CHEMISTRY

BOOKS - G.R. BATHLA & SONS CHEMISTRY (HINGLISH)

CHEMICAL KINETICS

EXAMPLE

1. In a reaction, the concentration of a reatant (A) changes from $0.200\text{mol litre}^{-1} \rightarrow 0.150\text{mol litre}^{-1}$ in 10 minutes. What is the average rate of reaction during this interval ?

2. Decomposition of N_2O_5 is expressed by the equation ,

$N_2O_5 \rightarrow 2NO_2 +^{1/2} O_2$

If during a certain time interval, the rate of decomposition of $N_2O_5 is 1.8 \times 10^{-3} \text{mol litre}^{-1} \text{min}^{-1}$, what will be the rates of formation of MO_2 and O_2 during the same intrval ?

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3. For each of the following reactions, express the given rate of change of concentration of the reactants or Products in that reaction:

(a) $H_2O_2 + 2H^{\oplus} + 3I^{\ominus} \rightarrow I_3^{\ominus} + 2H_2O, \frac{-d\left[I^{\ominus}\right]}{dt} = ?, \frac{-d[H^{\oplus}]}{dt}?$

(b) $16H^{\oplus} + 2MnO_4^{\ominus} + 10I^{\ominus} \rightarrow 2Mn^{2+} + 8H_2O + 5I_2,$

$\frac{-d\left[MNO_4^{\ominus}\right]}{dt} = ?$

(c) $4NH_3 + 5O_2 \rightarrow 4NO_2 + 6H_2O$, $\frac{-d[NH_3]}{dt} = ?$

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4. The following reaction was carried out in water :

$Cl_2 + 2I^{\ominus} \rightarrow I_2 + 2Cl^{\ominus}$

The initial concentration of $I^{\ominus}$ was $0.25 molL^{-1}$ and the concentration after $10 \min$ was $0.23molL^{-1}$. Calculate the rate of disappearance of $I^{\ominus}$ and rate of appearance of I_2.

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5. The reaction between $Cr_2O_7^{2-}$ and HCO_2 in an acidic medium is :

$Cr_2O_7^2 + 5H^+ + 2HNO_2 \rightarrow 2Cr^{3+} + 3NO_3^- + 4H_2O$

The rate of disappearance of $Cr_2O +_7^{2-}$ is found to be $2.4 \times 10^{-4} \text{mol}L^{-1}s^{-1}$ during a meausred time interval. Find the rate of disppearanceo of HNO_2 and the rate of appearance of Cr^{3+} during this time interval

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6. 4g of hydrogen and 128 g of hydrogen iodide are present in a 2litre flask. What are their active masses?

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7. The rate of reaction triples when temperature changes form $20^\circ C$ to $50^\circ C$. Calculate the energy of activation for the reaction $(R = 8.314 JK^{-1}mol^{-1})$.

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8. In Arrhenius equation for a certain reaction , the values of A and E_a (activation energy are $4 \times 10^{13}\text{sec}^{-1}$ and $98.6 kJ\text{mol}^{-1}$ respectively. At what temepeeratue, the reaction will have specific constant $1.1 \times 10^{-3}\text{sec}^{-1}$?

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9. The rate constant is given by Arrhenius equation.

$k = Ae^{-E_a/RT}$

Calculate the ratio of the catalysed and uncatalysed rate constants at $25^\circ C$ if the energy of activation of a catalysed raction is 162 kJ and for the uncatalysed reaction the value is 350 kJ

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10. Calculate the rate constant of a reaction at 293 K when energy of activation is 103 kJ mol^{-1} and the rate constant at 273 K is $7.87 \times 10^{-7} s^{-1}$

$\left(R = 8.314 \times 10^{-3} kJ\text{mol}^{-1} KJ^{-1}\right)$

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11. At 407 K, the rate contant of a chemical reaction is $9.5 \times 10^{-5} s^{-1}$ and at 420 K the rate constant is $1.9 \times 10^{-4} s^{-1}$. Calculate the frequency equation is

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12. The energy of activation for a reaction is $100 KJmol^{-1}$. The peresence of a catalyst lowers the energy of activation by 75% . What will be the effect on the rate of reaction at $20^{\circ} C$, other things being equal?

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13. The experiment data for the reaction $2A + B_2 \rightarrow 2AB$ is

Experiment	$[A]M$	$[B_2]M$	Initial rate $(molL^{-1}s^{-1})$
I	0.50	0.5	1.6×10^{-4}
II	0.50	1.0	3.2×10^{-4}
III	1.00	1.0	3.2×10^{-4}

Write the most probable rate equation for the reacting giving reason for you answer.

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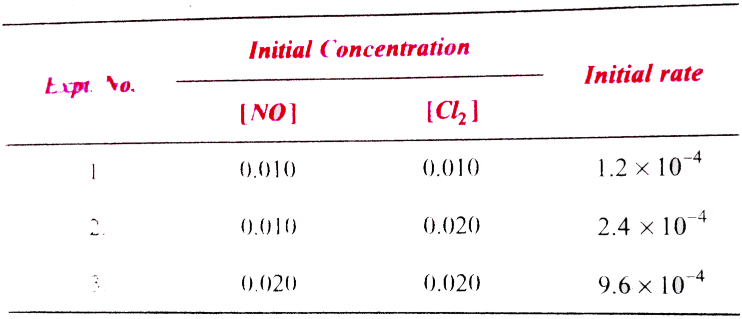
14. For the reaction

$2NO \rightarrow 2NOCl$

at 300 K, following data are obtained:



Expt. No.	Initial Concentration		Initial rate
	$[NO]$	$[Cl_2]$	
1	0.010	0.010	1.2×10^{-4}
2.	0.010	0.020	2.4×10^{-4}
3	0.020	0.020	9.6×10^{-4}

Write rat law for the reaction. What is the order of the reaction? Also calculate the specific rate constant.

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15. For the hypothetical reaction

$2A + B \rightarrow$ Products

following data obtained:

Experiment number	Initial conc of (A) $(molL^{-1})$	Initial conc of (B) $(m$
1	0.10	0.20
2	0.30	0.40
3	0.30	0.80
4	0.10	0.40
5	0.20	0.60
6	0.30	1.20

Find out how the rate of the reaction depends upon the concentration of A and B and fill in the blanks given in the table.

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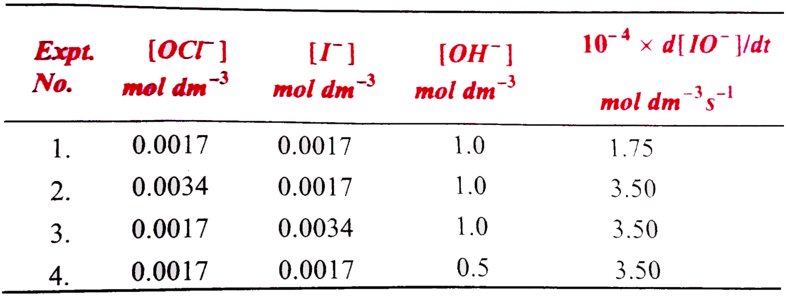
16. The table given below gives kinetic data for the following reaction at 298 K:

$OCl^- + I^- \rightarrow OI^- + Cl^-$



Expt. No.	$[OCl^-]$ $mol\ dm^{-3}$	$[I^-]$ $mol\ dm^{-3}$	$[OH^-]$ $mol\ dm^{-3}$	$10^{-4} \times d[IO^-]/dt$ $mol\ dm^{-3}s^{-1}$
1.	0.0017	0.0017	1.0	1.75
2.	0.0034	0.0017	1.0	3.50
3.	0.0017	0.0034	1.0	3.50
4.	0.0017	0.0017	0.5	3.50

What is the rate law and what is the value of rate constant?

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17. The rate law for the reaction,

$2Cl_2O \rightarrow 2Cl_2 + O_2$

at $200^\circ C$ is found to be : rate = $k[Cl_2O]^2$

(a) How would the rate change if $[Cl_2O]$ is reduced to one- third of its original value

(b) How should the $[Cl_2O]$ be chabged in order to double the rate

(c) How would the rate change is $[Cl_2O]$ is raised to threefold of its original value ?

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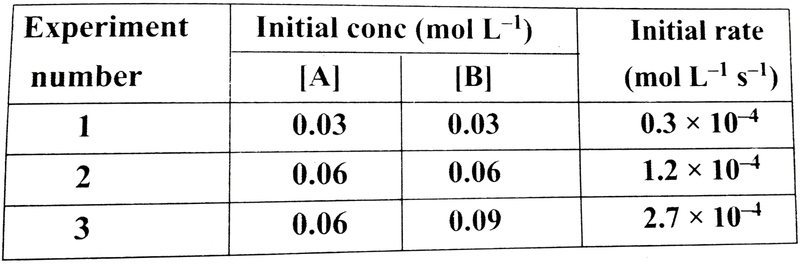
18. For a reaction in which A and B form C, the following data were obtained from three experiments:



Experiment number	Initial conc (mol L^{-1})		Initial rate (mol L^{-1} s^{-1})
	[A]	[B]	
1	0.03	0.03	0.3×10^{-4}
2	0.06	0.06	1.2×10^{-4}
3	0.06	0.09	2.7×10^{-4}

What is the rate equation of the reaction and what is the value of rate constant ?

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19. The thermal decomposition of a compound is of first order. If 50% of a sample of the compound is decomposed in 120 minutes, how long it take for 90% of the compounds to decompose.

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20. The decompoistion of Cl_2O_7 at $400K$ in gas phase to Cl_2 and O_2 is a first order reaction.

a. After $55s$ at $400K$, the pressure of Cl_2O_7 falls form 0.062 to $0.044atm$. Calculate k.

b. Calculate the pressure of Cl_2O_7 after $100s$ of decompoistion.

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21. Catalytic decomposition of nitrous oxide by gold at $900^\circ C$ at an initial pressure of 200mm was 50% in 53 minutes and 73% in 100 minutes.

(a) What is theorder of reaction?

(b) How much it will decompose in 100 minutes at the same temperature but at an initial pressure of 600mm?

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22. A substance reacts according to I order kinetics and rate constant for the reaction is $1 \times 10^{-2} \sec^{-1}$. If its initial concentration is $1M$.

(a) What is initial rate?

(b) What is rate after I minute ?

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23. A first order reaction is 50% completed in 30 min at $27^{\circ} C$ and in 10 min at $47^{\circ} C$. Calculate the reaction rate constants at $27^{\circ} C$ and the energy of activation of the reaction in $kJmol^{-1}$.

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24. In a Arrhenius equation for a certain reaction, the values of A and E_a (energy of activation)are $4 \times 10^{13} s^{-1}$ and $98.6 KJmol^{-1}$, respectively. If the reaction of first order at, what temperature will its life periof be 10 min .

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25. A second order reaction in which in both the reactants have same conentratio, is 20% completed in 500 seconds. How much time it will take for 60% completion?

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26. The decomposition of dinitrogen pentoxide (N_2O_5) follows first order rate law. Calculate the rate constant from the given data:

$t = 800 \sec [N_2O_5] = 1.45 \text{mol} L^{-1} = [A]$

$t = 1600 \sec [N_2O_5] = 0.88 \text{mol} L^{-1} = [A_2]$

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27. The decompasition N_2O_5 acccording to the equation.

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

is a first order reaction. After 30 minutes from the start of the decomposition is a closed vessel, the total pressure developed is found to be 284. 5 mm Hg and on completion the total pressure is 584.5mm Hg. Calculate the rate constant of the reaction

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28. The gas phase decomposition of dimethyl ether follows first order kinetics.

$CH_3-O-CH_3(g)\to CH_4(g)+H_2(g)+CO(g)$

The reaction is carried out in a constant volume container at $500^\circ C$ and has a half life of 14.5 min . Initially, only dimethyl ether is present at a pressure $0.40 atm$. What is the total pressure of the system after 12 min ? (Assume ideal gas behaviour)

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29. The half time of first order decomposition of nitramide is 2.1 hour at $15^\circ C$.

$NH_2NO_{2(aq.)}\to N_2O_{(g)}+H_2O_{(l)}$

If $6.2g$ of NH_2NO_2 is allowed to decompose, calculate:

(i) Time taken for NH_2NO_2 is decompose 99% .

(ii) Volume of dry N_2O produced at this point measured at STP.

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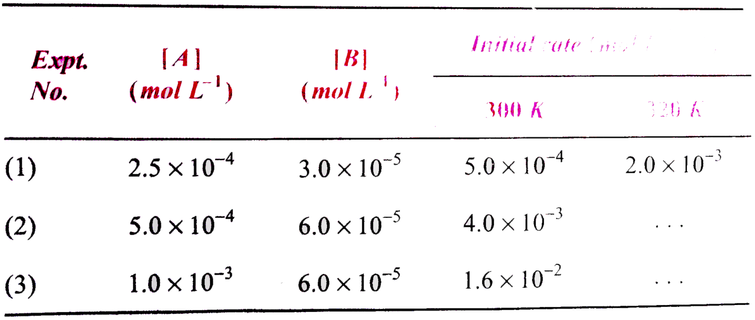
30. From the following data for the reaction between A and B



Expt. No.	[A] (mol L^{-1})	[B] (mol L^{-1})	Initial rate (mol L	
			300 K	320 K
(1)	2.5×10^{-4}	3.0×10^{-5}	5.0×10^{-4}	2.0×10^{-3}
(2)	5.0×10^{-4}	6.0×10^{-5}	4.0×10^{-3}	...
(3)	1.0×10^{-3}	6.0×10^{-5}	1.6×10^{-2}	...

Calculate the following

(i) The order of the reaction with respect to A and with respect to B

(ii) The rate constant at 300K

(iii) The energy of activation and

(iv) The pre-exponential factor.

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31. At a certain temperature the half change periof for the catalystic decompoistion of ammonia was found as follows:

Pressure (Pa)	6667	13333	26666
Half life periof in hours	3.52	1.92	1.0

Calculate the order of reaction.

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32. On heating orisine $(AsH_3))$ decomposes as :

$$2AsH_3(g) \rightarrow 2As(s) + 3H_2(g)$$

The total pressure measured at constant temperature and constant volume varies with time as follows:

t(min)	0	5	7.5	10
$p/mmHg$	760	836	866.4	896.8

Calculate the rate constant assuming the reaction to follow the first order rate law.

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33. Cane sugar is gradualaly converted into dextrose and laevuloe by dilute acid. The rate of inversion is observed by measuring the polarisation angle, at various times, when the following results are obtained:

Time (min)	0	10	20	30	40	100	∞
Angle	32.4	28.8	25.5	22.4	19.6	-6.1	-14.1

Show that the reaction is of first order. Calculate the value of t, when the solution is optically inactive.

