (i) Only

(b) (iii) only

(c) (i) and I(ii) only

(d) All of these

15. If the volume of the vessel in which the reaction $2NO + O_2 \rightarrow 2NO_2$ is occurring is diminished to 1/3rd of its initial volume. The rate of the reaction will be increased by

(a) 3 times

(b) 9 times

(c) 27 times

(d) 36 times

16. The rate of reaction increases with temperature due to

(a) Decrease in activation energy

(b) Increase in activation energy

(c) Increase in collision frequency

(d) Increase in concentration

17. 100 cm^3 of 1 M CH_3COOH was mixed with 100 cm^3 of 2M CH_3OH to form an ester. The change in the initial rate if each solution is diluted with 100 cm^3 of water would be

(a) 0.5 times

(b) 2 times

(c) 0.25 times

(d) 4 times

18. For the reaction $A + 2B \rightarrow C$, the reaction rate is doubled if the concentration of A is doubled. The rate is increased by four times when concentrations of both A and B are increased by four times. The order of the reaction is

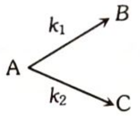
(a) 3

(b) 0

(c) 1

(d) 2

19. A Substance undergoes first order decomposition. The decomposition follows two parallel first order reactions as



$k_1 = 1.26 \times 10^{-4} s^{-1}$

$k_1 = 3.8 \times 10^{-5} s^{-1}$

The percentage distribution of B and C are

(a) 75% B and 25% C

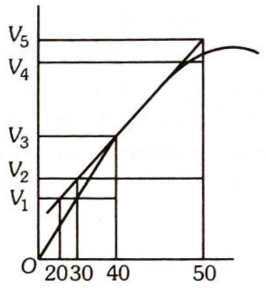
(b) 80% B and 20% C

(c) 60% B and 40% C

(d) 90% B and 10% C

(e) 76.83% B and 23.17% C

20. A graph of volume of hydrogen released vs time for the reaction between zinc and dil. HCl is given in figure. On the basis of this mark the correct option



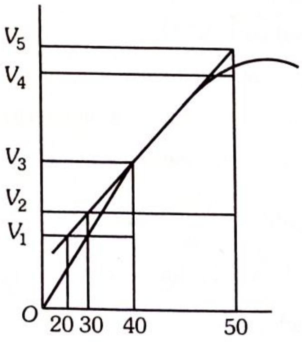
(a) Average rate upto 40s is $\frac{V_3 - V_2}{40}$

(b) Average rate upto 40s is $\frac{V_3 - V_2}{40 - 30}$

(c) Average rate upto 40s is $\frac{V_3}{40}$

(d) Average rate upto 40s is $\frac{V_3 - V_1}{40 - 20}$

21. Consider the graph given in figure. Which of the following options does not show instantaneous rate of reaction at 40s



(a) $\frac{V_5 - V_2}{50 - 30}$

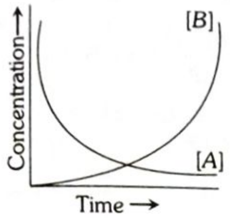
(b) $\frac{V_4 - V_2}{50 - 30}$

(c) $\frac{V_3 - V_2}{40 - 30}$

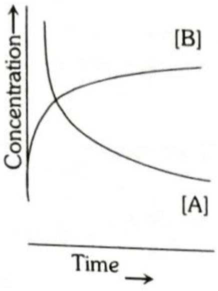
(d) $\frac{V_3 - V_1}{40 - 20}$

22. Consider the reaction $A \longrightarrow B$. The concentration of both the reactants and the products varies exponentially with time. Which of the following figures correctly describes the change in concentration of reactants and products with time

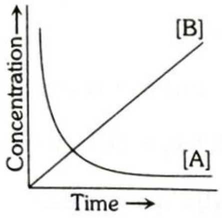
(a)



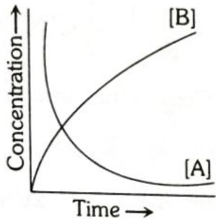
(b)



(c)



(d)



23. In the reaction $Cl_2 + CH_4 \xrightarrow{h\upsilon} CH_3Cl + HCl$, presence of a small amount of oxygen

(a) Increases the rate of reaction for a brief period of time

(b) Decreases the rate of reaction.for a brief period of time

(c) Does not affect the rate of reaction

(d) Completely stops the reaction

24. For the reaction, $A \rightleftharpoons nB$ the concentration of A decreases from 0.06 to $0.03\, mol\, L^{-1}$ and that of B rises from 0 to $0.06\, mol\, L^{-1}$ at equilibrium. The values of n and the equilibrium constant for the reaction, respectively, are

(a) 2 and 0.12 (b) 2 and 1.2

(c) 3 and 0.12 (d) 3 and 1.2

2. Rate Law and Rate Constant

1. In the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$, initial pressure is $500\, atm$ and rate constant K is $3.38 \times 10^{-5}\, \text{sec}^{-1}$. After 10 minutes the final pressure of N_2O_5 is

(a) 490 *atm* (b) 250 *atm*

(c) 480 *atm* (d) 420 *atm*

2. Which of the following oxides of nitrogen will be the most stable one

(a) $2NO_2(g) \rightleftharpoons N_2(g) + 2O_2(g); K = 6.7 \times 10^{16} mol\, l^{-1}$

(b) $2NO(g) \rightleftharpoons N_2(g) + O_2(g); K = 2.2 \times 10^{30} mol\, l^{-1}$

(c) $2N_2O_5(g) \rightleftharpoons 2N_2(g) + 5O_2(g); K = 1.2 \times 10^{34}\, mol\, l^{-1}$

(d) $2N_2O(g) \rightleftharpoons 2N_2(g) + O_2(g); K = 3.5 \times 10^{33}\, mol\, l^{-1}$

3. The reaction

$$N_2O_5\,(\text{in}\, CCl_4\ \text{solution}) \rightarrow 2NO_2(\text{solution}) + \frac{1}{2}O_2(\text{gas})$$

is of first order in N_2O_5 with rate constant $6.2 \times 10^{-1} s^{-1}$. What is the value of rate of reaction when $[N_2O_5] = 1.25\, mole\, l^{-1}$

(a) $7.75 \times 10^{-1} mole\, l^{-1} s^{-1}$ (b) $6.35 \times 10^{-3} mole\, l^{-1} s^{-1}$

(c) $5.15 \times 10^{-5} mole\, l^{-1} s^{-1}$ (d) $3.85 \times 10^{-1} mole\, l^{-1} s^{-1}$

4. Which one of the following formula represents a first order reaction

(a) $K = \frac{x}{t}$ (b) $K = \frac{1}{2t}\left[\frac{1}{(a-x)^2} - \frac{1}{a^2}\right]$

(c) $K = \frac{2.303}{t}\log_{10}\frac{a}{(a-x)}$ (d) $K = \frac{1}{t}\frac{x}{a(a-x)}$

5. The rate constant for a chemical reaction has units $L\, \text{mol}^{-1}\, s^{-1}$, order of the reaction will be

(a) 0 (b) 1

(c) 2 (d) 3

6. Which is correct about zero order reaction

(a) Rate of reaction depends on decay constant

(b) Rate of reaction is independent of concentration

(c) Unit of rate constant is concentration^{-1}

(d) Unit of rate constant is concentration^{-1} time^{-1}

7. A substance with initial concentration of 'a' mol dm^{-3} reacts according to zero order kinetics. The time it takes for the completion of the reaction is (k = rate constant)

(a) k / a (b) $a / 2k$

(c) a / k (d) $2k / a$

(e) ka

8. Which one is not correct

(a) Rate of zero order reaction depends upon initial concentration of reactant

(b) Rate of zero order reaction does not depend upon initial concentration of reactant

(c) $t_{1/2}$ of first order reaction is independent of initial concentration of reactant

(d) $t_{1/2}$ of zero order reaction is dependent of initial concentration of reactant

9. Which of these changes with time for a first-order reaction

A. Rate of reaction

B. Rate constant

C. Half-life

(a) A only (b) C only

(c) A and B only (d) B and C only

10. The unit of rate constant depends upon

(a) Rate of reaction (b) Order of reaction

(c) Molecularity of reaction (d) All of the above

11. The temperature coefficient of most of the reactions lies between

(a) 1 and 3 (b) 2 and 3

(c) 1 and 4 (d) 2 and 4

12. For a zero order reaction, the plot of concentration of reactant vs time is (intercept refers to concentration axis)

(a) Linear with +ve slope and zero intercept

(b) Linear with – ve slope and zero intercept

(c) Linear with – ve slope and non– zero intercept

(d) Linear with +ve slope and non– zero intercept

(e) A curve asymptotic to concentration axis

13. 75% of a first order reaction was completed in 32 minutes when was 50% of the reaction completed

(a) 16 *min.* (b) 24 *min.*

(c) 8 *min.* (d) 4 *min.*

14. Cyclopropane rearranges to form propene


$\longrightarrow CH_3-CH=CH_2$

This follows first order kinetics. The rate constant is $2.714\times10^{-3}\ \text{sec}^{-1}$. The initial concentration of cyclopropane is 0.29 M. What will be the concentration of cyclopropane after 100 sec

(a) 0.035 M (b) 0.22 M

(c) 0.145 M (d) 0.0018 M

15. Consider the decomposition of N_2O_5 as

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

The rate of reaction is given by

$$\frac{-d[N_2O_5]}{dt} = \frac{1}{2}\frac{d[NO_2]}{dt} = 2\frac{d[O_2]}{dt} = k_1[N_2O_5]$$

Therefore, $\dfrac{-d[N_2O_5]}{dt} = k_1[N_2O_5]$

$$\frac{+d[NO_2]}{dt} = 2k_1[N_2O_5] = k_1^{'}[N_2O_5]$$

$$\frac{+d[O_2]}{dt} = \frac{1}{2}k_1[N_2O_5] = k_1''[N_2O_5]$$

Choose the correct option

(a) $k_1 = k'_1 = k''_1$ (b) $k_1 = 2k'_1 = k''_1$

(c) $4k_1 = k'_1 = 2k''_1$ (d) None of these

16. Sucrose decomposes in acid solution into glucose and fructose according to first order rate law with a half life of 3.33 hrs at 25°C. What fraction of sample of sucrose remains after 9.00 hrs

(a) 0.333 (b) 0.666

(c) 0.153 (d) 0.250

17. For the second order reaction,

$A+B\rightarrow$ Products

When a moles of A reacts with b moles of B, the rate equation is given by

$$k_2t = \frac{1}{(a-b)}\ln\frac{b(a-x)}{a(b-x)}$$

When $a >> b$, the rate expression becomes that of

(a) First order

(b) Zero order

(c) Unchanged, second order

(d) Third order

18. Consider a first order gas phase decomposition reaction given below

$A(g)\rightarrow B(g)+C(g)$

The initial pressure of the system before decomposition of A was p_i. After lapse of time 't' total pressure of the system increased by x units and became 'p_t'. The rate constant k for the reaction is given as......