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34. 1 mL of methyl acetate was added to a flash containing 20 mL of N/20 HCl maintained at $25 \circ C$. 2mL of the reaction mixture were withdrawn at different intervals and titrate with a standard alkali solution. The following results were obtained :

Time (min)	0	75	119	183	∞
Alkali used (mL)	19.24	24.20	26.60	29.32	42.03

show that the reaction follows first order kinetics

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35. The gaseous decomposition of ozome

$2O_3 \rightarrow 3O_2$

obeys the rate law $r = -\frac{d[O_3]}{dt} = \frac{k[O_3]^2}{[O_2]}$

Show that the following mechanims is consistent with the above rate law

:

$$O_3 \overset{K_{eq}}{\Longleftrightarrow} O_2 + O \qquad (\text{fast})$$

$$O + O_3 \xrightarrow{k_1} 2O_2 \qquad (\text{slow})$$

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36. For the formation of phosgene from CO(g) and chlorine.

$CO(g) + Cl(g) \rightarrow CoCl_2(g)$

the exermientally detrmined rate equation is,

$$\frac{d[COcl_2]}{dt} = k[CO][Cl_2]^{2/3}$$

Is the following mechanism consistent with the rate equation

$$\begin{array}{lll} (i) & Cl_2 \Leftrightarrow 2Cl & (\text{fast}) \\ (ii) & Cl + CO \Leftrightarrow COCl & (\text{fast}) \\ (iii) & COCl + Cl_2 \Leftrightarrow COCl_2 + Cl & (\text{slow}) \end{array}$$

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37. Rate constant for the decomposition of ethylene oxide into CH_4 and CO may be described be the equation. $\log k(s)^{-1} = 14.34 - \frac{1.25 \times 10^4}{T}$

(a) What is the energy of activation of this reaction ?

(b) What is the value of k at 670K ?

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38. A drug becomes ineffective after 30% decompoistion. The original concentration of a sample was $5mgmL^{-1}$ which becomes $4.2mgmL^{-1}$ during 20 months. Assuming the decompoistion of first order, calculate the expiry time of the drug in month. What is the half life of the Product?

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39. Two reactions of the same order have equal exponential factors but their activation energies differ by $24.9kjmol^{-1}$. Calcualte the ratio between the rate constants of these reactions at 27°C (Gas constant $R = 8.3JK^{-1}mol^{-1}$)

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40. Pseudo first order rate for the reaction

$A + B \rightarrow P$

when studied in $0.1M$ of B is given by

$$-\frac{d[A]}{dt} = k[A]$$

where $k = 1.85 \times 10^4 s^{-1}$. Calculate the value of second order rate constant.

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41. The time required for 10% completion of a first order reaction at $298K$ is equal to that required for its 25% completion at $308K$. If the pre-exponential factor for the reaction is $3.56 \times 10^9 s^{-1}$, calculate its rate constant at $318K$ and also the energy of activation.

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42. The rate constant of a reaction is $1.5 \times 10^7 s^{-1}$ at $50^\circ C$ and $4.5 \times 10^7 s^{-1}$ at $100^\circ C$. Evaluate the Arrhenius parameters A and E_a.

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43. In hydrogenation reaction at $25^\circ C$, it is observed that hydrogen gas pressure falls from 2 atm to 1.2 atm isn 50 min. Calculate the rate of reaction in molarity per sec. (R=0.0821 litre -atm $\text{degree}^{-1}\text{mol}^{-1}$)

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44. A drop of solution (volume $0.05mL$) contains $3 \times 10^{-6}\text{mole}H^{\oplus}$ ions. If the rate constant of disappearance of $H^{\oplus}$ ions is $1 \times 10^7 molL^{-1}s^{-1}$, how long would it take for $H^{\oplus}$ ions in the drop of disappear?

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45. $2X(g) \rightarrow 3Y(g) + 2Z(g)$

Time (in min)	0	100	200
Partial pressure of X (mm Hg)	800	400	200

Assuming ideal gas condition, calculate

(a) Order of reaction

(b) Rate constant

(c) Time taken for 75% completion of reaction

(d) Total pressure when $p_x = 700mm$

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46. Suppose 50 bacteria are placed in a flask contining nutrients for the bacteria so that they can multiply.

A study at $35^\circ C$ gave the following results.:

Time (minute)	0	15	30	45	60
Number of bacteria	50	100	200	400	800

Show that the rate of productin of bacteria is of first order. How many bacteria wil be there after 3 hours?

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47. A viral preparation was inactivated in a chemical both. The inactivation process was found to be of first order is virus concentration, and at the beaginning of the minutes. Evaluate 'k' the inactivation process.

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48. Trans $1, 2$-dideuterocyclopropane (A) undergoes a first order decompoistion. The observed rate constant at a certain temperature, measured in terms of disapperance of A was $1.52 \times 10^{-4} s^{-1}$. The analyiss of Products shwoed that the reaction followed two parallel paths, one leading to dideuteropropane (B) and the other to cis-$1, 2$-dideuterocyclopropane (c). (B) was found to constitute 11.2% of the reaction Product, independently of the extent of reaction. What is the order of reaction for each path and what is the value of the rate constant for the formation of each of the Products ?

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49. In milk at $37^\circ C$, lactobalicillus acidophilus has a generation time of about 75 minutes . Calculate the population relative to the initial value at 30,60,75,and 150 minutes

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50. Rate law for ozone layer depletion is,

$$\frac{d[O_3]}{dt} = \frac{K[O_3]^2}{[O_2]}$$

Give the proboble mechanism of reaction ?

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51. In hypothetical reaction, $A_2 + B_2 \to 2AB$, follows the follows the mechnism as given below :

$$\begin{array}{ll} A_2 \Leftrightarrow A + A & (\text{fast reaction}) \\ A + B_2 \to AB + B & (\text{slow reaction}) \\ A + B \to AB & (\text{fast reaction}) \end{array}$$

Give the rate law and order of reaction

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52. Calculate the order of reaction form the following data:

$2NH_3 \rightarrow N_2 + 3H_2$ (reaction)

Pressure (mm Hg)	50	100	200
Half lives (min)	3.52	1.82	0.93

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53. The rate constant of the reaction $A \rightarrow B$ is k=0.5 , the initial concentration of A being 1 mol/litre. Calculate the degree of conversion of substance 'A' within1 hour if the reaction is of zeroth, first and second order. How does the degree of conversion depne on the order of reaction?

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54. Two first order reactions proceed at $25^\circ C$ at the same rate. The temperature coefficient of the rate of the first reaction is 2 and that of second reaction is 3. Find the ratio of the rates of these reactions at $75^{\circ} C$.

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55. The reaction $A + OH^{-} \rightarrow$ Products, obeys rate law expression as :

$$\frac{-d[A]}{dt} = k[A]\left[OH^{-}\right]$$

If initial concentrations of [A] and $\left[OH^{-}\right]$ are 0.02 M and 0.3 M respectively and if it takes 30 sec for 1% A to react at $25^{\circ} C$, caclutate the rate constant for the reaction

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56. A hydrogenation reaction is carried out at $500K$. If the same reaction is carried out in the presence of a catalyst at the same rate, the temperature required is $400K$. Calculate the activation energy of the reaction if the catalyst lowers the activation barrier by $20kJmol^{-1}$.

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57. Some $PH_3(g)$ is introduced into a flask at $600^\circ C$ containing an intert gas. PH_3 proceeds to decompose into $P_4(g)$ and $H_2(g)$ and the reaction goes to complection. Total pressure is given below as a fucntion of time. Find the order of the reaction and calcualate the rate constant.

Time (sec)	0	60	120	∞
Pressure (mm Hg)	262.40	272.90	275.51	276.51

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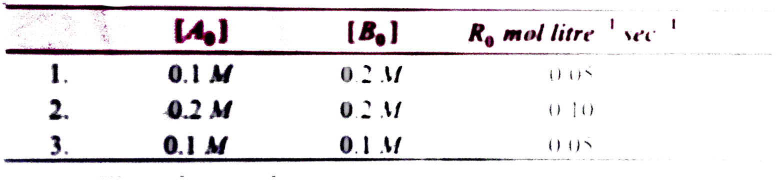
58. For the given reaction, $A + B \rightarrow$ Products following data were obtained



	$[A_0]$	$[B_0]$	R_0 mol litre^{-1} sec^{-1}
1.	0.1 M	0.2 M	0.05
2.	0.2 M	0.2 M	0.10
3.	0.1 M	0.1 M	0.05

(i) Write the rate law expression.

(ii) Find the rate constant.

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59. The rate law of a chemical reaction given below:

$2NO + O_2 \rightarrow 2NO_2$

is given as rate $= K[NO]^2[O_2]$. How will the rate of reaction change if the volume of reaction vessel is reduced to $1/4th$ of its original valur?

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ILLUSTRATIONS

1. For the reaction $2N_2O_5 \rightarrow NO_2 + O_2$ rate of reaction is :

A. $\frac{1}{2}\frac{d}{dt}[N_2O_5]$

B. $2\frac{d}{dt}[N_2O_5]$

C. $\frac{1}{2}\frac{d}{dt}[NO_2]$

D. $4\frac{d}{dt}[NO_2]$

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2. Observe the following reaction:

$A(g) + 3B(g) \rightarrow 2C(g)$

The rate of this reaction $\left\{\frac{-d[A]}{dt}\right\}$ is 3×10^{-3}mol litre^{-1}min^{-1}. What is the value of $\frac{-d[B]}{dt}$ in mol litre^{-1}min^{-1} ?

A. 3×10^{-3}

B. 9×10^{-3}

C. 10^{-3}

D. 1.5×10^{-3}

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3. for the reaction, $2A + B \rightarrow 3C + D$, which of the following does not express the reaction rate

A. $\frac{-d[C]}{3dt}$

B. $\frac{-d[B]}{dt}$

C. $\frac{d[D]}{dt}$

D. $\frac{-d[A]}{2dt}$

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4. Consider the reaction:

$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$.

The equally relationship between $-\frac{d[NH_3]}{dt}$ and $-\frac{d[H_2]}{dt}$ is:

A. $\frac{d[NH_3]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt}$

B. $+\frac{d[NH_3]}{dt} = -\frac{2}{3}\frac{d[H_2]}{dt}$

C. $+\frac{d[NH_3]}{dt} = -\frac{3}{2}\frac{d[H_2]}{dt}$

D. $\frac{d[NH_3]}{dt} = -\frac{d[H_2]}{dt}$

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5. For a reaction $\frac{1}{2}A \rightarrow 2B$, rate of disappearance of $'A'$ is related to the rate of apperance of $'B'$ by the expression:

A. $\frac{-d[A]}{dt} = 4\frac{d[B]}{dt}$

B. $\frac{-d[A]}{dt} = \frac{1}{2}\frac{d[B]}{dt}$

C. $\frac{-d[A]}{dt} = \frac{1}{4}\frac{d[B]}{dt}$

D. $\frac{-d[A]}{dt} = +\frac{d[B]}{dt}$

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6. in a reacton, of acidified hydrogen peroxide with potassium iodide, the concentration of iodine formed rises from 0 to $10^{-5}\text{mil dm}^{-3}$ in 10 seconds. What is the rate of reaction ?

A. $10^{-6}\text{mol dm}^{-3}s^{-1}$

B. $10^{6}\text{mol dm}^{-3}s^{-1}$

C. $10^{-5}\text{mol dm}^{-3}s^{-1}$

D. $10^4 \text{mol dm}^{-3} s^{-1}$

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7. For a reaction, $E_a = 0$ and $k = 3.2 \times 10^4 s^{-1}$ at $300K$. The value of k at $310K$ would be

A. $6.4 \times 10^4 s^{-1}$

B. $3.2 \times 10^4 s^{-1}$

C. $3.2 \times 10^8 s^{-1}$

D. $3.2 \times 10^5 s^{-1}$

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8. For a gaseous reaction, following data is given:

$A \to B, k_1 = 10^{15} e^{-2000/T}$

$C \rightarrow D, k_2 = 10^{14} e^{-1000/T}$

The temperature at which $k_1 = k_2$ is

A. 1000K

B. 2000 K

C. $868.82K$

D. $443.2K$

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9. For $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g) + 22kcal, \ E_a$ for the reaction is $70kcal$. Hence, the activation energy for $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ is :

A. 92 Kcal

B. 70 Kcal

C. 48 Kcal

D. 22 Kcal

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10. On introducing a ctatlyst at 500 K, the rate of a first order reaction increases by 1.718 times. The activation energy in the presence of a catalyst is $60.5 kJ \text{mol}^{-1}$. The slop of the plot of In k $\left(\text{sec}^{-1}\right)$ against 1/T in the absence of catalyst is :

A. $+1$

B. -1

C. $+1000$

D. -1000

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11. For which of the following reactions k_{310} / k_{300} would be maxiumum?

A. $A + B \rightarrow C, E_a = 50kJ$

B. $X + Y \rightarrow Z, E_a = 40kJ$

C. $P + Q \rightarrow R, E_a = 60kJ$

D. $E + F \rightarrow G, E_a = 100kJ$

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12. The activation energy of exothermic reaction $A \rightarrow B$ is 80 kJ mol^{-1}. The heat of reaction is $200kJ\text{mol}^{-1}$. The activation energy for the reaction$B \rightarrow a$ (in kJ/mol) will be :

A. 80

B. 120

C. 40

D. 280

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13. Which equation is true to calculate the energy of ativation, if the rate of reaction is doubled by increasing temperature from $T_1 K \text{to} T_2 K$?

A. $\log_{10}\left(\frac{k_1}{k_2}\right) = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

B. $\log_{10}\left(\frac{k_2}{k_1}\right) = \frac{E_a}{2.303R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$

C. $\log_{10}.\frac{1}{2} = \frac{E_a}{2.303R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$

D. $\log_{10}.2 = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

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14. If the half-lives of the first order reaction at 350 K and 300 K are 2 and 20 seconds respectively, the activation energy of the reaction in kJ mol^{-1} is :

A. 40.2

B. 20.1

C. 60.3

D. 30.2

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15. For the decompoistion of HI at $1000K(2HI \rightarrow H_2 + I_2)$, following data were obtained:

$[HI](M)$	Rate of decomposition of HI $\left(molL^{-1}s^{-1}\right)$
0.1	2.75×10^{-8}
0.2	11×10^{-8}
0.3	24.75×10^{-8}

The order of reaction is

A. 1

B. 2

C. 0

D. 1.5

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16. Conisder a reaction $A \rightarrow B + C$. The initial concentration of A was reduced form $2M$to $1M$ in $1h$ and form $1M$ to $0.25M$ in $2h$, the order of the reaction is

A. 1

B. 0

C. 2

D. 3

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17. The rate of a gaseous reaction is given by the expresion $k[A]^2[B]^3$. The volume of the reaction vessel is suddenly reduced to one-half of the initial volume. The reaction rate relative to the original rate will be

A. $1/24$

B. $1/32$

C. 32

D. 24

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18. For a chemical reaction $A \rightarrow B$, the rate of reaction increases by a factor of 1.837 when the concentration of A is increased by 1.5 time. The order of reaction with respect to A is:

A. 1

B. 1.5

C. 2

D. -1

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19. The rate of the reaction

$3A + 2B \rightarrow$ Products

is given by the rate expresison: Rate $= k[A][B]^2$

If A is taken in excess, the order of the reaction would be

A. 3

B. 2

C. 1

D. 5

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20. For the reaction $A + B \rightarrow C + D$, if concentratiton of A is doubled without altering the concentration of B, the rate gets doubling, If the concentration of B is increased by nine times without altering the concentration of A, the rate gas tripled. The order of reaction is

A. 2

B. 1

C. $3/2$

D. $4/3$

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21. Inversion of can sugar in dilute acid (conversion into glucose and fructose) is a

A. bimolecular reaction

B. pseudo-unimolecular reaction

C. unimolecular reaction

D. trimolecular reaction

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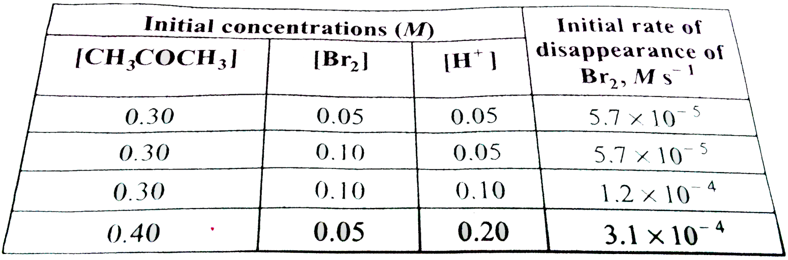
22. The bromination of acetone that occurs in acid solution is represented by

$$CH_3COCH_3(aq.) + Br_2(aq.) \rightarrow CH_3COCH_2Br(aq.) + H^+(aq.) + Br$$

These kinetic data were obtained for given reaction concentrations :



Initial concentrations (*M*)			Initial rate of disappearance of Br_2, $M\ s^{-1}$
$[CH_3COCH_3]$	$[Br_2]$	$[H^+]$	
0.30	0.05	0.05	5.7×10^{-5}
0.30	0.10	0.05	5.7×10^{-5}
0.30	0.10	0.10	1.2×10^{-4}
0.40	0.05	0.20	3.1×10^{-4}

Based on these data, rate equations is :

A. $\text{Rate} = k[CH_3COCH_3][Br_2]\left[H^+\right]^2$

B. $\text{Rate} = k[CH_3COCH_3][Br_2]\left[H^+\right]$

C. Rate $= k[CH_3COCH_3[H^+]$

D. Rate $= k[CH_3COCH_3[Br_2]$

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23. A first order reaction has half life of 14.5 hrs. What percentage of the reactant will remain after 24 hrs ?

A. 18.3%

B. 31.8%

C. 45.5%

D. 68.2%

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24. Half life of a first order reaction in 10 min. What $\%$ of reaction will be completed in 100 min ? `

A. 25%

B. 99.9%

C. 75%

D. 80%

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25. A certain zero order reaction has $k = 0.025 M s^{-1}$ for the disappearance of A. What will be the concentration of A after 15 seconds if the initial concentration is $0.5M$?

A. $0.5M$

B. $0.32M$

C. $0.12M$

D. $0.06M$

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26. The first order reaction $2N_2O(g) \rightarrow 2N_2(g) + O_2(g)$ has a rate constant of $1.3 \times 10^{-11}s^{-1}$ at $270^\circ C$ and $4.5 \times 10^{-10}s^{-1}$ at $350^\circ C$. What is the activation energy for this reaction ?

A. 15 kJ

B. 30 kJ

C. 68 kJ

D. 120 kJ

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27. The reaction of O_3 with chlorine atom is given as :

$O_3(g) + Cl(g) \rightarrow O_2(g) + ClO(g), k_1 = 5.2 \times 10^9 L\text{mol}^{-1}\text{sec}^{-1}$

$ClO(g) + O(g) \rightarrow Cl(g) + O_2(g), k_2 = 2.6 \times 10^{10} L\text{mol}^{-1}\text{sec}^{-1}$

Which of theses values is closest to the rate constant of the overall reaction ?

$O_3(g)O(g) \rightarrow 2O_2(g)$

A. 5.2×10^9

B. 2.6×10^{10}

C. 3.1×10^{10}

D. 1.4×10^{20}

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28. If a first order reaction takes 32 minutes for 75% completion, then time required for 50% completion is :

A. 32 min

B. 16 min

C. 8 min

D. 4 min

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29. Rate constant of a reaction (k) is $175 \text{litre}^2 \text{mol}^{-2} \sec^{-1}$. What is the order of reaction ?

A. First

B. Second

C. Third

D. Zero

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30. The half life of a first order reaction having rate constant $k = 1.7 \times 10^{-5} \sec^{-1}$ is :

A. 12.1 hrs

B. 9.7 hrs

C. 11.3 hrs

D. 1.8 hrs

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31. At 500 K, the half-life period of a gaseous reaction at the initial pressure of 80 kPa is 350 sec. When the pressure is 40 kPa, the half life period is 175 sec. The order of reaction is

A. zero

B. one

C. two

D. three

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32. 90% of the first order reaction is completed in 70 minutes. The velocity constant of the reaction is :

A. 0.0329

B. 0.329

C. 3.29

D. 0.0293

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33. The half life period of a first reaction is 1 min 40 seconds. Calulate its constant

A. $6.93 \times 10^{-3}\text{min}^{-1}$

B. $6.93 \times 10^{-3}\text{sec}^{-1}$

C. 6.93×10^{-3} sec

D. 6.93×10^{-3} sec

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34. At T (K) , if the rate constant of a first order reaction is $4.606 \times 10^{-3} s^{-1}$, the time to reduce the initial concentration of the reactant to $\frac{1}{10}$ in seconds is :

A. 500

B. 1000

C. 100

D. 50

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PRACTICE PROBLEMS

1. From the reaction $A \rightarrow B$ it was found that the concentration of B increased by 0.3 mol L^{-1} in 2 hours. What is the average rate of reaction ?

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2. In the reaction $X \rightarrow Y$, the initial concentration of Xis 2.5 mol L^{-1} and its concentration after 3 hours is 0.7 mol L^{-1} . What is the average rate of the reaction ?

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3. For the reaction$2A + B \rightarrow C$, the rate of formation of C is $0.5 \text{mol} L^{-1} hr^{-1}$. What is the rate of disappearance of A and b?

Watch Video Solution

4. When ammonia is treated with O_2 at elevated temperature, the rate of disappearance of ammonia is found to be $3.5 \times 10^{-2} \text{mol} dm^{-3} s^{-1}$ during a measured time interval. Calculate the rate of appearance of nitric oxide and water.

Watch Video Solution

5. In a reaction, the concentration of a reatant (A) changes from $0.200 \text{mol litre}^{-1} \rightarrow 0.150 \text{mol litre}^{-1}$ in 10 minutes. What is the average rate of reaction during this interval ? $N_2O_5 \rightarrow 2NO_2 +_{1/2} O_2$ the rate of disappearance of $N_2O_5 \text{is} 6.5 \times 10^{-3} \text{mol} L^{-1} s^{-1}$. Computer the rates of formation of NO_2 and O_2

Watch Video Solution

6. For the reaction,

$2O_3 \Leftrightarrow 3O_2 - \frac{\Delta[O_3]}{dt}$ was found to be $4.0 \times 10^4 atms^{-1}$ Determine the value of $\frac{\Delta[O_2]}{\Delta t}$ in atms s^{-1} during this period of time

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7. The following reaction was carried out at $44^\circ C$:

$N_2O_5 \rightarrow 2NO_2 +_{1/2} O_2$

The concentration of NO_2 is 6.0×10^{-3} M afte minutes of the start of reaction . Calculate the rat of production of NO_2 over the first ten minutes of the reaction

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8. The rate of a reaction doubles when its temperature changes form $300K$ to $310K$. Activation energy of such a reaction will be:

$(R = 8.314JK^{-1}mol^{-1} \text{ and } \log 2 = 0.301)$

A.

B.

C.

D.

Answer: $53.59kJ\text{mol}^{-1}$

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9. The rate constant for a reaction is $2 \times 10^{-2}s^{-1}$ at 300 K and $8 \times 10^{-2}s^{-1}$ at 340 K The energy of activation of the reaction is

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10. For a chemical reaction the energy of activation is 85 kJ mol^{-1} If the frequency factor is $4.0 \times 10^{9}L\text{mol}^{-1}s^{-1}$, what is the rate constant at 400 K?

A.

B.

C.

D.

Answer: $k = 3.19 \times 10^{-2} L\text{mol}^{-1} s^{-1}$

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11. The energy of activation of a reaction is $140kJ\text{mol}^{-1}$. If its rate constant at 400 K is $2.0 \times 10^{-6} s^{-1}$, what is the value at 500 K

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12. Calculate the ratio of the catalysed and uncatalysed rate constant at $20^{\circ} C$ if the energy of activation of a catalysed reaction is $20kJ\text{mol}^{-1}$ and for the uncatalysed reaction is $75kJ\text{mol}^{-1}$

Watch Video Solution

13. The decomposition of methyl iodid,

$2CH_3I(g) \rightarrow C_2H_6(g) + I_2(g)$ at 273°C has a rate constant of $2.418 \times 10^{-5} s^{-1}$. If activation energy for the reaction is $+179.9 kJ\text{mol}^{-1}$, what is the value of collision factor A at $273^\circ C$?

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14. For the inversion of cane, sugar,

$C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$, the rate constant is $2.12 \times 10^{-4} L\text{mol}^{-1}\text{sec}^{-1}\text{at} 27^\circ C$. The activation energy of the reaction is $1.07 \times 10^5 K\text{mol}^{-1}$. What is the rate constant of the reaction at $37^\circ C$

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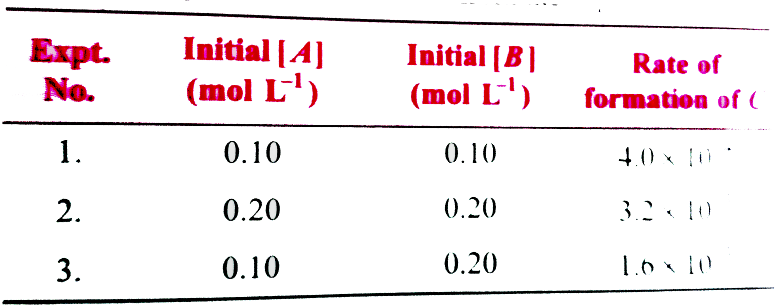
15. What is the rat law expressio for the reaction ,

$A + B \rightarrow C$

The following data were collected from the experiments. :



Expt. No.	Initial $[A]$ (mol L^{-1})	Initial $[B]$ (mol L^{-1})	Rate of formation of (
1.	0.10	0.10	4.0×10
2.	0.20	0.20	3.2×10
3.	0.10	0.20	1.6×10

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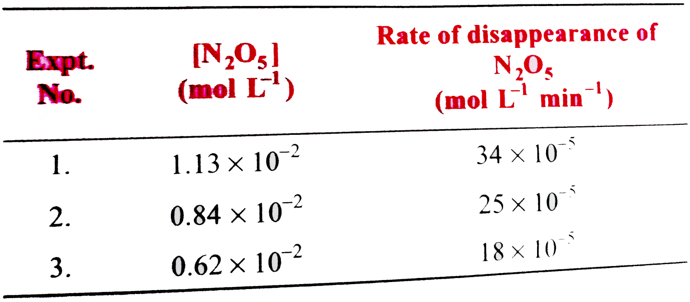
16. The reaction ,

$2N_2O_5 \rightarrow 4NO_2 + O_2$

was studdied and the following data were collected :



Expt. No.	$[N_2O_5]$ (mol L^{-1})	Rate of disappearance of N_2O_5 (mol L^{-1} min^{-1})
1.	1.13×10^{-2}	34×10^{-5}
2.	0.84×10^{-2}	25×10^{-5}
3.	0.62×10^{-2}	18×10^{-5}

Determine (i) order the reaction (ii) the rate law and (iii) rate constant for the reaction

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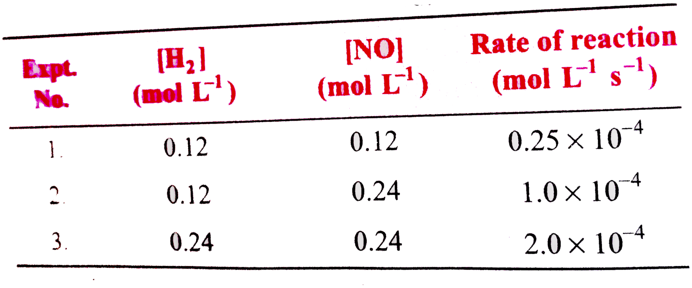
17. For the reaction,

$2NO + 2H_2 \rightarrow N_2 + 2H_2O,$

the following kinetic data were obtained.



Expt. No.	$[H_2]$ $(mol\ L^{-1})$	[NO] $(mol\ L^{-1})$	Rate of reaction $(mol\ L^{-1}\ s^{-1})$
1.	0.12	0.12	0.25×10^{-4}
2.	0.12	0.24	1.0×10^{-4}
3.	0.24	0.24	2.0×10^{-4}

Determine the rate law and the rate constant

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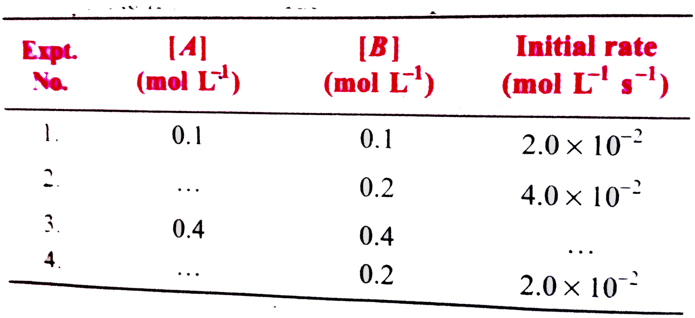
18. Fill in the balanks in the following table which treats reaction of a compound A with a compound B , that is of the first order with respect to

A and zero order with respect to B :



Expt. No.	[*A*] (mol L^{-1})	[*B*] (mol L^{-1})	Initial rate (mol L^{-1} s^{-1})
1.	0.1	0.1	2.0×10^{-2}
2.	...	0.2	4.0×10^{-2}
3.	0.4	0.4	...
4.	...	0.2	2.0×10^{-2}

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19. The reaction $2NO + O_2 \rightarrow 2NO_2$ follows the rate law $= k[NO]^2[O_2]$. What is the order of the reaction? If $k = 2.0 \times 10^{-6} \text{mol}^{-2} L^2 s^{-1}$. What is the rate of the reaction when $= [NO] = 0.04 \text{mol} L^{-1}$ and $[O_2] = 0.2 \text{mol} L^{-1}$?