(a) $k = \dfrac{2.303}{t}\log\dfrac{p_i}{p_i-x}$ (b) $k = \dfrac{2.303}{t}\log\dfrac{p_i}{2p_i-p_t}$

(c) $k = \dfrac{2.303}{t}\log\dfrac{p_i}{2p_i+p_t}$ (d) $k = \dfrac{2.303}{t}\log\dfrac{p_i}{p_i+x}$

19. The following data is obtained during the first order thermal decomposition of $2A_{(g)} \longrightarrow B_{(g)} + C_{(s)}$

at constant volume and temperature

S. No.	**Time**	**Total pressure in Pascal**
1.	At the end of 10 minutes	300
2.	After completion	200

The rate constant in min^{-1} is

(a) 0.0693
(b) 6.93
(c) 0.00693
(d) 69.3

20. For consecutive first order reaction

$A \xrightarrow{k_1} B \xrightarrow{k_2} C$, at 300 K

$k_1 = 2\times10^{-3}s^{-1}$ and $k_2 = 5\times10^{-5}s^{-1}$

The time which [B] will be maximum is

(a) 189.2 s
(b) 1892 s
(c) 0 s
(d) ∞

21. The rate of the reaction $A \rightarrow$ products, at the initial concentration of $3.24\times10^{-2}M$ is nine times its rate at another initial concentration of $1.2\times10^{-3}M$. The order of the reaction is

(a) $\frac{1}{2}$
(b) $\frac{3}{4}$
(c) $\frac{3}{2}$
(d) $\frac{2}{3}$
(e) $\frac{1}{3}$

22. For a reaction between *A* and *B* the order with respect to *A* is 2 and the order with respect to *B* is 3. The concentration of both *A* and *B* are doubled the rate will increase by a factor of

(a) 12
(b) 16
(c) 32
(d) 10

23. $X \xrightarrow{step-I} Y \xrightarrow{step-II} Z$ is a complex reaction. Total order of reaction is 2 and step – II is slow step. What is molecularity of step-II

(a) 1
(b) 2
(c) 3
(d) 4

24. The inversion of cane sugar is represented by

$$C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$$

It is a reaction of

(a) Second order
(b) Unimolecular
(c) Pseudo unimolecular
(d) None of the three

25. The alkaline hydrolysis of ethyl acetate is represented by the equation

$$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$$

Experimentally it is found that for this reaction

$$\frac{dx}{dt} = k[CH_3COOC_2H_5][NaOH]$$

Then the reaction is

(a) Bimolecular and of first order

(b) Bimolecular and of second order

(c) Pseudo–bimolecular

(d) Pseudo–unimolecular

26. In a reaction involving hydrolysis of an organic chloride in presence of large excess of water

$$RCl + H_2O \rightarrow ROH + HCl$$

(a) Molecularity is 2, order of reaction is also 2

(b) Molecularity is 2, order of reaction is 1

(c) Molecularity is 1, order of reaction is 2

(d) Molecularity is 1, order of reaction is also 1

27. For the reaction $A + B \rightarrow$ products, doubling the concentration of *A*, the rate of the reaction is doubled, but on doubling the concentration of *B*, rate remains unaltered. The overall order of the reaction is

(a) 1
(b) 0
(c) 2
(d) 3

28. For a given reaction $t_{1/2} = \frac{1}{Ka}$. The order of the reaction is

(a) 1
(b) 0
(c) 3
(d) 2

29. If the order of the reaction $x + y \xrightarrow{h\upsilon} xy$ is zero, it means that the rate of

(a) Reaction is independent of temperature

(b) Formation of activated complex is zero

(c) Reaction is independent of the concentration of reacting species

(d) Decomposition of activated complex is zero

30. Given the hypothetical reaction mechanism

$$A \xrightarrow{\text{I}} B \xrightarrow{\text{II}} C \xrightarrow{\text{III}} D \xrightarrow{\text{IV}} E$$

and the data as :

Species formed	**Rate of its formation**
B	0.002 *mol/h*, per mole of *A*
C	0.030 *mol/h*, per mole of *B*
D	0.011 *mol/h*. per mole of *C*
E	0.420 *mol h/* per mole of *D*

The rate determining step is

(a) Step I (b) Step II

(c) Step III (d) Step IV

31. $CH_3COOC_2H_5 + H_2O \xrightarrow{H^+} CH_3COOH + C_2H_5OH$ is an example of .... order

(a) Zero (b) Second

(c) Third (d) Pseudo first order

32. For the reaction $O_{3\,(g)} + O_{(g)} \rightarrow 2O_{2(g)}$, if the rate law expression is, rate $= K[O_3][O]$ the molecularity and order of the reaction are respectively

(a) 2 and 2 (b) 2 and 1.33

(c) 2 and 1 (d) 1 and 2

33. For the reaction $2SO_2 + O_2(\text{excess}) \rightarrow 2SO_3$ the order of reaction with respect to O_2 is

(a) Zero (b) One

(c) Two (d) Three

34. Which of the following statements is not correct about order of a reaction

(a) The order of a reaction can be a fractional number

(b) Order of a reaction is experimentally determined quantity

(c) The order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction

(d) The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression

35. The value of rate constant of a pseudo first order reaction......

(a) Depends on the concentration of reactants present in small amount

(b) Depends on the concentration of reactants present in excess

(c) Is independent of the concentration of reactants

(d) Depends only on temperature

36. The reaction $2H_2O_2 \rightarrow 2H_2O + O_2$ is a

(a) Zero order reaction (b) First order reaction

(c) Second order reaction (d) Third order reaction

37. Which of the following reactions end in finite time

(a) 0 order (b) 1st order

(c) 2nd order (d) 3rd order

38. For a reaction between *A* and *B*, the initial rate of reaction is measured for various initial concentrations of *A* and *B*. The data provided are

	[*A*]	**[*B*]**	**Initial reaction rate**
(i)	0.20 *M*	0.30 *M*	5×10^{-5}
(ii)	0.20 *M*	0.10 *M*	5×10^{-5}
(iii)	0.40 *M*	0.05 *M*	1×10^{-4}

The overall order of the reaction is

(a) One (b) Two

(c) Two or a half (d) Three

39. Which of the following is the correct statement

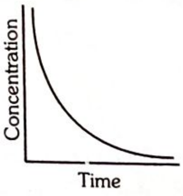
(a) Order of a reaction has always an integral value

(b) Mechanism of a reaction proposed is always final

(c) Zero order reactions are multi-step reactions

(d) Order of reaction can be predicted even without knowing the rate law

40. Certain reactions follow the relation between concentrations of the reactant *vs* time as



What is the expected order for such reactions

(a) 0 (b) 1

(c) 2 (d) Infinity

41. Acid catalysed hydrolysis of ethyl acetate follows a *pseudo*-first order kinetics with respect to ester. If the reaction is carried out with large excess of ester, the order with respect to ester will be

(a) 1.5 (b) 0

(c) 2 (d) 1

42. For a certain reaction $R \rightarrow$ products, a plot of $\log[R]$ versus time gives a straight line with a slope of $-1.46\,\text{sec}^{-1}$. The order of reaction is

(a) Zero
(b) One
(c) Two
(d) Fractional

43. If 'a' is the initial concentration and 'n' is the order of the reaction and the half life period is 'T', then

(a) $T \propto a^{n-1}$
(b) $T \propto a^{n}$
(c) $T \propto \frac{1}{a^{n}}$
(d) $T \propto \frac{1}{a^{n-1}}$

44. The half life of a first order reaction is 10 minutes. If initial amount is $0.08\,mol/litre$ and concentration at some instant is $0.01\,mol/litre$, then $t =$

(a) 10 minutes
(b) 30 minutes
(c) 20 minutes
(d) 40 minutes

45. If initial concentration is reduced to its 1/4th in a zero order reaction, the time taken for half of the reaction to complete

(a) Remains same
(b) Becomes 4 times
(c) Becomes one-fourth
(d) Doubles

46. For a first order reaction velocity constant, $K = 10^{-3}\,s^{-1}$. Two third life for it would be

(a) 1100 s
(b) 2200 s
(c) 3300 s
(d) 4400 s

47. The rate equation for a reaction $A \rightarrow B$ is $r = k[A]^0$. if the initial concentration of the reactant is $a\ mol\ dm^{-3}$, the half-life period of the reaction is

(a) $\frac{k}{a}$
(b) $\frac{a}{k}$
(c) $\frac{2a}{k}$
(d) $\frac{a}{2k}$

48. For a first order reaction, the time required for 99.9% of the reaction to take place is nearly

(a) 10 times that required for half of the reaction
(b) 100 times that required for two-third of the reaction
(c) 10 times that required for one-fourth of the reaction
(d) 20 times that required for half of the reaction

49. Half life period of a first order reaction is 10 *min*. Starting with initial concentration 12 *M*, the rate after 20 *min* is

(a) $0.0693 \times 3\,M\ min^{-1}$
(b) $0.0693\,M\ min^{-1}$
(c) $0.0693 \times 4\,M\ min^{-1}$
(d) $0.693 \times 3\,M\ min^{-1}$