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20. From the following data of initial concentration and rates, calculate rhe order of reaction $aA \rightarrow$ Products, and rate constant

$[A] \text{mol} L^{-1}$	0.1	0.2	0.4
$[\text{Rate}] \text{mol} L^{-1} s^{-1}$	9×10^{-5}	36×10^{-5}	144×10^{-5}

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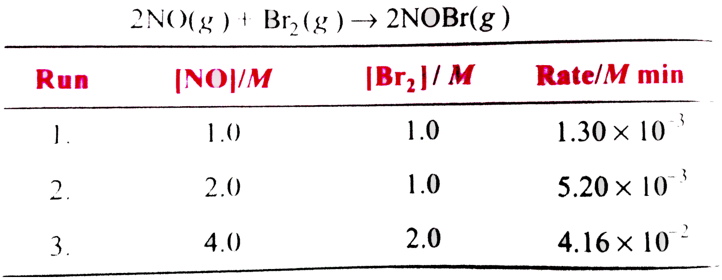
21. The following initial rate data were obtianed for the reaction

$2NO_g + Br(g) \rightarrow 2NOBr(g)$



$2NO(g) + Br_2(g) \rightarrow 2NOBr(g)$

Run	[NO]/M	[Br_2]/ M	Rate/M min
1.	1.0	1.0	1.30×10^{-3}
2.	2.0	1.0	5.20×10^{-3}
3.	4.0	2.0	4.16×10^{-2}

Determine the reaction rat law and the value of te rate constant.

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22. The data given below are for the reaction of NO and Cl_2 to from $NOCl$ at $295K$.

$[Cl_2]$	$[NO]$	Initial rate$\left(mollitre^{-1}\sec^{-1}\right)$
0.05	0.05	1×10^{-3}
0.15	0.05	3×10^{-3}
0.05	0.15	9×10^{-3}

(a) What is the order with respect to NO and Cl_2 in the reaction?

(b) Write the rate expression.

(c) Calculate the rate constant.

(d) Determine the reaction rate when conc. of Cl_2 and NO are $0.2M$ and $0.4M$ respectively.

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23. In the hydrogen of propyl acetate in presence of dilute HCl in aqueous solution. The following data were recorded.

Time from start (in minute)	60	350
%of ester decomposed	18.17	69.12

Calculate the rate constant of decomposition and time in in which half of the ester was decomposed.

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24. In a first order reaction the concentration of the reactant is reduced to one-fourth of its initial value in 50 seconds. Cacluate the rate constant the reaction

Watch Video Solution

25. For a first order reaction, the rate constant is $0.1s^{-1}$. How much time will it take to reduce the concentration from initial value of $0.6\text{mol}L^{-1}s^{-1}$

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26. A substance decomposes following first order reaction. If the half life period of the reaction is 35 minutes , what is the rate constant of this reaction?

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27. In a first order reaction the concentration of the reactant is reduced from $0.6\text{mol}L^{-1}$ to $0.2\text{mol}L^{-1}$ in 5 minutes the rate constant of the reaction is

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28. Find the two-thirds life $\left(t_{2/3}\right)$ of a first order reaction in which $k = 5.48 \times 10^{-1}\text{sec}^{-1}$ (log 3 = 0.4771 , log 2 = 0.3010)

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29. A first order reaction has a specific rate of 10^{-3}sec^{-1} . How much time will it take from 10 g the rectant to reduce to $7.5g(\log 2 = 0.3010, \log 4 = 0.6020 \text{ and } \log 6 = 7782)$?

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30. In a hydrolysis reaction, 5 g of ethyl acetate is hydroloysed in the presence of dilute HCl in 300 minutes. If the reaction is of first order and the initial concentration of ethyl acetate is 22g/L, calculate the rate constant for the reaction.

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31. Calculate the half life of the reaction $A \rightarrow B$, when the initial concentration of A is $0.01 \text{mol} L^{-1}$ and initial rate is $0.00352 \text{mol} L^{-1} \text{min}^{-1}$. The reaction is of the first order

Watch Video Solution

32. In reaction, $A \rightarrow B + C$ the following data were obtained.

t in seconds	0	900	180
Concentration of A	50.8	19.7	7.62

Prove that it is a first order reaction.

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33. The first order reaction has $k = 1.5 \times 10^{-6}$ per second at $200^{\circ} C$. If the reaction is allowed to ruf for 10 hours at the same temperature, what percentage of the initial concentration would have changed into the product? What is the half life period of this reaction ?

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34. What will be the initial rate of a reaction if its rate constant is $10^{-3}\min^{-1}$ and the concentration of reactant is $0.2moldm^{-3}$? How much of reactant will be converted into Products in $200\min$?

Watch Video Solution

35. The catalytic decomposition of H_2O was studied by titrating it at different intervals with $KMnO_4$ and the following data were obtained :

t (second)	0	600	1200
V of $\text{KMmO}_4(mL)$	22.8	13.8	8.3

Calculate the velocity constant for the reaction assuming it to be a first order reaction.

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36. A first order reaction is 40% complete after 8 min . How long will it take before it is 90% complete? What is the value of the rate constant?

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37. The reaction $SO_2Cl_2 \xrightarrow{k_1} SO_2 + Cl_2$ is a first order reaction with $k_1 = 2.2 \times 10^{-5} s^{-1}$ at $575K$. What percentage of SO_2Cl_2 will get decomposed in 90 min when the reaction is carried out at $575K$.

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38. The decomposition of $Ab(g) \rightarrow A(g) + B(g)$, is first order reaction with a rate constant $k = 4 \times 10^{-4} s^{-1}$ at 318 K . If AB has 26664 Pa pressure at the initial stage, what will be the partial pressure of AB after half an hour?

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39. In the first order reaction $A(g) \rightarrow B(g) + C(g)$, the initial pressure of A is 11200 Pa and the total pressure at the end of 16 minutes is 14667 Pa. Calculate the half life period of reaction.

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40. It was found that a solution of cane sugar was hydrolysed to the extent of 25% in 1 hr. Calculate the time taken for the sugar to be 50% hydrolysed assuming that the reaction is of first order.

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41. A second order reaction in which in both the reactants have same conentratio, is 20% completed in 500 seconds. How much time it will take for 60% completion?

Watch Video Solution

42. At a certain temperature the half life periods of a reactio at different initial pressure were as follows :

$p(kPa)$	100	66.67	33.33
$t(\text{min})$	150	235	950

Find out the order or the reaction.

Watch Video Solution

Watch Video Solution

43. The time for half change fro a gaseous reaction was measured for varous initial pressures and the following data were obtained :

$p(kPa)$	26.6	40	53.3
$t(\text{min})$	150	99	75.3

Find out the order of the reaction

Watch Video Solution

44. The decomposition of an aqeous solution of ammonium nitrite was studied. The volume of nitrogen gas collected at

Time (minutes)	10	15	20	∞
Vol.of $N_2(mL)$	6.25	9.00	11.40	35.05

From the above data prove that the reaction is of the first order.

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45. Optical rotation of sucrose in 1 N Hcl at various times was found as shown below :

Time (sec)	0	7.18	18.0	27.05	∞
Rotation (deg)	$+24.09$	$+21.7$	$+17.7$	$+15.0$	-10.74

Shwo that the inversion of scrose is a first order reaction

Watch Video Solution

46. The rate law for the decompoistion of gaseous N_2O_5,

$N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ is observed to be:

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

A reaction machanism which has been suggested to be conisstent with this rate law is

$$N_2O_5(g) \overset{k_{eq}}{\Longleftrightarrow} NO_2(g) + NO_3(g)(\text{fast equilibrium})$$

$NO_2(g) + NO_3(g) \xrightarrow{k_1} NO_2(g) + NO(g) + O_2(g)$ (slow)

$NO(g) + NO_3(g) \xrightarrow{k_2} 2NO_2(g)$ (fast)`

Show that the mechanism is consistent with the above rate law.

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47. Write the overall reaction and the rate law equation from the following elementary steps:

$NOBr_2 \Leftrightarrow NOBr$

$NOBr + NO \rightarrow 2NOBr$

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48. The reaction $2NO + O_2 \rightarrow 2NO_2$ proceeds in two steps. If one elementry reaction is $NO + O_2 \rightarrow NO_3$, write the second elementary reaction. Write the rate law of the reaction

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49. At $380^\circ C$, the half-life periof for the first order decompoistion of H_2O_2 is 360 min . The energy of activation of the reaction is $200 kJ mol^{-1}$. Calculate the time required for 75% decompoistion at $450^\circ C$.

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50. Calculating the average reaction rate : Calculate the average rate of decomposition of N_2O_5 by the reaction

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

during the time interval from $t = 600s$ $t = 1200s$, using the following data:

Time , $[N_2O_5]$

$600s$, $1.24 \times 10^{-2} M$

$1200s$, $0.93 \times 10^{-2} M$

Strategy : Calculater a Δ quantity in concentration, $[N_2O_5]$, by taking the final value minus the value. Then, divide it by the time interval, Δt.

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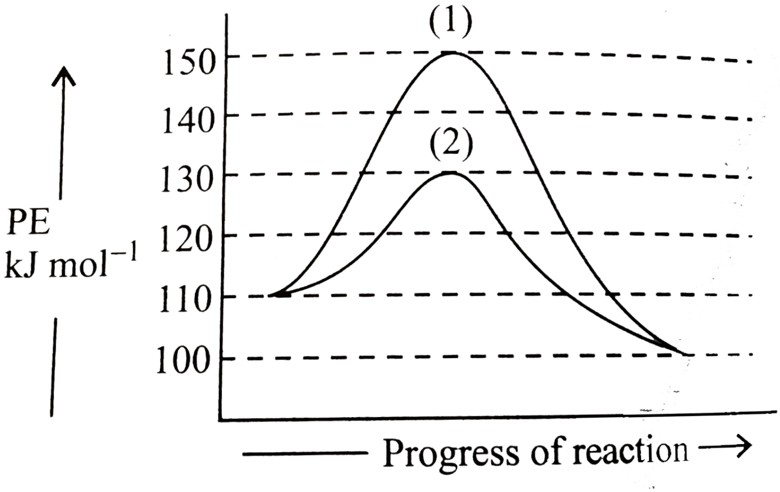
51. Given the following graph.

(a) Calculate ΔH for the reaction and energy of activation for the forward and backward reaction.



(b) Curve (2) is the energy profile in the presence of a catalyst. What is the energy of activation for the two reaction in the presence of a catalyst?

(c) Will the catalyst change the extent of the reaction?

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52. Temperature coceficient, $\mu = \frac{k_{35^{\circ} C}}{k_{25^{\circ} C}}$ of a reaction is 1.82. Calculate the energy of activation in colories $\left(R = 1.987\text{cal degree}^{-1}\text{mol}^{-1}\right)$

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53. For first order gaseous reaction , log k when plotted atgains $\frac{1}{t}$ gives a straight line with a slop of -8000. Calcualte the activation energy of the reaction

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54. The rate at $27^{\circ}C$ of a chemical reaction increases 1000 times when a suitable catalyst introduced. Calculate the change in the energy of of activation that the catalyst has brought in

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55. Dehydration of tertiary butyl alcohol follows a first order reaction,

$(CH_3)_3C - OH(g) \rightarrow (CH_3)_2C = CH_2(g) + H_2O(g)$

the rate constant at 300°C is $2.27 \times 10^{-8}s^{-1}$. Calculate the rate of constat at $400^{\circ}C$ if the energy of activaion for the reaction is 58 kcal.

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56. Let us consider the following mechanism :

$CH_3CN+^+ \Leftrightarrow CH_3CNH^+$ (fast)

$CH_3CNH^+ + H_2O \rightarrow \text{Product}$ (slow)

Wha would be the rate law

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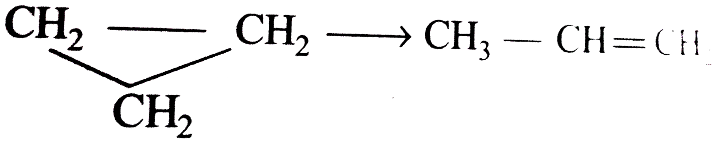
57. The thermal isomerization of cyclopropane occures according to the equation



The specific reaction rate for this reaction at $499^\circ C$ was $5.95 \times 10^{-4} \text{sec}^{-1}$. What is the half life of the reaction? What fraction of the cylopropane will reamain after 1 hour at $499.5^\circ C$?

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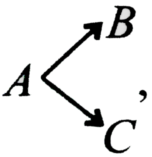
58. A substance " was found to undergo two parallel first order reaction



i.e., $A \rightarrow B$ and $A \rightarrow C$.

with rate constants $1.26 \times 10^{-4} s^{-1}$ and $3.8 \times 10^{-5} s^{-1}$ respectively. What were the precentage disritbutions of B and C ?

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59. Two reactions proceed at $25^{\circ} C$ at the same rate, the temperature coefficient of the rate of the first reaction is 2 and that of the second reactions 2.5. Find the ratio of rates of these reaction at $95^{\circ} C$

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60. Half lives against initial pressure are given below. Calculate the order of the reaction.

p(mm)	750	500	250
t(min)	105	235	950

Find out order of the reaction.

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61. for a given reaction at temeperature T, the velocity constant k, is expressed as :

$k = ae^{-27000K'/T}$ (K' = Boltzmann constant)

Given , $R = 2calK^{-1}\text{mol}^{-1}$. Calculate the value of energy of activation. Comment on the results.

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62. If the activation energy of a reaction is $80.9kJ\text{mol}^{-1}$. Calculate he fraction of molecules at $400^{\circ}C$ which have enough energy to react to from products

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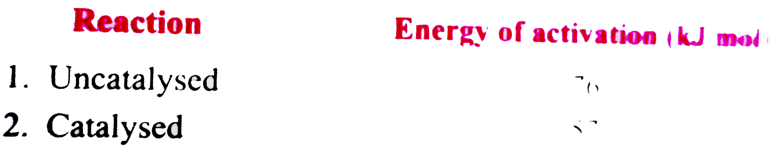
63. The following data wer obtained for a given reaction at 300 K



Reaction	Energy of activation (kJ mol
1. Uncatalysed	[illegible]
2. Catalysed	[illegible]

Calculate by what factor the rate of catalyst reaction is increases ?

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64. The Arrhenius equations for cis-trans isomerzation of but-2-ene $(CH_3-CH=CH-CH_3)$ and but-2-ene, 1 nitrile $(CH_3-CH=CH-CN)$ are,

$k(s^{-1}) = 10^{13.8}\exp\left(-263.5kJ\text{mol}^{-1}/RT\right)$

$k^{-1}(s^{-1}) = 10^{11}\exp\left(-214.5kJ\text{mol}^{-1}/RT\right)$ Calculate the temperature at which $k=k^{-1}$.

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65. The half life for a reaction between fixed conecntration of reactants varies with temperature as follows:

$t^\circ C$	520	533	555	574
$t_{1/2}$ sec	1288	813	562	477

Calcutate the activation energy of this reaction.

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66. What percentage of reactant molecules will crossover the energe barrier t 325 K? Heat of reaction is 0.12 kcal and activation energy of backward reaction is 0.02 kcal.

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67. In milk at $37^\circ C$, lactobalicillus acidophilus has a generation time of about 75 minutes . Calculate the population relative to the initial value at 30,60,75,and 150 minutes

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68. Two reactiosn of same order have equal pre-exponential factors but their activation energies differ by 41.9 J/mol. Calculte the ratios between rate constant of these reactions at 600 K

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69. A decompositio has following mecfhanism

$2N_2O_5 \rightarrow 4NO_2 +$ (overall)

$N_2O_5 \Leftrightarrow NO_2 +$ (fast decomposition)

$NO_2NO_3 \rightarrow NO + NO_2 + O_2$ (slow)

$NO + NO_3 \rightarrow 2NO_2$ (fast)

Determine rate law, is the mechanism correspond. first order reacrtion

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70. Rate constant of a reaction changes by 2% by $0.1^\circ C$ rise in temperataure at $25^\circ C$. The standard heat of reaction is $12.1 kJ\text{mol}^{-1}$. Calculate E_a or reverse reaction.

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OBJECTIVE QUESTIONS (LEVEL-A)

1. Chemical kinetics, a branch of physical chemistry, deals with :

A. heat changes in a reaction

B. physical changes in reaction

C. rate of reaction

D. structure of molecules

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2. The rate at which a substance reacts, depends on its:

A. atomic mass

B. equivalent mass

C. molecular mass

D. active mass

Answer: C

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3. The rate at which a substance react depends upon its :

A. increases as the reaction proceeds

B. decreases as the reaction proceeds

C. my increases or decreases during the reaction

D. reamins constant as the reaction proceeds

Answer: D

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4. For the reaction, $N_2 3H_2 \rightarrow 2NH_3$ rate is expressed as :

A. $-3\frac{d[N_2]}{dt} = -\frac{d[H_2]}{dt} = \frac{3}{2}\frac{d[NH_3]}{dt}$

B. $-\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{3}\frac{d[NH_3]}{dt}$

C. $-\frac{d[N_2]}{dt} = -\frac{3d[H_2]}{dt} = \frac{2d[NH_3]}{dt}$

D. $-\frac{d[N_2]}{dt} = -\frac{d[H_2]}{dt} = \frac{d[NH_3]}{dt}$

Answer: B

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5. For the reaction $2NO_2 \rightarrow 2NO + O_2$, rate expressed as :

A. $-\frac{1}{2}\frac{d[NO_2]}{dt} = \frac{1}{2}\frac{d[NO]}{dt} = \frac{d[O_2]}{dt}$

B. $-\frac{1}{2}\frac{d[NO_2]}{dt} = -\frac{1}{2}\frac{d[NO]}{dt} = \frac{d[O_2]}{dt}$

C. $-\frac{2d[NO_2]}{dt} = \frac{2d[NO]}{dt} = \frac{d[O_2]}{dt}$

D. $-\frac{d[NO_2]}{dt} = \frac{d[NO]}{dt} = \frac{d[O_2]}{dt}$

Answer: B

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6. The rate of reaction that does not involve gases, is not depend on :

A. prssrure

B. temeprature

C. concentration

D. catalyst

Answer: A

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7. For the reaction,$A+B \rightarrow 2C+D$, which one is the incorrect statement?

A. Rate of disappearance of A = Rate of disappearace of B

B. Rate of disappearance of A = Rate of disappearace of D

C. Rate of disappearance of $B = 2 \times$ rate of disappearace of C

D. Rate of disappearance of $B = \frac{1}{2} \times$ rate of disappearace of C

Answer: C

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8. In a reaction $2A_2 + B_2 \rightarrow 2A_2B$, the reactant A will desapper at :

A. half the rate that B will decrease

B. the same rarte that B will decrease

C. double the rate that A_2B will from

D. twice the rate that B will deceases

Answer: D

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9. In the reaction $3A \rightarrow 2B$, rate of reaction $+\frac{d[B]}{dt}$ is equal to :

A. $\frac{1}{3}\frac{d[A]}{dt}$

B. $\frac{2}{3}\frac{d[A]}{dt}$

C. $+2\frac{d[A]}{dt}$

D. $\frac{3}{2}\frac{d[A]}{dt}$

Answer: B

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10. For the reaction, $2NO \rightarrow N_2 + O_2$, the expression $-\frac{1}{2}\frac{d[NO]}{dt}$ represents:

A. the rat of formation of NO

B. the average rate of the reaction

C. the instantaneous rate of the reaction

D. all of the above

Answer: C

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11. Accroding to collision theory of reaction rates :

A. every collision between reactant molecules leaeds to a chemical reaction

B. rate of reaction proportional to the velocity of the molecules

C. rate of reaction is proportional to the average energy of the molecules

D. rate of reaction is proportional to the number of collisions per second

Answer: D

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12. According to collision theory :

A. all collisions are sufficiently violent

B. all collisions are responsible for porduct formation

C. all collisions are effective

D. only a fraction of collisions are effective which have enough energy to from products

Answer: D

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13. The Activation energy for a chemical reaction mainly depends upon

A. temperature

B. nature of reacting species

C. concentration of the reacting species

D. collision frequecny

Answer: B

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14. In a reaction, the threshold energy is equal to

A. activation energy + normal enrgy of reatants

B. activation energy - normal enrgy of reatants

C. normal energy of reactants - activation energy

D. average kinetic energy of molecules of reactants

Answer: A

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15. Accroding to the colision theory of reaction rates, the rate of reaction increases with temperature due to :

A. greater number of collisions

B. higher velocity of reacting molecules

C. greater number of molecules having the activation energy

D. deceases in the activation energy

Answer: C

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16. The temeprature cofficient of a reaction is :

A. ratio of rate conctants at two temperatures differing by $1^\circ C$

B. ratio of rate conctants at two temperatures $35^\circ C \text{ and } 25^\circ C$

C. ratio of rate conctants at two temperatures $30^\circ C \text{ and } 25^\circ C$

D. specific reaction rate at $25^\circ C$

Answer: B

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17. In general, with every $10^{\circ}C$ rise in temperature, the rate of reaction becomes appproximately..........

A. ten times

B. double

C. half

D. one tenth

Answer: B

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18. Activation energy of the reaction is :

A. the energy released during the reaction

B. the energy evolved when actiavated complex is formed s

C. minimum amount of energy needed to overcome the potential barrier

D. the energy needed to from one mole of the product

Answer: C

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

A. 2 and 3

B. 1 and 2

C. 2 and 4

D. 3 and 4

Answer: A

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20. Accroding to Arrhenius equation, rate constant of a chemical reaction is equal to :

A. $Ae^{-E_a/RT}$

B. $Ae^{E_a/RT}$

C. Ae^{RT/E_a}

D. Ae^{-RT/E_a}

Answer: A

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21. In order to react, a molecule at the time of collision, must posses a certain amount of energy known as :

A. free enegy

B. kinetic energy

C. threshold energy

D. internal enegy

Answer: C

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22. The activation energy of a reaction is zero. The rate constant of the reaction

A. increases with increase of temperature

B. decreases with decrease of temperature

C. decreases with incrrease of temperature

D. in nearly independent of temperature

Answer: D

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23. The activation energy of a reaction can be lowered by :

A. using a positive catalyst

B. increasing temperature

C. decreasing temperature

D. increasing concentration of the reactants

Answer: A

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24. The activation energy for a hypothetical reaction $A \rightarrow X$ is $12.49 kcal mol^{-1}$. If temperature is raised to 305 form $295K$, the reaction rate increased by $0.002 kcal L^{-1} mol^{-1}$ is almost equal to

A. 60%

B. 100%

C. 50%

D. 20%

Answer: B

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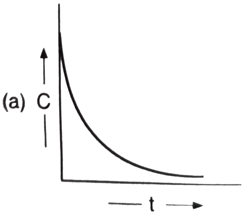
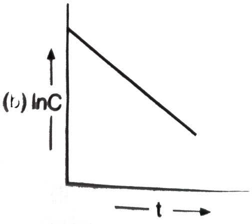
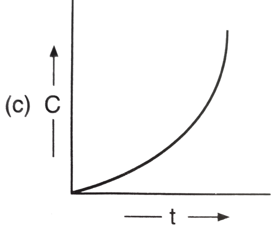
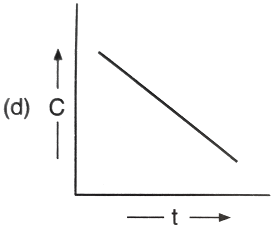
25. The plote between concentration versus time for a zero order reaction is represented by :

A. 

B. 

C. 

D. 

Answer: D

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26. The rate of reaction increases with rise in temerature because of :

A. increase in the number of activated molecules.

B. increase in the activation energy

C. decrease in the activation energy

D. increase in the number of the molecular collisions

Answer: D

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27. Which of the following is a first order reaction ?

A. $2HI \rightarrow H_2 + I_2$

B. $2NO_2 \rightarrow 2NO + O_2$

C. $2NO + O_2 \rightarrow 2NO_2$

D. $NH_4NO_2 \rightarrow N_2 + 2H_2O$

Answer: D

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28. Which one of the following is not a first order reaction?

A. $CH_3COOCH + H_2O \xrightarrow{H^+} CH_3OH$

B. $CH_3COOCH_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$

C. $2H_2O_2 \rightarrow 2H_2O + O_2$

D. $2N_2O_5 \rightarrow 4NO_2 + O_2$

Answer: B

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29. Rate expression of a chemical change is $-\frac{dx}{dt} = k[A]^2[B]^1[C]^0$ The order of reaction is :

A. 3

B. 2

C. 1

D. zero

Answer: A

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30. For a reaction $2A + B \rightarrow C + D$, the active mass of B is kept constant but tht of A is tripled. The rate of reaction will

A. nine tiems

B. three times

C. same

D. zero

Answer: A

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31. The rate of certain hypothetical reaction

$A + B + C \rightarrow$ Products, is given by

$$r = -\frac{dA}{dt} = k[A]^{1/2}[B]^{1/3}[C]^{1/4}$$

The order of a reaction is given by

A. $1/2$

B. $13/12$

C. 1

D. 2

Answer: B

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

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 = $k[C_x][C_y]^{-2}[C_z]^{0}$

Answer: C

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33. If the rate of reaction between A and B is given by rate $= k[A][B]^2$, then the reaction is :

A. first orfer in A

B. second order in B

C. third order oveall

D. all are correct

Answer: D

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34. For a reaction $A \rightarrow B$, the rate of reaction quadrupled when the concentration of A is doubled. The rate expression of the reaction is $r = K[A]^n$ when the value of n is

A. 1

B. zero

C. 3

D. 2

Answer: D

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35. For a chemical reactin $A \rightarrow E,$ it is found that rate of reaction is doubled when the concentration of A is increased four times. The order of the reaction is :

A. 1

B. 2

C. $1/2$

D. zero

Answer: D

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36. The rate of reaction $A + B \rightarrow$ Product is given by the equation $r = k[A][B]$. If B is taken in large excess, the order of the reaction would be

A. 2

B. 1

C. zero

D. unpredictable

Answer: C

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37. The rate of reaction between A and B increases by a factor of 100, when the concentration with respect to A is increased 10 folds, the order of reaction w.r.t. A is

A. 10

B. 2

C. 1

D. 30

Answer: B

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38. The rate law for the reaction

$RCl + NaOH(aq) \rightarrow ROH + NaCl$ is given by

Rate $= k[RCl]$. The rate of the reaction will be

A. unaffected by increasing temperature of the reaction

B. doubled on doubling concentration of NaOH

C. halved on reducing the concentration of NaOH to one half

D. halved on reducing the concentration of RCl to one half

Answer: B

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39. A zero order reactio is one:

A. in which reactant is one:

B. in which one of the reactant is in large excess

C. whose rate is uniform and not affected by time

D. whose rate increases with time

Answer: D

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40. The rates of a certain at differnet time intervals are as follows :

Time (seconds)	0	10	20
Rate	1.8×10^{-2}	1.82×10^{-2}	$1.79 \times 10^{-2} \text{mol} L^{-1} s^{-1}$

The reactio is of :

A. zero order

B. first order

C. second order

D. third order

Answer: A

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41. For which of the following reactions, the units of rate constant and rate of reaction are same?

A. First order reaction

B. Zero order reaction

C. Second order reaction

D. Fractional order reaction

Answer: B

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42. The unite of rate constant for zero order reaction is :

A. mol time^{-1}

B. $L\text{time}^{-1}$

C. $\text{mol}L^{-1}\text{time}^{-1}$

D. $L\text{mol}^{-1}\text{time}^{-1}$

Answer: C

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43. For a zero order reaction :

A. $t_{1/2} \propto a$

B. $t_{1/2} \propto \frac{1}{a}$

C. $t_{1/2} \propto a^2$

D. $t_{1/2} \propto \frac{1}{a^2}$

Answer: A

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44. The rate of the first order $A \rightarrow$ Products, is $7.5 \times 0^{-4} \text{mol} L^{-1} s^{-1}$, when the concentration of A is 0.2 mol L^{-1} . The rate constant of the reaction is :

A. $2.5 \times 10^{-5} s^{-1}$

B. $8.0 \times 10^{-4} s^{-1}$

C. $6.0 \times 10^{-4} s^{-1}$

D. $3.75 \times 10^{-3} s^{-1}$

Answer: D

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45. 75% of a first-order reaction was completed in 32 minutes, when was 50% of the reaction completed ?

A. 4 min

B. 8 min

C. 24 min

D. 16 min

Answer: D

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46. The specific rate constant of a first order reaction depends on the

A. concentration of the reactants

B. concentration of the products

C. time

D. temperature

Answer: D

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47. For a given reaction of first order, it takes 20 minutes for the concentration to drop from $1.0 \text{mol liter}^{-1}$ to $0.6 \text{mol litre}^{-1}$. The time required for the concentration to drop from $0.6 \text{mol litre}^{-1}$ to $0.36 \text{mol litre}^{-1}$ will be

A. more than 20 minutes

B. less than 20 minutes

C. equal to 2 minutes

D. inifinity

Answer: C

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48. The following data were obtained for the thermal decomposition of nitrous oxide on finely divided gold :

t (minutes)	0	20	40	60	80
Concentration of $N_2O(\text{mol}L^{-1})$	0.10	0.08	0.06	0.04	0.02

The order of reaction is :

A. zero

B. 1

C. 2

D. 3

Answer: A

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49. The following data are for the decomposition of ammonium nitrite in aqueous solution.:

Vol of $N_2 (cm^3)$	6.25	9.0	11.42	13.65	35.2
Time (min)	10	15	20	25	∞

The order of reaction is :

A. 3

B. 2

C. 1

D. zero

Answer: C

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50. The time required for a first order to complee 90% is t . What is the time reqauired to complete 99% of the same reaction ?