50. Half life of a reaction is found to be inversely proportional to the cube of its initial concentration. The order of reaction is

(a) 2
(b) 5
(c) 3
(d) 4

51. A first order reaction is 50% completed in $1.26 \times 10^{14}\,s$. How much time would it take for 100% completion

(a) $1.26 \times 10^{15}\,s$
(b) $2.52 \times 10^{14}\,s$
(c) $2.52 \times 10^{28}\,s$
(d) Infinite

52. The half-life of 2 samples is 0.1 and 0.4 seconds. Their concentrations are 200 and 50 respectively. What is the order of the reaction

(a) 0
(b) 2
(c) 1
(d) 4

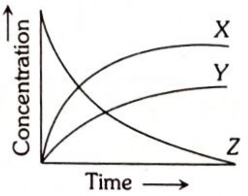
53. The concentration of a substance undergoing a chemical reaction becomes one–half of its original value after time t regardless of the initial concentration. The reaction is an example of a

(a) Zero order reaction
(b) First order reaction
(c) Second order reaction
(d) Third order reaction

54. For a first order reaction $R \rightarrow P$, the rate constant is k. If the initial concentration of R is $[R_0]$, the concentration of R at any time 't' is given by the expression

(a) $[R_0]e^{kt}$
(b) $[R_0](1-e^{-kt})$
(c) $[R_0]e^{-kt}$
(d) $[R_0](1-e^{kt})$

55. Consider the reaction: $2NO_2(g) \rightarrow 2NO(g) + O_2(g)$. In the figure below, identify the curves X, Y and Z associated with the three species in the reaction



(a) $X = NO, Y = O_2, Z = NO_2$
(b) $X = O_2, Y = NO, Z = NO_2$
(c) $X = NO_2, Y = NO, Z = O_2$
(d) $X = O_2, Y = NO_2, Z = NO$

56. After 2 hours the amount of a certain radioactive substance reduces to 1/16th of the original amount (the decay process follows first–order kinetics). The half–life of the radioactive substance is

(a) 15 *min*
(b) 30 *min*
(c) 45 *min*
(d) 60 *min*

57. In a zero–order reaction, if the initial concentration of the reactant is doubled, the time required for half the reactant to be consumed

(a) Increases two-fold (b) Increases four–fold

(c) Decreases by half (d) Does not change

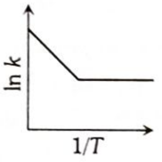
58. A zero–order reaction, $A \rightarrow$ Product, with an initial concentration $[A]_0$ has a half–life of $0.2 s$. If one starts with the concentration $2[A]_0$, then the half–life is

(a) $0.1 s$ (b) $0.4 s$

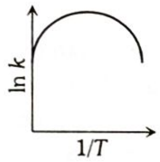
(c) $0.2 s$ (d) $0.8 s$

59. Among the following graphs showing variation of rate (k) with temperature (T) for a reaction, the one that exhibits arrhenius behaviour over the entire temperature range is

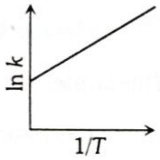
(a)



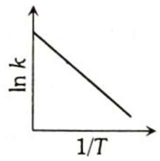
(b)



(c)



(d)



60. For a zero-order reaction with rate constant k, the slope of the plot of reactant concentration against time is

(a) $k/2.303$ (b) k

(c) $-k/2.303$ (d) $-k$

61. It takes 1h for a first order reaction to go to 50% completion. The total time required for the same reaction to reach 87.5% completion will be

(a) $1.75 h$ (b) $6.00 h$

(c) $3.50 h$ (d) $3.00 h$

3. Collision Theory, Energy of Activation and Arrhenius Equation

1. Activation energy of any reaction depends on

(a) Temperature

(b) Nature of reactants

(c) Number of collisions per unit time

(d) Concentration of reactants

2. For a reaction, activation energy $(E_a) = 0$ and rate constant $(K) = 3.2 \times 10^6 s^{-1}$ at 300 K. What is the value of the rate constant at 310 K

(a) $3.2 \times 10^{-12} s^{-1}$ (b) $3.2 \times 10^6 s^{-1}$

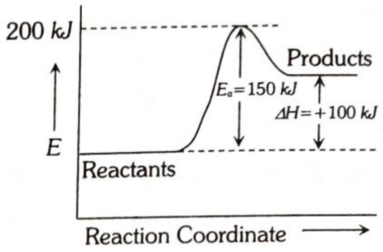
(c) $6.4 \times 10^{12} s^{-1}$ (d) $6.4 \times 10^6 s^{-1}$

3. The rate constant is given by the equation $k = pze^{-E/RT}$. Which factor should register a decrease for the reaction to proceed more rapidly

(a) T (b) Z

(c) E (d) p

4. In the given graph the activation energy, E_a for the reverse reaction will be



(a) $150 kJ$ (b) $50 kJ$

(c) $200 kJ$ (d) $100 kJ$

5. The rate constant (K') of one reaction is double of the rate constant (K'') of another reaction. Then the relationship between the corresponding activation energies of the two reactions (E_a' and E_a'') will be

(a) $E_a' > E_a''$ (b) $E_a' = E_a''$

(c) $E_a' < E_a''$ (d) $E_a' = 4E_a''$

6. The role of catalyst is to change.......

(a) Gibbs energy of reaction

(b) Enthalpy of reaction

(c) Activation energy of reaction

(d) Equilibrium constant

7. In the presence of a catalyst, the heat evolved or absorbed during the reaction.......

(a) Increases

(b) Decreases

(c) Remains unchanged

(d) May increase or decrease

8. For a reversible chemical reaction where the forward process is exothermic which of the following statements is correct

(a) The backward reaction has higher activation energy than the forward reaction

(b) The backward and the forward Processes have the same activation energy

(c) The backward reaction has lower activation energy

(d) No activation energy is required at all since energy is liberated in the process

9. A large increase in the rate of a reaction for a rise in temperature is due to

(a) The decrease in the number of collisions

(b) The increase in the number of activated molecules

(c) The shortening of the mean free path

(d) The lowering of the activation energy

10. The minimum energy a molecule should possess in order to enter into a fruitful collision is known as

(a) Reaction energy (b) Collision energy

(c) Activation energy (d) Threshold energy

11. Activation energy is

(a) The amount of energy to be added to the actual energy of a molecule so that the threshold energy is reached

(b) The amount of energy the molecule must contain so that it reacts

(c) The energy which a molecule should have in order to enter into an effective collision

(d) The average kinetic energy of the molecule

12. The activation energy for a reaction at the temperature TK was found to be $2.303RT\,J\,mol^{-1}$. The ratio of the rate constant to Arrhenius factor is

(a) 10^{-1} (b) 10^{-2}

(c) 2×10^{-3} (d) 2×10^{-2}

13. Collision theory is applicable to

(a) First order reactions (b) Zero order reactions

(c) Bimolecular reactions (d) Intra molecular reactions

14. Pick the appropriate choice about collision theory of reaction rates

(a) It explains the effect of temperature on rate of reaction

(b) It assumes that the reactants must be in correct orientation to react

(c) It says rate depends upon the frequency at which reactants collide

(d) The collisions having energy higher than the threshold value give successful reaction

15. The rate of reactions exhibiting negative activation energy

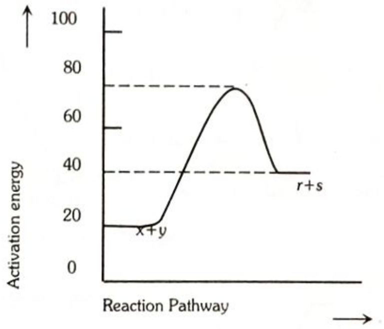
(a) Decreases with increasing temperature

(b) Increases with increasing temperature

(c) Does not depend on temperature

(d) Depends on the height of the potential barrier

16. Consider the following energy profile for the reaction. $X+Y=R+S$. Which of the following deductions about the reaction is not correct



(a) The energy of activation for the backward reaction is 80 *kJ*

(b) The forward reaction is endothermic

(c) ΔH for the forward reaction is 20 *kJ*

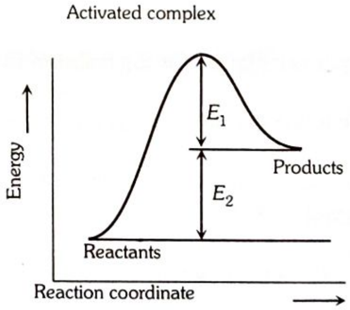
(d) The energy of activation for the forward reaction is 60 *kJ*

17. The minimum energy required for molecules to enter into the reaction is called

(a) Potential energy (b) Kinetic energy

(c) Nuclear energy (d) Activation energy

18. Consider figure and mark the correct option



(a) Activation energy of forward reaction is E_1+E_2 and product is less stable than reactant

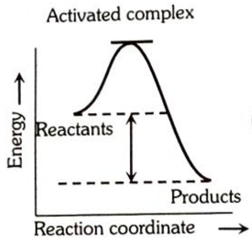
(b) Activation energy of forward reaction is E_1+E_2 and product is more stable than reactant

(c) Activation energy of both forward and backward reaction is E_1+E_2 and reactant is more stable than product

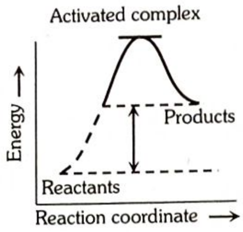
(d) Activation energy of backward reaction is E_1 and product is more stable than reactant

19. Which of the following graphs represent exothermic reaction

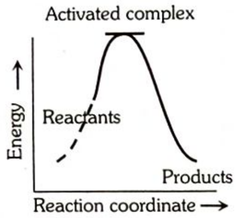
(i)



(ii)



(iii)



(a) Only (I) (b) Only (II)

(c) Only (III) (d) Only (I) and (II)

20. Which of the following statements is incorrect about the collision theory of chemical reaction

(a) It considers reacting molecules or atoms to be hard spheres and ignores their structural features

(b) Number of effective collisions determines the rate of reaction

(c) Collision of atoms or molecules possessing sufficient threshold energy results into the product formation

(d) Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective

21. Which of the following statement is not correct for the catalyst

(a) It catalyses the forward and backward reactions to the same extent

(b) It alters ΔG of the reaction

(c) It is a substance that does not change the equilibrium constant of a reaction

(d) It provides an alternate mechanism by reducing activation energy between reactants and products

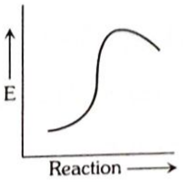
22. A chemical reaction was carried out at 300 K and 280 K. The rate constants were found to be K_1 and K_2 respectively. The energy of activation is 1.157×10^4 $cal\ mole^{-1}$ and $R = 1.987\ cal$. Then

(a) $K_2 \approx 0.25 K_1$ (b) $K_2 \approx 0.5 K_1$

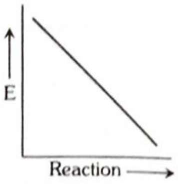
(c) $K_2 \approx 4 K_1$ (d) $K_2 \approx 2 K_1$

23. Which graph shows zero activation energy for reaction

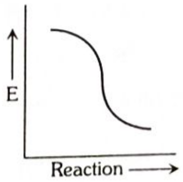
(a)



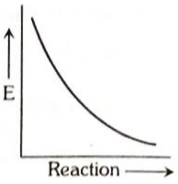
(b)



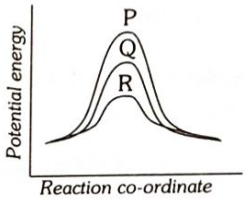
(c)



(d)



24. If a homogeneous catalytic reaction can take place through 3 alternative path as depicted below, the catalytic efficiency of P, Q, R representing the relative case would be



(a) $P > Q > R$ (b) $Q > P > R$

(c) $P > R > Q$ (d) $R > Q > P$

(e) $P = Q = R$ as the initial and final states are the same

25. In Arrhenius plot, intercept is equal to

(a) $\frac{-E_a}{R}$ (b) $\ln A$

(c) $\ln K$ (d) $\log_{10} A$

26. According to Arrhenius theory, the activation energy is

(a) The energy it should possess so that it can enter into an effective collision

(b) The energy which the molecule should possess in order to undergo reaction

(c) The energy it has to acquire further so that it can enter into an effective collision

(d) The energy gained by the molecules on colliding with another molecule

27. The rate constant of a reaction at temperature $200K$ is 10 times less than the rate constant at 400 K. What is the activation energy (E_a) of the reaction (R = gas constant)

(a) 1842.4 R (b) 921.2 R

(c) 460.6R (d) 230.3 R

28. A reaction rate constant is given by

$k = 1.2 \times 10^{14} e^{-(25000/RT)} \text{ sec}^{-1}$

It means

(a) $\log k$ versus $\log T$ will give a straight line with slope as – 25000

(b) $\log k$ versus T will give a straight line with slope as – 25000

(c) $\log k$ versus $\log 1/T$ will give a straight line with slope as – 25000

(d) $\log k$ versus $1/T$ will give a straight line

29. In the Arrhenius plot of $\ln k$ *vs* $\frac{1}{T}$, a linear plot is obtained with a slope of $-2 \times 10^4\ K$. The energy of activation of the reaction (in $kJ\ mole^{-1}$) is (R value is $8.3\ J\ K^{-1}\ mol^{-1}$)

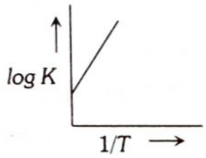
(a) 83 (b) 166

(c) 249 (d) 332

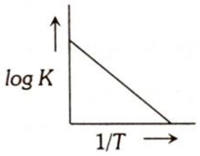
(e) 830

30. A graph plotted between log *K* vs 1/*T* for calculating activation energy is shown by

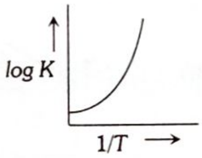
(a)



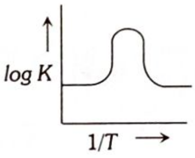
(b)



(c)



(d)



31. The activation energy for a reaction is $9.0\ K\ cal/mol$. The increase in the rate constant when its temperature is increased from 298*K* to 308*K* is

(a) 63% (b) 50%

(c) 100% (d) 10%

32. Consider the Arrhenius equation given below and mark the correct option

$$k = Ae^{-\frac{E_a}{RT}}$$

(a) Rate constant increases exponentially with increasing activation energy and decreasing temperature

(b) Rate constant decreases exponentially with increasing activation energy and decreasing temperature

(c) Rate constant increases exponentially with decreasing activation energy and decreasing temperature

(d) Rate constant increases exponentially with decreasing activation energy and increasing temperature

33. A given sample of milk turns sour at room temperature (27°C) in 5 hours. In a refrigerator at $-3°C$, it can be stored 10 times longer. The energy of activation for the souring of milk is

(a) $2.303 \times 10\ R\ kJ\ mol^{-1}$ (b) $2.303 \times 5\ R\ kJ\ mol^{-1}$

(c) $2.303 \times 3\ R\ kJ\ mol^{-1}$ (d) $2.303 \times 2.7\ R\ kJ\ mol^{-1}$

34. Increasing the temperature increases the rate of reaction but does not increase the

(a) Number of collisions

(b) Activation energy

(c) Average energy of collisions

(d) Average velocity of the reactant molecules

35. The rate of gas phase chemical reactions generally increases rapidly with rise in temperature. This is mainly because

(a) The collision frequency increases with temperature

(b) The fraction of molecules having energy in excess of the activation energy increases with temperature

(c) The activation energy decreases with temperature

(d) The average kinetic energy of molecules increases with temperature

36. The rate constant of a chemical reaction at a very high temperature will approach

(a) Arrhenius frequency factor divided by the ideal gas constant

(b) Activation energy

(c) Arrhenius frequency factor

(d) Activation energy divided by the ideal gas constant

37. A reaction has an activation energy of $209\ kJ\ \text{mol}^{-1}$. The rate increases 10–fold when the temperature is increased from $27°C$ to $X°C$. The temperature X is closest to

[Gas constant, $R = 8.314 J\ mol^{-1} K^{-1}$]

(a) 35 (b) 40

(c) 30 (d) 45

38. In fire flies the flashes are produced due to the slow combustion of a protein luciferin in air and moisture. The phenomenon is known as

(a) Photochemical change (b) Photocombustion

(c) Chemiluminescence (d) None of the above

4. Graphical Questions

1. Rate law of the n^{th} order reaction is given by

$$\frac{dx}{dt} = k[A]^n$$

What kinetic parameters can you derive from logarithm graph

(a) n (order) of reaction (b) k (rate constant)

(c) Both a and b (d) None of these

2. Rate constant k of the first order reaction is given by

$$k = \frac{2.303}{t}\log\frac{a}{a-x}$$

What parameters can be derived from logarithm graph

(a) k (b) a

(c) Both k and a (d) None of these

3. Rate constant k varies with temperature $T(k)$ as given by equation

$$\log k = \log A - \frac{E_a}{2.303RT}$$

A plot between $\log k$ and $\frac{1}{T}$ is straight line from the graph we can say

(a) $E_a = 2.303R \times \text{slope}$ (b) $E_a = 2.303R^2 \times \tan\theta$

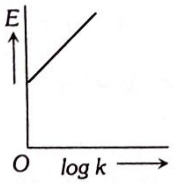
(c) $E_a = R\tan\theta$ (d) None of these

4. EMF of a cell is related to standard EMF, E^o by the equation

$$E = E^o - \frac{0.0591}{n}\log k$$

Where k is reaction quotient and n the volume of electrons which is correct graphical representation

(a)



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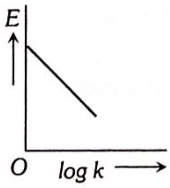
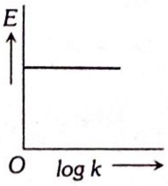
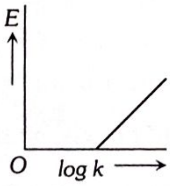


(c)



(d)

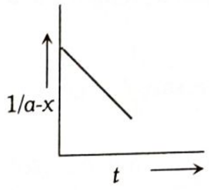


5. For the reaction $A \to \text{Product}$

$$k = \frac{1}{t}\left[\frac{1}{a-x} - \frac{1}{a}\right]$$

Where k is rate constant (in $mol^{-1}s^{-1}$) and $(a-x)$ are the concentration of A at the start and after time interval $t\,\text{sec}$. A graph between $\frac{1}{a-x}$ and time t is of the following

(a)



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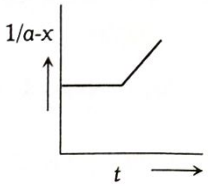

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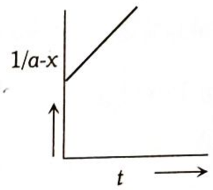
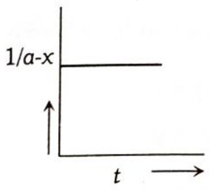


(d)

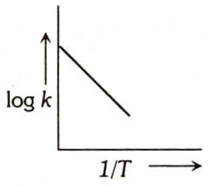


6. Following equation gives variation of equilibrium constant k with temperature T

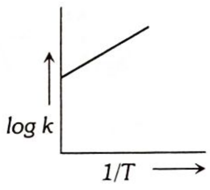
$$\log k = \log A - \frac{\Delta H}{2.303RT}$$

Graphically this variation is represented as

(a)



(b)



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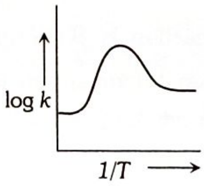
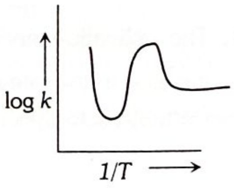


(d)



5. IIT-JEE/ AIEEE

1. The rate law for the reaction

$RCl + NaOH(aq) \to ROH + NaCl$ is given by Rate $= K_1[RCl]$. The rate of the reaction will be **[1988]**