A. 2t

B. 3t

C. t

D. 4t

Answer: A

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51. The half life period of a first order reaction is 10 minutes . The time required for the concentration of the reactant to change from $0.08M \rightarrow 0.02$is :

A. 10 min

B. 20 min

C. 30 min

D. 40 min

Answer: B

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52. The rate constant for the hydrolysis reaction of an ester by dilute acids is $0.6931 \times 10^{-4} s^{-1}$. The time required to change to concentration of ester form $0.04M \rightarrow 0.01M$ is :

A. 9631 sec

B. 4000 sec

C. 2000 sec

D. 1000 sec

Answer: C

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53. The rate of a gaseous reaction is given by the expression $k[A][B]$. If The volume of reaction vessel is suddenly reduced to one-fourth of the initial volume, the reaction rate relative to the original rate will be :

A. $1/16$

B. $1/8$

C. 8

D. 16

Answer: D

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54. 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

A. 12 times

B. 16 times

C. 32 times

D. 50 times

Answer: C

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55. If the rate expression for a reaction is $\frac{dx}{dt} = k[A]^{1/2}[B]^{2/3}$, the overall order of the reaction is :

A. 2

B. $1/2$

C. $3/2$

D. 1

Answer: A

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56. The second order rate constant is usually expressed as

A. mol $L^{-1}s^{-1}$

B. $\text{mol}^{-1}L^{-1}s^{-1}$

C. $\text{mol}Ls^{-1}$

D. mol Ls^{-1}

Answer: C

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57. The hydrolysis of ethyl acetate is a reaction of :

$$CH_3COOC_2H_5 + H_2O \xrightarrow{H^+} CH_3COOH + C_2H_5OH$$

A. zero order

B. first order

C. second order

D. third order

Answer: B

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58. In a second ordr reaction, the time needed for the initial concentration of the reactant to reduce or half hat value is :

A. independent of the initial concentration

B. proportional to the initial concentration

C. inversely proportional to initial concentration

D. proportional to the square of the initial concentration

Answer: C

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59. Which of the following statement regarding the molecularity of a reaction is wrong ?

A. It may eithe whole number or fractional.

B. It is calculated from the reaction mechanism

C. It depends on the rate determining step

D. It is number of molecules of reactans taking part in a single step chemical reaction

Answer: A

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60. The reaction rate of the reaction $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$ is given by $r = k[H_2][Br_2]^{1/2}$

Which of the following statement/is/are true ?

A. The reaction is of second order.

B. The molecularity of the reaction is 3/2

C. The unit of k is $\sec^{-1}$

D. The molecularity of the reaction is two.

Answer: D

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61. Molecularity of the reaction :

A. is always a whole number

B. is never whole number

C. can have a fractional value

D. can be zero

Answer: A

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62. For a single step reaction $X + 2Y \to$ Products, the molecularity is

A. zero

B. three

C. two

D. one

Answer: B

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63. In hypothetical reaction, $A_2 + B_2 \to 2AB$, follows the follows the mechnism as given below :

$$\begin{array}{ll} A_2 \Leftrightarrow A + A & (\text{fast reaction}) \\ A + B_2 \to AB + B & (\text{slow reaction}) \\ A + B \to AB & (\text{fast reaction}) \end{array}$$

Give the rate law and order of reaction

A. zero

B. 1

C. 2

D. $3/2$

Answer: D

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64. The molecularity of a reaction is :

A. same as its order

B. different from order

C. may be same or different as compound to order

D. always zero

Answer: C

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65. The chemical reaction $2O_3 \to 3O_2$ proceeds as follows :

$O_3 \to O_2O$ (fast)

$O + O_3 \to 2O_2$ (slow)

The rate law expression should be :

A. $r = k[O_3]^2$

B. $r = k[O_3]^2[O_2]^{-1}$

C. $r = k[O_3][O_2]$

D. $r = k[O_3][O_2]^2$

Answer: B

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66. If a is the initial concentration then time required to decompose half of the substance for nth order is inversely proportional to:

A. a^{n+1}

B. a^{n-1}

C. a^{n-2}

D. a^{n}

Answer: B

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67. What is the order of the reaction which obeys the expressition $t_{1/2} = \frac{1}{ka}$?

A. zero

B. Third

C. First

D. Second

Answer: D

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68. A graph between time (t) and the substance consumed at any time is found to be a straight line passing through the orginal This indicates that the reaction is of :

A. zero order

B. first order

C. Second order

D. fractional order

Answer: C

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69. A plot of log (a-x) against time 't' is a straight line. This indicates that the reaction is of :

A. zero order

B. first order

C. second order

D. third order

Answer: B

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70. For the reaction $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$, the rate of disappearance of N_2O_5 is $6.25 \times 10^{-3} \text{mol L}^{-1} s^{-1}$. The rate of formation of NO_2 and O_2 will be respectively.

A. $6.25 \times 10^{-3} \text{mol} L^{-1} s^{-1}$ and $6.25 \times 10^{-3} \text{mol} L^{-1} s^{-1}$

B. $1.25 \times 10^{-2} \text{mol} L^{-1} s^{-1}$ and $3.125 \times 10^{-3} \text{mol} L^{-1} s^{-1}$

C. $6.25 \times 10^{-3} \text{mol} L^{-1} s^{-1}$ and $3.125 \times 10^{-3} \text{mol} L^{-1} s^{-1}$

D. $1.25 \times 10^{-2} \text{mol} L^{-1} s^{-1}$ and $6.25 \times 10^{-3} \text{mol} L^{-1} s^{-1}$

Answer: B

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71. For a first order reaction, calculate the ratio between the time taken to complete $3/4th$ of the reaction and time to complete half of the reaction.

A. $4:3$

B. $3:2$

C. $2:1$

D. $1:2$

Answer: C

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72. In pseudo-unimolecular reactions :

A. one of the reactants is present in large excess

B. both reactants have some concentration

C. both the reactants are present in low concentration

D. one of the reactants is less reactive

Answer: A

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73. The reaction

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

is found to be firt order with respect to $N_2O_5(g)$. Which of the following is correct ?

A. $\log(p_{N_2O_5})$ versus time with -ve slope

B. $(p_{N_2O_5})^{-1}$ versus time

C. $(p_{N_2O_5})$ versus time

D. $\log(p_{N_2O_5})$ versus tiem with +ve slope

Answer: A

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74. Consider the following statements

(i) increase in the concentration of reactants increase the rate of zero order reactions

(ii) rate constant, k is equal to collision frequency of A if $E_a = 0$

(iii) rate constant, k is equal to the collision frequency if $E_a = \infty$

(iv) $lnkvsT$ is straight line

(v) $lnkvs1/T$ is a straight line

correct statements are

A. (i) and (iv)

B. (ii) and (v)

C. (iii) and (iv)

D. (ii) and (iii)

Answer: B

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75. In accordance to Arrhenius equation, the plot of log k against $\frac{1}{T}$ is a straight line. The slope of the line is equal to

A. $-E_a/R$

B. $+E_a/R$

C. $-\frac{E_a}{2.303R}$

D. $+\frac{E_a}{2.303R}$

Answer: C

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76. The rate of the reaction

$CCl_3CHO + NO \rightarrow CHC_3 + NO + CO$ is given by Rate

$= K[CCl_3CHO][NO]$. If concentration is expressed in moles / litre, the units of K are

A. $\text{mol}^{-2}L^2s^{-1}$

B. $\text{mol}L^2s^{-1}$

C. $L\text{mol}^{-1}s^{-1}$

D. s^{-1}

Answer: C

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77. In a reaction $2A + B \rightarrow A_2B$, the reactant A will disappear at

A. half the rarte will B will decrease

B. twice the rarte will B will decrease

C. the same rate B will decrease

D. the same rate A_2B will decrease

Answer: B

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78. The rate of the reaction $2NO + O_2 \to 2NO_2, \text{at} 25^\circ C$ is

$r = k[NO]^2[O_2]$

If the initial concentrations of the reactant are $O_2 = 0.040 \text{mol} L^{-1}$ and $NO = \ = 0.01 \text{mol} L^{-1}$, the rate constant of the reaction is :

A. $7.0 \times 10^{-2} L \text{mol}^{-1} s^{-1}$

B. $7.0 \times 10^{-4} L^2 \text{mol}^{-2} s^{-1}$

C. $7.0 \times 10^2 L^2 \text{mol}^{-2} s^{-1}$

D. $7.0 \times 10^3 L^2 \text{mol}^{-2} s^{-1}$

Answer: D

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79. For the reaction,

$2NO + Cl_2 \rightarrow 2NOCl$

the following mechanism has been proposed.

$NO + Cl_2 \Leftrightarrow NOCl_2$ (fast)

$NOCl_2 + NO \rightarrow 2NOCl$ (slow)

The rate for the reaction is :

A. rate = $k[NO]^2[Cl_2]$

B. rate = $k[NO][Cl_2]^2$

C. rate = $k[NOCl_2]$

D. rate = $k[NOCl]^2$

Answer: A

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80. Consider the following reaction :

$H_2(g) + I_2(g) \rightarrow 2HI(g)$ and Rate $= k[H_2][I_2]$

Which one of the following statement is correct ?

A. The reaction must occur in a single step

B. This is a second order reaction overall

C. Raising the temperature will cause the value of k to decrease

D. Raising the temperature lowers the activation energy for the reaction

Answer: B

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81. How will the rate $r = k[SO_2][[O_2]$ of reaction, $2SO_2 + O_2 \rightarrow 2SO_3$ change if the volume of the reaction vessel is tripled?

A. It wil be $\frac{1}{3}$ rd of its initial value.

B. It wil be 3 times of its initial value.

C. It wil be 9 times of its initial value.

D. It wil be $\frac{1}{9}th$ of its initial value.

Answer: D

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82. In the formation of sulphur trioxide by the contact process,

$2SO_2 + O_2 \Leftrightarrow 2SO_3$, the rate of reaction was measured as

$$\frac{d[O_2]}{dt} = 3.0 \times 10^{-4} \text{mol} L^{-1} s^{-1}.$$

The rate of reaction expressed in terms of SO_3 will be

A. $3.0 \times 10^{-4} \text{mol} L^{-1} s^{-1}$

B. $6.0 \times 10^{-4} \text{mol} L^{-1} s^{-1}$

C. $1.5 \times 10^{-4} \text{mol} L^{-1} s^{-1}$

D. $4.5 \times 10^{-4} \text{mol} L^{-1} s^{-1}$

Answer: B

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83. For a first order reaction the rate constant is 6.909min^{-1}. The time taken for 75 % conversion in minutes is

A. $\frac{2}{3}\log 2$

B. $\frac{2}{3}\log 4$

C. $\frac{3}{2}\log 2$

D. $\frac{3}{2}\log 4$

Answer: A

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84. For the reaction

$A+2B \rightarrow C+D, \frac{d[A]}{dt}k=[A][B]^2$ the expression for $\frac{d[B]}{dt}$ will be :

A. $2k[A][B]^2$

B. $\frac{1}{2}k[A][B]^2$

C. $k[A][B]^2$

D. $k[A][B/2]^2$

Answer: A

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85. Which of the follwing statement is not correct for the reaction,

$4A + B \rightarrow 2C + 2D$?

A. The rate of appearance of C is one-half the rate of disappearance of B.

B. The rate of disappearance of B is one-half the rate of disappearance of B.

C. The rate of formation of D is one-half the rate of disappearance of B.

D. The rates of formation of C and D are equal

Answer: A

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86. The overall rate of a reaction is governed by :

A. the rate of the fastest intermediate step

B. the sum total of the rates of all the intermediate steps

C. the average of the slowest of all the intermediate step

D. the rate of the slowest intermediate step

Answer: D

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87. The rate constant of a reaction does not depend upon:

A. temperture

B. activation energy

C. catalyst

D. concentration of reactants and products

Answer: D

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

A. 230.3 minutes

B. 23.03 minutes

C. 46.06 minutes

D. 460.6 minutes

Answer: C

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89. For the chemical reaction $X \to Y$, it is found that the rate of reaction increases by 2.25 times when the concentration of X is increased by 1.5 times, what is the order w.r.t. X ?

A. One

B. Two

C. Three

D. Zero

Answer: B

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90. From different sets of data of $t_{1/2}$ at diifferent initial concentrations say 'a' for a given reaction, the $\left[t_{1/2}\times qa\right]$ is found to be constant. The order or reaction is :

A. zero

B. 1

C. 2

D. 3

Answer: C

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91. Diazonium salt decomposes as

$C_6H_5N_2^+Cl^- \rightarrow C_6H_5Cl+N_2$. At $0^\circ C$, the evolution of N_2 becomes two times faster when the initial concentration of the salt is doubled. Therefore, it is

A. a first order reaction

B. a second order reaction

C. independent of the initial concentration of the salt.

D. a zero order reaction

Answer: A

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92. For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, uneder certain conditions of temperature and pressure of the reactants, the rate of formation, of ammonia is $0.001 kg hr^{-1}$. The rate of consumption of hydrogen under the same conditions is ...... kg hr^{-1}

A. 0.001

B. 0.003

C. 0.002

D. 0.0015

Answer: D

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93. The rate constant, the activation energy, and the Arrhenius parameter of a chemical reaction at $25^\circ C$ are $3.0 \times 10^{-4} S^{-1}$, $104.4 KJmol^{-1}$, and $6.0 \times 10^{14} S^{-1}$, respectively. The value of the rate constant as $T \rightarrow \infty$ is

A. $2.0 \times 10^{18} s^{-1}$

B. $6.0 \times 10^{14} s^{-1}$

C. infinity

D. $3.6 \times 10^{30} s^{-1}$

Answer: B

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94. In the reaction

$BrO^{-3}(aq) + 5Br^{-}(aq) + 6H^{+} \rightarrow 3Br_2(1) + 3H_2O(1)$

The rate of appearance of bromine (Br_2) is related to rate of disapperance of bromide ions as folllwoing :

A. $\frac{d[Br_2]}{dt} = \frac{3}{5}\frac{d[Br^{-}]}{dt}$

B. $\frac{d[Br_2]}{dt} = -\frac{3}{5}\frac{d[Br^{-}]}{dt}$

C. $\frac{d[Br_2]}{dt} = -\frac{5}{3}\frac{d[Br^{-}]}{dt}$

D. $\frac{d[Br_2]}{dt} = +\frac{5}{3}\frac{d[Br^{-}]}{dt}$

Answer: B

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95. K is rate constant at temp T then value of $\lim_{T \rightarrow \infty}$ log K is equal to :-