(a) Doubled on doubling the concentration of sodium hydroxide

(b) Halved on reducing the concentration of alkyl halide to one half

(c) Decreased on increasing the temperature of the reaction

(d) Unaffected by increasing the temperature of the reaction

2. For the reaction $N_2(g)+3H_2(g)\rightarrow 2NH_3(g)$ under certain conditions of temperature and partial pressure of the reactants, the rate of formation of NH_3 is $0.001\,kg\,h^{-1}$. The rate of conversion of H_2 under the same conditions is **[1994]**

(a) $1.82\times10^{-4}\,kg/hr$ (b) $0.0015\,kg/hr$

(c) $1.52\times10^{4}\,kg/hr$ (d) $1.82\times10^{-14}\,kg/hr$

3. For a reaction $\frac{1}{2}A\rightarrow 2B$, rate of disappearance of 'A' is related to the rate of appearance of 'B' by the expression **[2008]**

(a) $-\frac{d[A]}{dt}=\frac{1}{4}\frac{d[B]}{dt}$ (b) $-\frac{d[A]}{dt}=\frac{d[B]}{dt}$

(c) $-\frac{d[A]}{dt}=4\frac{d[B]}{dt}$ (d) $-\frac{d[A]}{dt}=\frac{1}{2}\frac{d[B]}{dt}$

4. The rate of a chemical reaction doubles for every $10^\circ C$ rise of temperature. If the temperature is raised by $50^\circ C$, the rate of the reaction increases by about **[2011]**

(a) 10 times (b) 24 times

(c) 32 times (d) 64 times

5. The rate law for a reaction between the substances *A* and *B* is given by, rate $=k[A]^n[B]^m$. On doubling the concentration of *A* and halving the concentration of *B*, the ratio of the new rate to the earlier rate of the reaction will be as **[2003]**

(a) $\frac{1}{2^{(m+n)}}$ (b) $(m+n)$

(c) $(n-m)$ (d) $2^{(n-m)}$

6. For the non-stoichiometre reaction $2A+B\rightarrow C+D$, the following kinetic data were obtained in three separate experiments, all at $298\,K$.

Initial Concentration (A)	**Initial Concentration (B)**	**Initial rate of formation of C $(mol\,L^{-}S^{-})$**
0.1 *M*	0.1 *M*	1.2×10^{-3}
0.1 *M*	0.2 *M*	1.2×10^{-3}
0.2 *M*	0.1 *M*	2.4×10^{-3}

The rate law for the formation of *C* is **[2014]**

(a) $\frac{dc}{dt}=k[A][B]$ (b) $\frac{dc}{dt}=k[A]^2[B]$

(c) $\frac{dc}{dt}=k[A][B]^2$ (d) $\frac{dc}{dt}=k[A]$

7. In a first order reaction the concentration of reactant decreases from $800\,mol/dm^3$ to $50\,mol/dm^3$ in 2×10^2 sec. The rate constant of reaction in sec^{-1} is **[2003]**

(a) 2×10^4 (b) 3.45×10^{-5}

(c) 1.386×10^{-2} (d) 2×10^{-4}

8. The rate equation for the reaction $2A+B\rightarrow C$ is found to be: rate $=k[A][B]$. The correct statement in relation to this reaction is that the **[2004]**

(a) Rate of formation of *C* is twice the rate of disappearance of *A*

(b) $t_{1/2}$ is a constant

(c) Unit of *k* must be s^{-1}

(d) Value of *k* is independent of the initial concentrations of *A* and *B*

9. Units of rate constant of first and zero order reactions in terms of molarity *M* unit are respectively **[2002]**

(a) $sec^{-1},\ M\,sec^{-1}$ (b) $sec^{-1},\ M$

(c) $M\,sec^{-1},\ sec^{-1}$ (d) M, sec^{-1}

10. For a first order reaction $(A)\rightarrow$ products the concentration of *A* changes from $0.1M$ to $0.025M$ in 40 minutes. The rate of reaction when the concentration of *A* is $0.01M$ is **2012]**

(a) $1.73\times10^{-5}M/\min$ (b) $3.47\times10^{-4}M/\min$

(c) $3.47\times10^{-5}M/\min$ (d) $1.73\times10^{-4}M/\min$

11. The integrated rate equation is $Rt=\log C_0-\log C_t$. The straight line graph is obtained by plotting **[2002]**

(a) *time v/s* $\log C_t$ (b) $\frac{1}{time}$ *v/s* C_t

(c) *time v/s* C_t (d) $\frac{1}{time}$ *v/s* $\frac{1}{C_t}$

12. Consider the reaction, $2A+B\rightarrow$ Products

When concentration of *B* alone was doubled, the half-life did not change. When the concentration of *A* alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is **[2007]**

(a) $L\,mol^{-1}\,s^{-1}$ (b) No unit

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

13. The rate constant for the reaction, $2N_2O_5\rightarrow 4NO_2+O_2$ is $3\times10^{-5}\,sec^{-1}$. If the rate is $2.40\times10^{-5}\,mol\,litre^{-1}\,sec^{-1}$. Then the concentration of N_2O_5 (in *mol litre*$^{-1}$) is **[2000]**

(a) 1.4 (b) 1.2

(c) 0.04 (d) 0.8

14. Under the same reaction conditions, initial concentration of $1.386\,mol\,dm^{-3}$ of a substance becomes half in 40 seconds and 20 seconds through first order and zero order kinetics, respectively. Ratio $\left(\frac{k_1}{k_0}\right)$ of the rate constants for first order (k_1) and zero order (k_0) of the reactions is **[2008]**

(a) $0.5\,mol^{-1}dm^3$ (b) $1.0\,mol\,dm^{-3}$

(c) $1.5\,mol\,dm^{-3}$ (d) $2.0\,mol^{-1}dm^3$

15. $t_{\frac{1}{4}}$ can be taken as the time taken for the concentration of a reactant to drop to $\frac{3}{4}$ of its initial value. If the rate constant for a first order reaction is K, the $t_{\frac{1}{4}}$ can be written as **[2005]**

(a) $0.10/K$ (b) $0.29/K$

(c) $0.69/K$ (d) $0.75/K$

16. Decomposition of H_2O_2 follows a first order reaction. In fifty minutes the concentration of H_2O_2 decreases from 0.5 to 0.125 M in one such decomposition. When the concentration of H_2O_2 reaches 0.05 M, the rate of formation of O_2 will be **[2016]**

(a) $6.93\times10^{-4}\,mol\,min^{-1}$ (b) $2.66\,L\,min^{-1}$ at STD

(c) $1.34\times10^{-2}\,mol\,min^{-1}$ (d) $6.93\times10^{-2}\,mol\,min^{-1}$

17. A reaction involving two different reactants **[2005]**

(a) Can never be a second order reaction

(b) Can never be a unimolecular reaction

(c) Can never be a bimolecular reaction

(d) Can never be a first order reaction

18. A reaction was found to be second order with respect to the concentration of carbon monoxide. If the concentration of carbon monoxide is doubled, with everything else kept the same, the rate of reaction will **[2006]**

(a) Remain unchanged (b) Triple

(c) Increase by a factor of 4 (d) Double

19. For the reaction system $2NO(g)+O_2(g)\rightarrow 2NO_2(g)$ volume is suddenly reduced to half its value by increasing the pressure on it. If the reaction is of first order with respect to O_2 and second order with respect to NO, the rate of reaction will **[2003]**

(a) Diminish to one fourth of its initial value

(b) Diminish to one eighth of its initial value

(c) Increase to eight times of its initial value

(d) Increase to four times of its initial value

20. Consider a reaction $aG + bH \rightarrow$ Products. When concentration of both the reactants G and H is doubled, the rate increases by eight times. However, when concentration of G is doubled keeping the concentration of H fixed, the rate is doubled. The overall order of the reaction is **[2007]**

(a) 0 (b) 1

(c) 2 (d) 3

21. Consider the reaction

$Cl_{2(aq)} + H_2S_{(aq)} \rightarrow S_{(s)} + 2H^+_{(aq)} + 2Cl^-_{(aq)}$

The rate equation for this reaction is rate $= k[Cl_2][H_2S]$

Which of these mechanisms is/are consistent with this rate equation

A. $Cl_2 + H_2S \rightarrow H^+ + Cl^- + Cl^+ + HS^-$ (slow)

$Cl^+ + HS^- \rightarrow H^+ + Cl^- + S$ (fast)

B. $H_2S \rightleftharpoons H^+ + HS^-$ (fast equilibrium)

$Cl_2 + HS^- \rightarrow 2Cl^- + H^+ + S$ (slow) **[2010]**

(a) A only (b) B only

(c) Both A and B (d) Neither A nor B

22. The formation of gas at the surface of tungsten due to adsorption is the reaction of order **[2002]**

(a) 0 (b) 1

(c) 2 (d) Insufficient data

23. The following mechanism has been proposed for the reaction of NO with Br_2 to from $NOBr$:

$NO(g) + Br_2(g) \rightarrow NOBr_2(g)$

$NOBr_2(g) + NO(g) \rightarrow 2NOBr(g)$

If the second step is the rate determining step, the order of the reaction with respect to $NO(g)$ is **[2006]**

(a) 1 (b) 0

(c) 3 (d) 2

24. The half life period of a first order chemical reaction is 6.93 minutes. The time required for the completion of 99% of the chemical reaction will be $(\log 2 = 0.301)$ **[2009]**

(a) 230.3 *min* (b) 23.03 *min*

(c) 46.06 *min* (d) 460.6 *min*

25. In a first order reaction, the concentration of the reactant, decreases from 0.8 M to 0.4 M in 15 minutes. The time taken for the concentration to change from 0.1 M to 0.025 M is **[2004]**

(a) 7.5 *min* (b) 15 *min*

(c) 30 *min* (d) 60 *min*

26. The time for half life period of a certain reaction A $\longrightarrow$ Products is 1 hour. When the initial concentration of the reactant 'A' is 2.0 $mol\ L^{-1}$, how much time does it take for its concentration to come for 0.50 to 0.25 $mol\ L^{-1}$ if it is a zero order reaction **[2010]**

(a) 1 h (b) 4 h

(c) 0.5 h (d) 0.25 h

27. At $518°C$, the rate of decomposition of a sample of gaseous acetaldehyde, initially at a pressure of 363 Torr, was 1.00 Torr s^{-1} when 5% had reacted and 0.5 Torr s^{-1} when 33% had reacted. The order of the reaction is **[2018]**

(a) 1 (b) 0

(c) 2 (d) 3

28. The energies of activation for forward and reverse reactions for $A_2 + B_2 \rightleftharpoons 2AB$ are 180 $kJ\ mol^{-1}$ and 200 $kJ\ mol^{-1}$ respectively. The presence of catalyst lowers the activation energy of both (forward and reverse) reactions by 100 $kJ\ mol^{-1}$. The enthalpy change of the reaction $(A_2 + B_2 \longrightarrow 2AB)$ in the presence of catalyst will be (in $kJ\ mol^{-1}$) **[2007]**

(a) 300 (b) 120

(c) 280 (d) 20

29. Higher order (>3) reactions are rare due to **[2015]**

(a) Low probability of simultaneous collision of all the reacting species

(b) Increase in entropy and activation energy as more molecules are involved

(c) Shifting of equilibrium towards reactants due to elastic collisions

(d) Loss of active species on collision

30. For a first order reaction $A \rightarrow P$, the temperature (T) dependent rate constant (k) was found to follow the equation $\log k = -(2000)\frac{1}{T} + 6.0$. The pre-exponential factor A and the activation energy E_a, respectively, are **[2009]**

(a) $1.0 \times 10^6 s^{-1}$ and $9.2 kJ\ mol^{-1}$

(b) $6.0 s^{-1}$ and $16.6 kJ\ mol^{-1}$

(c) $1.0 \times 10^6 s^{-1}$ and $16.6 kJ\ mol^{-1}$

(d) $1.0 \times 10^6 s^{-1}$ and $38.3 kJ\ mol^{-1}$

31. In respect of the equation $k = Ae^{-E_a/RT}$ in chemical kinetics, which one of the following statement is correct **[2003]**

(a) k is equilibrium constant

(b) A is adsorption factor

(c) E_a is energy of activation

(d) R is Rydberg's constant

32. The rate of a reaction doubles when its temperature changes from $300 K$ to $310 K$. Activation energy of such a reaction will be : $(R = 8.314\ JK^{-1}mol^{-1}$ and $\log 2 = 0.301)$

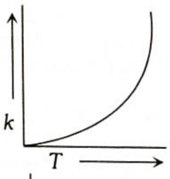
[2013]

(a) $53.6 kJ\ mol^{-1}$ (b) $48.6 kJ\ mol^{-1}$

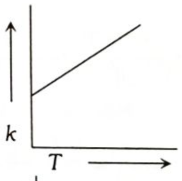
(c) $58.5 kJ\ mol^{-1}$ (d) $60.5 kJ\ mol^{-1}$

33. Plots showing the variation of the rate constant (k) with temperature (T) are given below. The plot that follows Arrhenius equation is **[2010]**

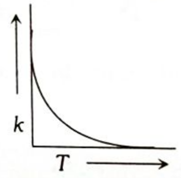
(a)



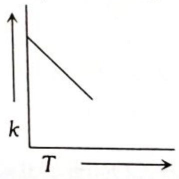
(b)



(c)



(d)



34. The rate constant, the activation energy and the arrhenius parameter of a chemical reaction at $25°C$ are $3.0 \times 10^{-4} s^{-1}$, $104.4 kJ\ mol^{-1}$ and $6.0 \times 10^{14} s^{-1}$ respectively. The value of the rate constant as $T \rightarrow \infty$ is **[1996]**

(a) $2.0 \times 10^{18} s^{-1}$ (b) $6.0 \times 10^{14} s^{-1}$

(c) Infinity (d) $3.6 \times 10^{30} s^{-1}$

35. Two reactions R_1 and R_2 have identical pre-exponential factors. Activation energy of R_1 exceeds that of R_2 by $10 kJ\ mol^{-1}$. If k_1 and k_2 are rate constants for reactions R_1 and R_2 respectively at 300 K, then $\ln(k_2/k_1)$ is equal to : $(R = 8.314\ J\ mol^{-1}K^{-1})$ **[2017]**

(a) 12 (b) 6

(c) 4 (d) 8

36. If 'I' is the intensity of absorbed light and C is the concentration of AB for the photochemical process $AB + h\upsilon \rightarrow AB^*$, the rate of formation of AB^* is directly proportional to **[2001]**

(a) C (b) I

(c) I^2 (d) $C.I$

6. NEET/ AIPMT/ CBSE-PMT

1. For the reaction $A + B \rightarrow$ products, it is observed that :

(i) On doubling the initial concentration of A only, the rate of reaction is also doubled and

(ii) On doubling the initial concentrations of both A and B, there is a change by a factor of 8 in the rate of the reaction

The rate of this reaction is given by **[2009]**

(a) Rate $= k[A]^2[B]$ (b) Rate $= k[A][B]^2$

(c) Rate $= k[A]^2[B]^2$ (d) Rate $= k[A][B]$

2. In the reaction

$BrO_3^-(aq) + 5Br^-(aq) + 6H^+ \rightarrow 3Br_2(l) + 3H_2O(l)$

The rate of appearance of bromine (Br_2) is related to rate of disappearance of bromide ions as following **[2009]**

(a) $\frac{d(Br_2)}{dt} = -\frac{3}{5}\frac{d(Br^-)}{dt}$ (b) $\frac{d(Br_2)}{dt} = -\frac{5}{3}\frac{d(Br^-)}{dt}$

(c) $\frac{d(Br_2)}{dt} = \frac{5}{3}\frac{d(Br^-)}{dt}$ (d) $\frac{d(Br_2)}{dt} = \frac{3}{5}\frac{d(Br^-)}{dt}$

3. The bromination of acetone that occurs in acid solution is represented by this equation.

$CH_3COCH_3(aq) + Br_2(aq) \rightarrow CH_3COCH_2Br(aq)$

$+ H^+(aq) + Br^-(aq)$

These kinetic data were obtained for given reaction concentrations. Initial concentrations, M

$[CH_3COCH_3]$	$[Br_2]$	$[H^+]$
0.30	0.05	0.05
0.30	0.10	0.05
0.30	0.10	0.10
0.40	0.05	0.20

Initial rate, disappearance of Br_2, Ms^{-1}

(i) 5.7×10^{-5} (ii) 5.7×10^{-5}

(iii) 1.2×10^{-4} (iv) 3.1×10^{-4}

based on these data, the rate equation is **[2008]**

(a) Rate $= k[CH_3COCH_3][Br_2][H^+]^2$

(b) Rate $= k[CH_3COCH_3][Br_2][H^+]^2$

(c) Rate $= k[CH_3COCH_3][H^+]$

(d) Rate $= k[CH = COCH_3][Br_2]$

4. For the reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ the value of rate of disappearance of N_2O_5 is given as 6.25×10^{-3} mol $L^{-1}S^{-1}$. The rate of formation of NO_2 and O_2 is given respectively as **[2010]**

(a) 1.25×10^{-2} mol $L^{-1}S^{-1}$ and 6.25×10^{-3} mol $L^{-1}S^{-1}$

(b) 6.25×10^{-3} mol $L^{-1}S^{-1}$ and 6.25×10^{-3} mol $L^{-1}S^{-1}$

(c) 1.25×10^{-2} mol $L^{-1}S^{-1}$ and 3.125×10^{-3} mol $L^{-1}S^{-1}$

(d) 6.25×10^{-3} mol $L^{-1}S^{-1}$ and 3.125×10^{-3} mol $L^{-1}S^{-1}$

5. In the reaction $2A + B \rightarrow A_2B$, if the concentration of A is doubled and of B is halved, then the rate of the reaction will **[2000]**

(a) Increase by four times (b) Decrease by two times

(c) Increase by two times (d) Remain the same

6. Consider the reaction

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ The equality relationship between $\frac{d[NH_3]}{dt}$ and $= -\frac{d[H_2]}{dt}$ is **[2006]**

(a) $+\frac{d[NH_3]}{dt} = -\frac{3}{2}\frac{d[H_2]}{dt}$ (b) $\frac{d[NH_3]}{dt} = -\frac{d[H_2]}{dt}$

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

7. If $3A \rightarrow 2B$, then the rate of reaction of $+\frac{d(B)}{dt}$ is equal to **[2002]**

(a) $+2\frac{d(A)}{dt}$ (b) $-\frac{1}{3}\frac{d(A)}{dt}$

(c) $-\frac{2}{3}\frac{d(A)}{dt}$ (d) $-\frac{3}{2}\frac{d(A)}{dt}$

8. In a reaction, $A + B \rightarrow$ Product, rate is doubled when the concentration of B is doubled, and rate increases by a factor of 8 when the concentrations of both the reactants (A and B) are doubled, rate law for the reaction can be written as **[2012]**

(a) Rate $= k[A][B]^2$ (b) Rate $= k[A]^2[B]^2$

(c) Rate $= k[A][B]$ (d) Rate $= k[A]^2[B]$

9. The rate of the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ can be written in three ways **[2011]**

$\frac{-d[N_2O_5]}{dt} = k[N_2O_5]$ $\frac{d[NO_2]}{dt} = k'[N_2O_5]$

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

The relationship between k and k' and between k and k'' are

(a) $k' = 2k$; $k'' = 2k$ (b) $k' = k$; $k'' = k$

(c) $k' = 2k$; $k'' = k$ (d) $k' = 2k$; $k'' = k/2$

10. If 60% of a first order reaction was completed in 60 *minutes*, 50% of the same reaction would be completed in approximately **[2007]**