A. $A/2.303$

B. A

C. $2.303A$

D. log A

Answer: D

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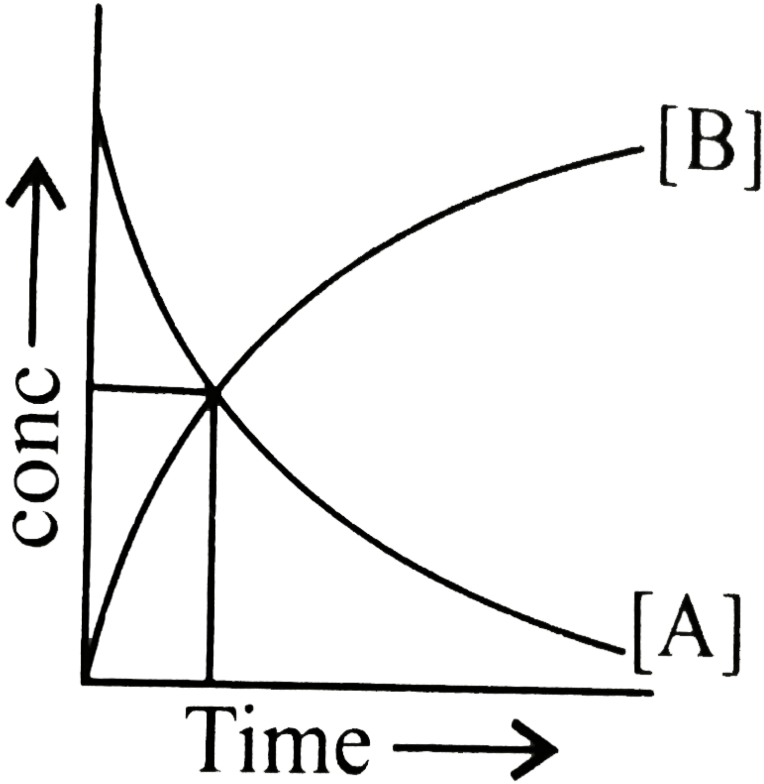
96. The accompanying figure depicts a change in concentration of species A and B for the reaction $A \rightarrow B$, as a function of time. The point of inter section of the two curves represents



A. $T_{1/2}$

B. $T_{3/4}$

C. $T_{2/3}$

D. data insufficient to predict

Answer: A

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97. In gaseous reaction, important for the understanding of the upper atmosphere H_2O and O react bimolecularly to from two OH readicals. ΔH for this reaction is 72 kJ at 500 K and E_a is 77 kJ mol^{-1}, then E_a for the bimolecular recombination of two OH readicals to form H_2O and O is :

A. $3kJ\text{mol}^{-1}$

B. $4kJ\text{mol}^{-1}$

C. $5kJ\text{mol}^{-1}$

D. $7kJ\text{mol}^{-1}$

Answer: C

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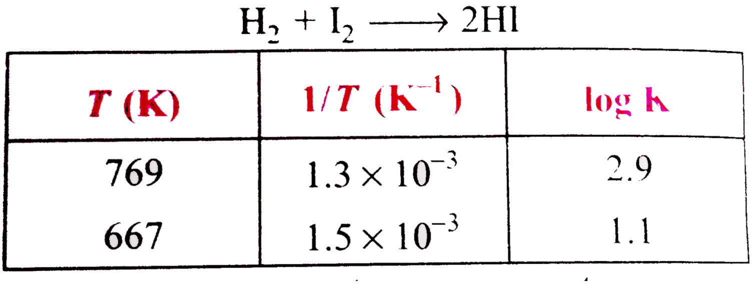
98. From the following data, the activation, energy for the reaction, (cal/mol) is :



$H_2 + I_2 \longrightarrow 2HI$

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

A. 4×10^4

B. 2×10^4

C. 8×10^4

D. 3×10^4

Answer: A

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99. The hydrolysis of an ester was carried out separately with $0.05NHCl$ and $0.05NH_2SO_4$. Which of the following will be true?

A. $k_{Hl} > k_{H_2SO_4}$

B. $k_{H_2SO_4} > k_{HCl}$

C. $k_{H_2SO_4} = 2k_{HCl}$

D. $k_{H_2SO_4} = k_{HCl}$

Answer: A

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100. For an endothermic reaction where ΔH represent the enthalpy of reaction in kj / mol, the minimum value for the energy of activation will be:

A. less than ΔH

B. zero

C. more than ΔH

D. equal to ΔH

Answer: C

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101. In the following first order reactions:

$A + \text{Reagent} \xrightarrow{K_1} Product$

$B + \text{Reagent} \xrightarrow{K_2} Product$

The ratio of K_1 / K_2 when only 50% of B reacts in a given time when 94% of A has been reacted is:

A. 4.06

B. 3.06

C. 2.06

D. 0.06

Answer: A

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102. Two reactions $A \rightarrow$ products and $B \rightarrow$ products have rate constants k_a and k_b respectively at temperature T and activation energies are E_a and E_b respectively.

If $k_a > k_b$ and $E_a < E_b$ and assuming the freuency factor A in both the reactions are same then

A. at higher temeprature k_A will be greater than k_B

B. at lower temperature k_A and k_B will be close to each other in magnatude

C. as temperature rises, k_A and k_B will be close to each other in magnatude

D. at lower temperature $k_B > k_A$

Answer: A::C

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103. The inversion of a sugar follows first order rate equation which can be followed by noting the change in the rotation of the plane of polarization of light in the polarimeter. If r_{∞}, r_f and r_0 are the rotations at $t=\infty$, $t=t$, and $t=0$, then the first order reaction can be written as

A. $k=\frac{1}{t}\log_e.\frac{r_t-r_{\infty}}{r_0-r_{\infty}}$

B. $k=\frac{1}{t}\log_e.\frac{r_0-r_{\infty}}{r_t-r_0}$

C. $k=\frac{1}{t}\log_e.\frac{r_{\infty}-r_0}{r_{\infty}-r_t}$

D. $k=\frac{1}{t}\log_e.\frac{r_{\infty}-r_t}{r_{\infty}-r_0}$

Answer: B

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104. The number of molecules of the reactants taking part in a single step of the reaction tells about. :

A. molecularity of the reaction

B. mechanism of the reaction

C. order of reaction

D. all of the above

Answer: A

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105. The inversion of cane sugar into glucose and frucose is :

A. I order

B. II order

C. III order

D. zero order

Answer: A

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106. The unit of rate constant obeying the rate expression $r = k[A]'[B]^{2/3}$ is :

A. $\text{mol}^{-2/3}\text{litre}^{2/3}\text{time}^{-1}$

B. $\text{mol}^{2/3}\text{litre}^{-2/3}\text{time}^{-1}$

C. $\text{mol}^{-5/3}\text{litre}^{5/3}\text{time}^{-1}$

D. none of these

Answer: A

107. For the reaction,

$$N_2O_5 \rightarrow 2NO_2 + O_2, Given$$

$$-\frac{d[N_2O_5]}{dt} = K_1[NO_2O_5]$$

$$\frac{d[NO_2]}{dt} = K_2[N_2O_5] \text{ and } \frac{d[O_2]}{dt} = K_3[N_2O_5]$$

The relation in between K_1, K_2 and K_3 is:

A. $2k_1 = k_2 = 4k_3$

B. $k_1 = k_2 = k_3$

C. $2k_1 = 4k_2 = k_3$

D. none of these

Answer: A

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108. The rate constant is unmerically the same for three reactions of first, second and third order respectively, the unit of concentration being in moles per litre. If $R_1, R_2 \text{ and } R_3$ are the rates of three reactions of first, second and third order respectively aqnd K is the rate constant, which of the following relationships is valid for the three reactions.

A. $r_1 = r_2 = r_3$

B. $r_1 > r_2 > r_3$

C. $r_1 < r_2 < r_3$

D. All of these

Answer: C

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109. In the Q.No , 108 if the concentration of the reactant is less than 1 M , then, :

A. $r_1 = r_2 = r_3$

B. $r_1 > r_2 > r_3$

C. $r_1 < r_2 < r_3$

D. all of these

Answer: B

View Text Solution

110. In the Q.No 108 , if the concentration of the reactant is 1 M , then :

A. $r_1 = r_2 = r_3$

B. $r_1 > r_2 > r_3$

C. $r_1 < r_2 < r_3$

D. all of these

Answer: A

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111. A first order reaction is one-fifth completed in 40 minutes. The time reuired for its 100% completion is :

A. 100 minutes

B. 200 minutes

C. 350 minutes

D. infinity

Answer: D

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112. The rate constant off a first order reaction, $A \rightarrow \text{Products}$, is $60 \times 40\text{min}^{-1}$. Its rate at [A] = $0.01\text{mol}L^{-1}$ would be :

A. $60 \times 10^{-4}\text{mol}L^{-1}\text{min}^{-1}$

B. $36 \times 10^{-4}\text{mol}L^{-1}\text{min}^{-1}$

C. $60 \times 10^{-2}\text{mol}L^{-1}\text{min}^{-1}$

D. $36 \times 10^{-1}\text{mol}L^{-1}\text{min}^{-1}$

Answer: A

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113. For first order reaction, the half life is dependent of :

A. initial concentration

B. cube root of initial concentration

C. first power of final concentration

D. square root of final concentration

Answer: A

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114. Activation energy of a chemical reaction can be determined by

A. changing concentration of reactants

B. evaluating rate constant at standard temperature

C. evaluating rate constant at two different tempertures

D. evaluating velocities of reaction at two different temperatures

Answer: C

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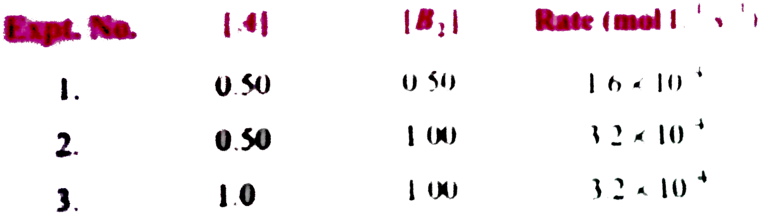
115. The experimental data for the reaction $2A + B_2 \rightarrow 2AB$, is :



Expt. No.	[A]	[B_2]	Rate (mol L^{-1} s^{-1})
1.	0.50	0.50	1.6×10^{-4}
2.	0.50	1.00	3.2×10^{-4}
3.	1.0	1.00	3.2×10^{-4}

The rate equation for the above data is :

A. rate = $k[B]^2$

B. rate = $k[B]$

C. rate =$k[A]^2[B]^2$

D. rate =$k[A]^2[B]$

Answer: B

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116. For the reaction $A \rightarrow B$, the rate law expression is rate $= k[A]$. Which of the following statements is incorrect ?

A. The reaction follows first order kinetics

B. The $t_{1/2}$ of the reaction depends on initial concentration

C. k is constant for the reaction at constant temperature

D. The rate law provides a simple way of predicting the concentration of reactant at any time after the start of the reaction

Answer: B

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117. Cyclopropane rearranges to form propane :

$\Delta \rightarrow CH_3 - CH = CH_2$

This follows first order kinetics. The rate constant is $2.174 \times 10^{-3} \text{sec}^{-1}$. The initial concentration of cyclopropane is $0.29M$. What will be the concentration of cyclopropane after 100 sec

A. $0.035M$

B. $0.22M$

C. $0.145M$

D. $0.0018M$

Answer: B

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118. 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 ?

A. $[N_3O_5]_0 = [N_2O_5]_t e^{kt}$

B. $\log_e . \frac{[N_2O_5]_0}{[N_2O_5]} = kt$

C. $\log_{10}[N_2O_5]_t = \log_{10}[N_2O_5]_0 - kt$

D. $[N_2O_5]_t = [N_2O_5]_0 + kt$

Answer: B

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119. The reaction $X \rightarrow Y$ (Product) follows first order kinetics. In 40 minutes, the concentration of X changes from 0.1M to 0.025 M , then rate of reaction when concentration of X is 0.01M is :

A. 1.73×10^{-4} M/min

B. 3.47×10^{-5} M/min

C. 3.47×10^{-4} M/min

D. 1.73×10^{-5} M/min

Answer: C

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120. 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 form 0.1 M to 0.025 M is :

A. 30 min

B. 15 min

C. 7.5 min

D. 60 min

Answer: A

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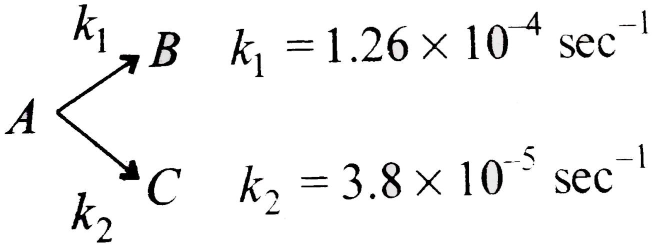
121. A substance undergoes first order decomposition. The decomposition follows two parallel first order reaction as :



The precentage 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. $76.83\,\%\,B$ and $23.17\,\%\,C$

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122. For the reaction, $2NH_3 \rightarrow N_2 + 3H_2$

if $\dfrac{-d[NH_3]}{dt} = k_1[NH_3]$,

$\dfrac{d[N_2]}{dt} = k_2[NH_3], \dfrac{d[H_2]}{dt} = k_3[NH_3]$

then the relation between k_1, k_2 and k_3 is

A. $k_1 = k_2 = k_3$

B. $3k_1 = 6k_2 = 2k_3$

C. $2k_1 = 3k_2 = 6k_3$

D. $6k_1 = 3k_2 = 2k_3$

Answer: C

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123. In Arrhenius equation $k = Ae^{-E/RT}$, factor $e^{-E_a/RT}$ is known as:

A. frequency factor

B. activation factor

C. pre-exponential factor

D. Boltzmann factor

Answer: D

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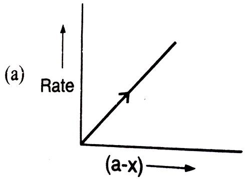
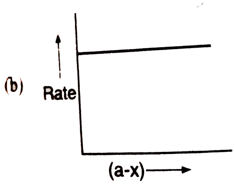
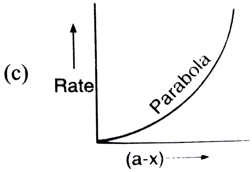
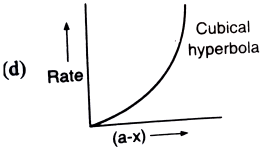
124. Which of the following graphs is correct for second order reaction ?

A. 

B. 

C. 

D. 