(a) 50 *min* (b) 45 *min*

(c) 60 *min* (d) 40 *min*

$(\log 4 = 0.60, \log 5 = 0.69)$

11. The unit of rate constant for a zero order reaction is **[2011]**

(a) $litre\ sec^{-1}$ (b) $litre\ mole^{-1}\ sec^{-1}$

(c) $mole\ litre^{-1}\ sec^{-1}$ (d) $mole\ sec^{-1}$

12. The rate constants k_1 and k_2 for two different reactions are $10^{16}.e^{-2000/T}$ and $10^{15}.e^{-1000/T}$, respectively. The temperature at which $k_1 = k_2$ is **[2008]**

(a) 2000 K (b) $\frac{1000}{2.303}K$

(c) 1000 K (d) $\frac{2000}{2.303}K$

13. The rate of the reaction $2NO + Cl_2 \rightarrow 2NOCl$ is given by the rate equation rate $= k[NO]^2[Cl_2]$ **[2010]**

The value of the rate constant can be increased by

(a) Increasing the temperature

(b) Increasing the concentration of NO

(c) Increasing the concentration of the Cl_2

(d) Doing all of these

14. The reaction $A \rightarrow B$ follows first order kinetics. The time taken for 0.8 mole of A to produce 0.6 mole of B is 1 *hour*. What is the time taken for conversion of 0.9 mole of A to produce 0.675 mole of B **[2003]**

(a) 2 *hours* (b) 1 *hour*

(c) 0.5 *hour* (d) 0.25 *hour*

15. The data for the reaction $A + B \rightarrow C$ is **[1994]**

Exp.	**[*A*]₀**	**[*B*]₀**	**Initial rate**
(1)	0.012	0.035	0.10
(2)	0.024	0.070	0.80
(3)	0.024	0.035	0.10
(4)	0.012	0.070	0.80

The rate law corresponds to the above data is

(a) Rate $= k[B]^3$ (b) Rate $= k[B]^4$

(c) Rate $= k[A][B]^3$ (d) Rate $= k[A]^2[B]^2$

16. The reaction of hydrogen and iodine monochloride is given as **[2007]**

$$H_{2(g)} + 2ICl_{(g)} \rightarrow 2HCl_{(g)} + I_{2(g)}$$

This reaction is of first order with respect to $H_{2(g)}$ and $ICl_{(g)}$, following mechanisms were proposed

Mechanism A:

$$H_{2(g)} + 2ICl_{(g)} \rightarrow 2HCl_{(g)} + I_{2(g)}$$

Mechanism B:

$H_{2(g)} + ICl_{(g)} \rightarrow HCl_{(g)} + HI_{(g)}$ Slow

$HI_{(g)} + ICl_{(g)} \rightarrow HCl_{(g)} + I_{2(g)}$ Fast

Which of the above mechanism(s) can be consists with the given information about the reaction

(a) B only (b) A and B both

(c) Neither A nor B (d) A only

17. The reaction $2FeCl_3 + SnCl_2 \rightarrow 2FeCl_2 + SnCl_4$ is an example of **[1996]**

(a) First order reaction (b) Second order reaction

(c) Third order reaction (d) None of these

18. If the rate of the reaction is equal to the rate constant, the order of the reaction is **[2003]**

(a) 3 (b) 0

(c) 1 (d) 2

19. The rate of reaction between two reactants *A* and *B* decreases by a factor of 4 if the concentration of reactant B is doubled. The order of this reaction with respect to reactant *B* is **[2005]**

(a) – 1 (b) – 2

(c) 1 (d) 2

20. During the kinetic study of the reaction, $2A + B \rightarrow C + D$, following results were obtained

Run	**[A] / *mol* *L*⁻¹**	**[B] / *mol L*⁻¹**	**Initial rate of formation of D /*mol* *L*⁻¹ min⁻¹**
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

Based on the above data which one of the following is correct **[2010]**

(a) Rate $= k[A][B]^2$ (b) Rate $= k[A]^2[B]$

(c) Rate $= k[A][B]$ (d) Rate $= k[A]^2[B]^2$

21. The given reaction $2NO + O_2 \rightarrow 2NO_2$ is an example of **[2001]**

(a) First order reaction (b) Second order reaction

(c) Third order reaction (d) None of these

22. Which one of the following statement for order of reaction is not correct **[2005; 2011]**

(a) Order can be determined experimentally

(b) Order of reaction is equal to sum of the powers of concentration terms in differential rate law

(c) It is not affected with the stoichiometric coefficient of the reactants

(d) Order cannot be fractional

23. The rate constant of the reaction $A \rightarrow B$ is 0.6×10^{-3} mole per second. If the concentration of A is 5 M then concentration of B after 20 minutes is **[2015]**

(a) 1.08 M (b) 3.60 M

(c) 0.36 M (d) 0.72 M

24. The decomposition of phosphine (PH_3) on tungsten at low pressure is a first-order reaction. It is because the **[2016]**

(a) Rate of decomposition is very slow

(b) Rate is proportional to the surface coverage

(c) Rate is inversely proportional to the surface coverage

(d) Rate is independent of the surface coverage

25. In a first order reaction $A \longrightarrow B$, if k is rate constant an initial concentration of the reactant A is 0.5 M then the half–life is **[2007]**

(a) $\frac{0.693}{0.5K}$ (b) $\frac{\log 2}{K}$

(c) $\frac{\log 2}{K\sqrt{0.5}}$ (d) $\frac{\ln 2}{K}$

26. The half life of a first order reaction is $69.35\,\text{sec}$. The value of the rate constant of the reaction is **[1990]**

(a) $1.0\,s^{-1}$ (b) $0.1\,s^{-1}$

(c) $0.01\,s^{-1}$ (d) $0.001\,s^{-1}$

27. After how many seconds will the concentration of the reactants in a first order reaction be halved, if the decay constant is $1.155 \times 10^{-3}\ \text{sec}^{-1}$ **[2000]**

(a) 100 s (b) 200 s

(c) 400 s (d) 600 s

28. The rate of a first order reaction is $1.5 \times 10^{-2}\ molL^{-1}\ \text{min}^{-1}$ at 0.5 M concentration of the reactant. The half life of the reaction is **[2004]**

(a) 8.73 *min* (b) 7.53 *min*

(c) 0.383 *min* (d) 23.1 *min*

29. For a first order reaction $A \rightarrow B$ the reaction rate at reactant concentration of $0.01M$ is found to be $2.0 \times 10^{-5} mol\ L^{-1}s^{1}$. The half life period of the reaction is **[2005]**

(a) 220 s (b) 30 s

(c) 300 s (d) 347 s

30. When initial concentration of a reactant is doubled in a reaction, its half-life period is not effected. The order of the reaction is **[2015]**

(a) First

(b) Second

(c) More than zero but less then first

(d) Zero

31. The half life of a substance in a certain enzyme – catalysed reaction is 138 s. The time required for the concentration of the substance to fall from 1.28 $mg\,L^{-1}$ to 0.04 $mg\,L^{-1}$ is **[2011]**

(a) 690 s (b) 276 s

(c) 414 s (d) 552 s

32. The rate of a first-order reaction is 0.04 $mol\ l^{-1}s^{-1}$ at 10 seconds and 0.03 $mol\ l^{-1}s^{-1}$ at 20 seconds after initiation of the reaction. The half-life period of the reaction is **[2016]**

(a) 24.1 s (b) 34.1 s

(c) 44.1 s (d) 54.1 s

33. Mechanism of a hypothetical reaction $X_2 + Y_2 \rightarrow 2XY$ is given below

(i) $X_2 \rightarrow X + X$ (fast)

(ii) $X + Y_2 \rightleftharpoons XY + Y$ (slow)

(iii) $X + Y \rightarrow XY$ (fast)

The overall order of the reaction will be **[2017]**

(a) 1 (b) 2

(c) 0 (d) 1.5

34. A first order reaction has a specific reaction rate of 10^{-2}. How much time will it take for $20\,g$ of the reaction to reduce to $5\,g$ **[2017]**

(a) 238.6 sec (b) 138.6 sec

(c) 346.5 sec (d) 693.0 sec

35. The correct difference between first – and second – order reaction is that **[2018]**

(a) The rate of a first – order reaction does not depend on reactant concentration; the rate of a second – order reaction does depend on reactant concentrations

(b) The half – life of a first – order reaction does not depend on $[A]_0$; the half – life of a second – order reaction does depend on $[A]_0$

(c) A first – order reaction can be catalyzed ; a second – order reaction cannot be catalyzed

(d) The rate of a first – order reaction does depend on reactant concentrations; the rate of a second – order reaction does not depend on reactant concentrations

36. When initial concentration of the reactant is doubled, the half – life period of a zero order reaction **[2018]**

(a) Is halved (b) Is doubled

(c) Is tripled (d) Remains unchanged

37. A reaction having equal activation energies for forward and reverse reaction has **[2013]**

(a) $\Delta H = 0$ (b) $\Delta S = 0$

(c) Zero order (d) None of these

38. The addition of a catalyst during a chemical reaction alters which of the following quantities **[2016]**

(a) Entropy (b) Internal energy

(c) Enthalpy (d) Activation energy

39. The activation energy for a simple chemical reaction $A \rightarrow B$ is E_a in forward direction. The activation energy for reverse reaction **[2003]**

(a) Is always double of E_a

(b) Is negative of E_a

(c) Is always less than E_a

(d) Can be less than or more than E_a

40. For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in *KJ/mol*). Minimum value of E_a will be **[2010]**

(a) Equal to zero (b) Less than ΔH

(c) Equal to ΔH (d) More than ΔH

41. The activation energy of a reaction can be determined from the slope of which of the following graphs **[2015]**

(a) $\frac{\ln K}{T} vs. T$ (b) $\ln K \, vs. \frac{1}{T}$

(c) $\frac{T}{\ln K} vs. \frac{1}{T}$ (d) $\ln K \, vs. T$

7. AIIMS

1. If doubling the concentration of a reactant 'A' increases the rate 4 times and tripling the concentration of 'A' increases the rate 9 times, the rate is proportional to **[1991]**

(a) Concentration of 'A'

(b) Square of concentration of 'A'

(c) Under root of the concentration of 'A'

(d) Cube of concentration of 'A'

2. For the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ rate of reaction is **[2006]**

(a) $\frac{1}{2}\frac{d}{dt}[N_2O_5]$ (b) $2\frac{d}{dt}[N_2O_5]$

(c) $\frac{1}{4}\frac{d}{dt}[NO_2]$ (d) $4\frac{d}{dt}[NO_2]$

3. The rate constant of a first order reaction is 3×10^{-6} per second. If the initial concentration is 0.10 *M*, the initial rate of reaction is **[1999]**

(a) $3 \times 10^{-5} Ms^{-1}$ (b) $3 \times 10^{-6} Ms^{-1}$

(c) $3 \times 10^{-8} Ms^{-1}$ (d) $3 \times 10^{-7} Ms^{-1}$

4. For reaction a $A \rightarrow x P$, when $[A] = 2.2\, mM$, the rate was found to be $2.4\, mM\, s^{-1}$. On reducing concentration of *A* to half, the rate changes to $0.6\, mM\, s^{-1}$. The order of reaction with respect to *A* is **[2005]**

(a) 1.5 (b) 2.0

(c) 2.5 (d) 3.0

5. A substance 'A' decomposes by a first order reaction starting initially with [A] =2.00m and after 200 *min* [A] = 0.15m. For this reaction what is the value of *k* **[2001]**

(a) $1.29 \times 10^{-2} \min^{-1}$ (b) $2.29 \times 10^{-2} \min^{-1}$

(c) $3.29 \times 10^{-2} \min^{-1}$ (d) $4.40 \times 10^{-2} \min^{-1}$

6. For a first order reaction, to obtain a positive slope, we need to plot {where [*A*] is the concentration of reactant *A*} **[2008]**

(a) $-\log_{10}[A] \, vs\, t$ (b) $-\log_e[A] \, vs\, t$

(c) $\log_{10}[A] \, vs \log t$ (d) $[A] \, vs\, t$

7. The rate constant *k*, for the reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ is $2.3 \times 10^{-2} s^{-1}$. Which equation given below describes the change of $[N_2O_5]$ with time? $[N_2O_5]_0$ and $[N_2O_5]_t$ correspond to concentration of N_2O_5 initially and at time, *t* **[2015]**

(a) $[N_2O_5]_t = [N_2O_5]_0 + kt$

(b) $[N_2O_5]_0 = [N_2O_5]_t e^{kt}$

(c) $\log_{10}[N_2O_5]_t = \log_{10}[N_2O_5]_0 - kt$

(d) $\ln\frac{[N_2O_5]_0}{[N_2O_5]_t} = kt$

8. Which of the following rate laws has an overall order of 0.5 for reaction involving substances *x*, *y* and *z* **[1983]**

(a) Rate $= K(C_x)(C_y)(C_z)$

(b) Rate $= K(C_x)^{0.5}(C_y)^{0.5}(C_z)^{0.5}$

(c) Rate $= K(C_x)^{1.5}(C_y)^{-1}(C_z)^{0}$

(d) Rate $= K(C_x)(C_z)^n/(C_y)^2$

9. For a chemical reaction $A \rightarrow B$ it is found that the rate of reaction doubles, when the concentration of A is increased four times. The order in A for this reaction is **[1997]**

(a) Two (b) One

(c) Half (d) Zero

10. For the reaction $H_2 + Cl_2 \xrightarrow{\text{Sunlight}} 2HCl$ taking place on water, the order of reaction is **[2002]**

(a) 1 (b) 2

(c) 3 (d) 0

11. A first order reaction which is 30% complete in 30 minutes has a half-life period of **[1998]**

(a) 24.2 *min* (b) 58.2 *min*

(c) 102.2 *min* (d) 120.2 *min*

12. The rate constant of a reaction is $0.69 \times 10^{-1}\ \text{min}^{-1}$ and the initial concentration is $0.2 mol\, l^{-1}$. The half-life period is **[1998]**

(a) 400 *sec* (b) 600 *sec*

(c) 800 *sec* (d) 1200 *sec*

13. A First order reaction is half completed in 45 minutes. How long does it need 99.9% of the reaction to be completed **[2001]**

(a) 5 *hours* (b) 7.5 *hours*

(c) 10 *hours* (d) 20 *hours*

14. T_{50} of first-order reaction is 10*min*. Starting with 10*mol* L^{-1}, rate after 20 *min* is **[2008]**

(a) 0.0693 *mol* L^{-1} min^{-1}

(b) 0.0693 × 2.5 *mol* L^{-1} min^{-1}

(c) 0.0693 × 5 *mol* L^{-2} min^{-1}

(d) 0.0693 × 10 *mol* L^{-1} min^{-1}

15. The half–life for the reaction $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$ is 2.4 *h* at STP.

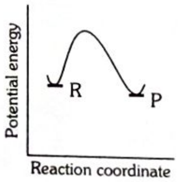
Starting with 10.8 *g* of N_2O_5 how much oxygen will be obtained after a period of 9.6 *h* **[2007]**

(a) 1.5 *L* (b) 3.36 *L*

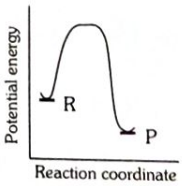
(c) 1.05 *L* (d) 0.07 *L*

16. An endothermic reaction with high activation energy for the forward reaction is given by the diagram **[2005]**

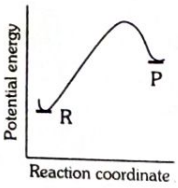
(a)



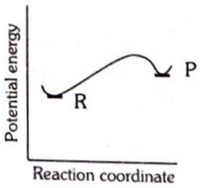
(b)



(c)



(d)



17. According to the adsorption theory of catalysis, the speed of the reaction increases because **[2007]**

(a) Adsorption produces heat which increases the speed of the reaction

(b) Adsorption lowers the activation energy of the reaction

(c) The concentration of reactant molecules at the active centres of the catalyst becomes high due to adsorption

(d) In the process of adsorption, the activation energy of the molecules become large

18. The temperature dependence of rate constant (k) of a chemical reaction is written in terms of Arrhenius equation, $K = A.e^{-E^*/RT}$. Activation energy (E^*) of the reaction can be calculated by plotting **[2007]**

(a) $\log k\ vs \frac{1}{\log T}$ (b) $k\ vs\ T$

(c) $k\ vs \frac{1}{\log T}$ (d) $\log k\ vs \frac{1}{T}$

8. Assertion and Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c) If assertion is true but reason is false.

(d) If the assertion and reason both are false.

(e) If assertion is false but reason is true.

1. Assertion : The rate of reaction is always negative.

Reason : Minus sign used in expressing the rate shows that concentration of product is decreasing.

2. Assertion : The order of a reaction can have fractional value.

Reason : The order of a reaction cannot be written from balanced equation of a reaction. **[AIIMS 2008]**

3. Assertion : Average life of a radioactive element is that period in which 63% of it is decayed.

Reason : Average life $\tau = 1.44t_{1/2}$ **[AIIMS 2007]**

4. Assertion : The hydrolysis of methyl acetate by dil. *HCl* is a pseudo first order reaction.

Reason : *HCl* acts as a catalyst for the hydrolysis. **[AIIMS 2007]**

5. Assertion : The emission of light during burning of *P* in O_2 is called chemiluminescence.

Reason : The chemical energy is converted into light energy. **[AIIMS 2015]**

20. Chemical Kinetics – Answers Keys

1. Rate of a Reaction

1	a	2	a	3	d	4	c	5	b
6	c	7	c	8	d	9	ad	10	a
11	c	12	b	13	b	14	a	15	c
16	c	17	c	18	c	19	e	20	c
21	b	22	b	23	d	24	a		

2. Rate Law and Rate Constant

1	a	2	a	3	a	4	c	5	c
6	b	7	c	8	a	9	a	10	b
11	b	12	c	13	a	14	b	15	d
16	c	17	a	18	b	19	a	20	b
21	d	22	c	23	b	24	c	25	b
26	b	27	a	28	d	29	c	30	a
31	d	32	a	33	a	34	c	35	c
36	b	37	a	38	a	39	d	40	b
41	b	42	b	43	d	44	b	45	c
46	a	47	d	48	a	49	a	50	d
51	d	52	b	53	b	54	b	55	a
56	b	57	a	58	b	59	d	60	d
61	d								

3. Collision Theory, Energy of Activation and Arrhenius Equation

1	b	2	b	3	c	4	b	5	c
6	c	7	c	8	a	9	b	10	d
11	a	12	a	13	c	14	d	15	a
16	a	17	d	18	a	19	a	20	c
21	b	22	a	23	c	24	d	25	b
26	c	27	b	28	d	29	b	30	b
31	a	32	d	33	d	34	b	35	b
36	c	37	a	38	a				

4. Graphical Questions

1	c	2	c	3	a	4	b	5	c
6	a								

5. IIT-JEE/ AIEEE

1	b	2	b	3	a	4	c	5	d
6	d	7	c	8	d	9	a	10	b
11	a	12	a	13	d	14	a	15	b
16	a	17	b	18	c	19	c	20	d
21	a	22	a	23	d	24	c	25	c
26	d	27	c	28	d	29	a	30	d
31	c	32	a	33	a	34	b	35	c
36	b								

6. NEET/ AIPMT/ CBSE-PMT

1	b	2	a	3	c	4	c	5	c
6	d	7	c	8	d	9	d	10	b
11	c	12	b	13	a	14	b	15	a
16	a	17	c	18	b	19	b	20	a
21	c	22	d	23	d	24	b	25	d
26	c	27	d	28	d	29	d	30	a
31	a	32	a	33	d	34	b	35	b
36	b	37	a	38	d	39	d	40	d
41	b								

7. AIIMS

1	b	2	c	3	d	4	b	5	a
6	b	7	d	8	c	9	c	10	d
11	b	12	b	13	b	14	b	15	c
16	c	17	b	18	d				

8. Assertion & Reason

1	d	2	b	3	a	4	b	5	a