Answer: C

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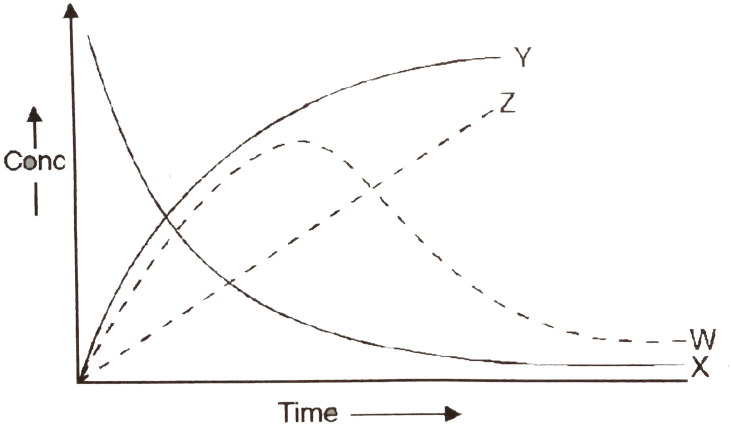
125. For the reaction $A + B \rightarrow C + D$ The variation of the concentration of the products is given by the curve



A. x

B. y

C. z

D. w

Answer: B

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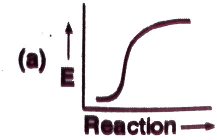
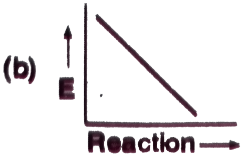
126. Which graph shows zero activation energy ?

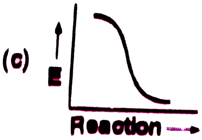
A.



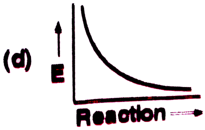
B.



C.



D.



Answer: C

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127. $E_{\text{Threshold}}$ can never be:

A. $> E_R$

B. $> E_p$

C. $< E_p$

D. $> E_R$ as well as $> E_p$

Answer: C

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128. A reaction takes place in theee steps: the rate constant are $k_1, k_2, \text{ and } k_3$. The overall rate constant $k = k_1 k_3 / k_2$. If the energies of activation are $40, 30, \text{ and } 20 KJmol^{-1}$, the overall energy of activation is (assuming A to be constant for all)

A. 10

B. 5

C. 30

D. 60

Answer: C

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129. For hypothetical reaction $A \rightarrow B$ takes placed according to

$$A \overset{k_1}{\Longleftrightarrow} C(\text{fast}),\ A + C \xrightarrow{k_2} D(\text{slow})$$

Rate law will be :

A. $k_2[A][C]$

B. $k_1 k_2 [A]$

C. $k_1 k_2 [A]$

D. $k_1 k_2 [A][C]$

Answer: C

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130. If concentration of reactant is increased by 'm' then k becomes :

A. $e^{k/m}$

B. k

C. k/m

D. mk

Answer: B

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131. $aB + bB \to P, dxx/dt = k[A]^a 8[B]^b$. If conc. of A is doubled, rate is doubled. If B is doubled, rate becomes four times. Which is corect?

A. $\frac{-d[A]}{dt} = \frac{-d[B]}{dt}$

B. $\frac{-d[A]}{dt} = \frac{-2d[B]}{dt}$

C. $\frac{-2d[A]}{dt} = \frac{-d[B]}{dt}$

D. None of these

Answer: C

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132. A drop of solution (volume $0.05 mL$) contains $3 \times 10^{-6} \text{mole} H^{\oplus}$ ions. If the rate constant of disappearance of $H^{\oplus}$ ions is $1 \times 10^{7} mol L^{-1} s^{-1}$, how long would it take for $H^{\oplus}$ ions in the drop of disappear?

A. 6×10^{-8} sec

B. 6×10^{-9} sec

C. 6×10^{-10} sec

D. 6×10^{-12} sec

Answer: B

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133. For the reaction, $H_2 + I_2 \underset{k_2}{\overset{k_1}{\Longleftrightarrow}} 2HI$. The rate law expression is :

A. $\left[-\frac{1}{2}\frac{d[HI]}{dt}\right]=k_1[H_2][I_2]$

B. $\left[-\frac{1}{2}\frac{d[HI]}{dt}\right]=\frac{k_1[HI]^2}{k_2[H_2][I_2]}$

C. $\left[-\frac{1}{2}\frac{d[HI]}{dt}\right]=k_1[H_2][I_2]-k_2[HI]^2$

D. $\left[-\frac{1}{2}\frac{d[HI]}{dt}\right]=k_1k_2[H_2][I_2]$

Answer: C

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134. For the reaction $NH_4^+ + OCN^- \rightarrow NH_2CONH_2$, rthe probable mechanism is,

$NH_4^+ + OCN^- \Leftrightarrow NH_4OCN$ (fast)

and $NH_4OCN \rightarrow CONH_2$ (slow)

The rate law will be :

A. rate $=k[NH_2CONH_2]$

B. rate $=k[NH_4]^+[OCN]^-$

C. rate $=k[NH_4OCN]$

D. None of these

Answer: B

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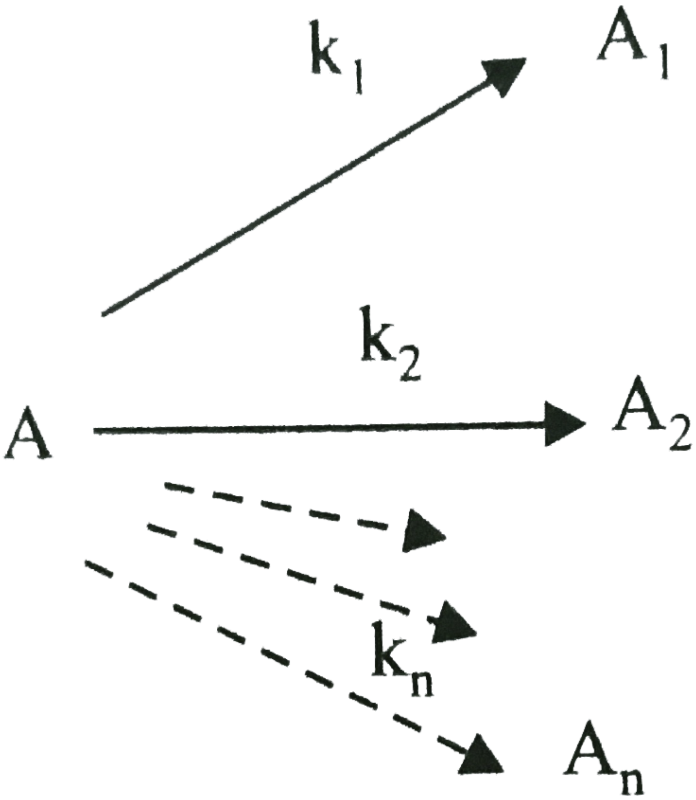
135. For a Ist order decomposition of A as given



Therefore rate constant (K) for the overall decomposition of A is

A. $k = k_1 + k_2 + \ldots. + k_n$

B. $k = (k_1 + k_2 + \ldots. + k_n)/n$

C. $k = k_1 \times k_2 \times \ldots. \times k_n)$

D. none of these

Answer: A

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136. For a reaction $A + 3B \rightarrow P$, Rate = $\frac{-d[A]}{dt}$,the expression for the rate of reaction in terms of change in the concentration of B, $\frac{-d[B]}{dt}$ will be :

A. $k[A]^2[B]$

B. $k[A]^2[3B]$

C. $3k[A]^2[B]$

D. $(1/3)k = [A]^2[B]$

Answer: C

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137. Which of the following statements is correct?

A. Rate of reaction $\propto \dfrac{1}{E_a}$

B. At lower temp. increase in temp. causes more change in the value of k

C. Both (a) and (b) are correct

D. None is correct

Answer: C

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138. For $X \to k = 10^{10} e^{-500/T}$, and for $W \to Z, k = 10^{12} e^{-1000/T}$ at what temperature 'T' both reactions will have same value of k?

A. 500 K

B. 1500 K

C. $\frac{4.606}{500}K$

D. $\frac{2.303}{5000}K$

Answer: C

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139. For a reversible reaction where the forward reaction is exotherminc, which of the following statement is corret?

A. The backward reaction has higher activation energy than the forward reaction .

B. The backward and the forward process have same activation energy .

C. The backward reaction has lower activation enerngy .

D. No activation, energy is required at all sicne energy is liberated in the process.

Answer: A

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140. For the reaction , $A + 3B \rightarrow 2C + d$

which one of the following is not correct ?

A. Rat or disappearance of A= Rate of formation of D

B. Rate of formation of C =$\frac{2}{3} \times$ Rate of disappearane of D

C. Rate of formation of D =$\frac{1}{3} \times$ Rate of disappearance of B

D. Rate of disappearance of $A = 2 \times$ Rate of formation of C

Answer: D

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141. Units of rate constant of first and zero order reactions in terms of molarity M are respectively:

A. $\sec^{-1}, M \sec^{-1}$

B. $\sec^{-1} M$

C. $M \sec^{-1}, \sec^{-1}$

D. $M, \sec^{-1}$

Answer: A

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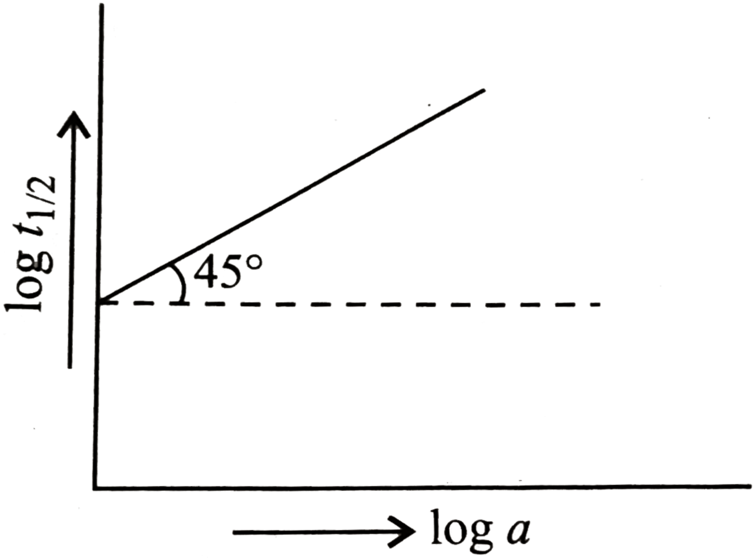
142. Following is the graph between $\log T_{50}$ and $\log a$ ($a =$ initial concentration) for a given reaction at $27^{\circ} C$. Hence order is



A. 0

B. 1

C. 2

D. 3

Answer: A

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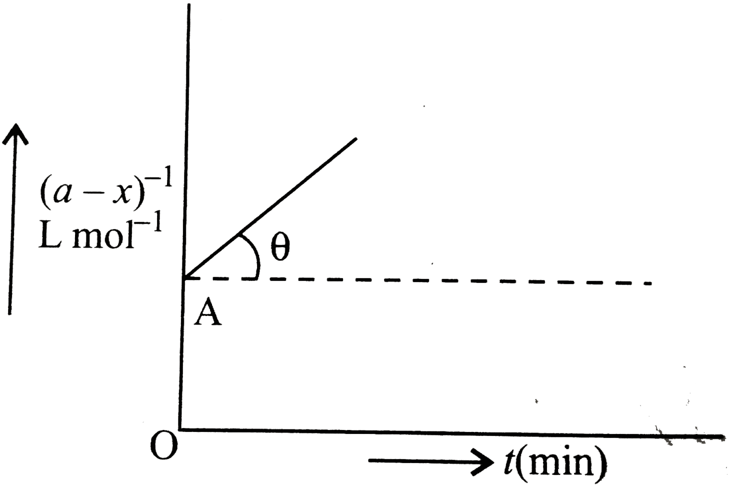
143. Following is the graph between $(a-x)^{-1}$ and time t for second order reaction $\theta = \tan^{-1}(0.5) OA = 2 Lmol^{-}$



Hence, the rate at the start of the reaction is

A. $1.25 L\text{mol}^{-1}\text{min}^{-1}$

B. $0.5\text{mol}^{-1} L\text{min}^{-1}$

C. $0.125\text{mol}^{-1} L\text{min}^{-1}$

D. $1.25\text{mol}^{-1} L\text{min}^{-1}$

Answer: C

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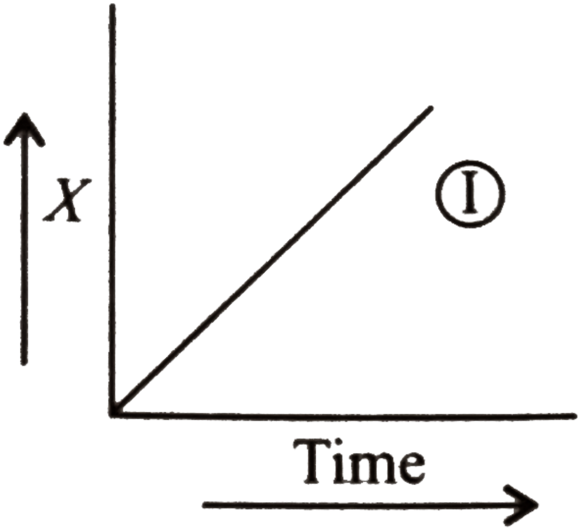
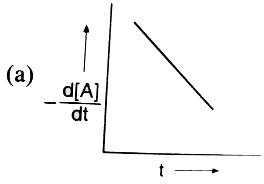
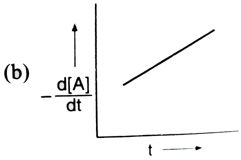
144. The graph between concentration (X) of the Product and time of the reaction $A \rightarrow B$ is of the type 1. Hence, graph between $-\frac{d[A]}{dt}$ and time will be of the type:

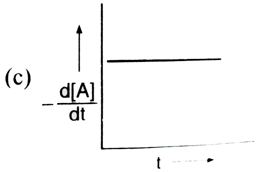


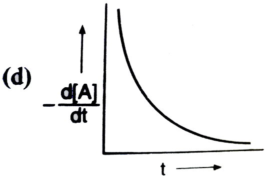
A.



B.



C. 

D. 

Answer: C

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145. Conside the chemical reaction,

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

The rate of reaction can be expressed in terms of time derrivate of concentration of $N_2(g), H_2(g)$ or $NH_3(g)$ Identift the correct relationship amongst the rate expression :

A. $rate = -\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = +\frac{1}{2}\frac{d[NH_3]}{dt}$

B. $rate = -\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = +2\frac{d[NH_3]}{dt}$

C. $rate = -\frac{d[N_2]}{dt} = \frac{1}{3}\frac{d[H_2]}{dt} = +\frac{1}{2}\frac{d[NH_3]}{dt}$

D. $rate = -\frac{d[N_2]}{dt} = -\frac{d[H_2]}{dt} = \frac{d[NH_3]}{dt}$

Answer: A

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146. Temerature dependent equation can be written as :

A. ln k=ln $A - e(E_a / RT)$

B. ln k=ln $A + e(E_a / RT)$

C. ln k=ln $A + e(RT / E_a)$

D. all of these

Answer: A

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147. If the rate of reaction $A \rightarrow B$ doubles on increasing the concentration of A by 4 times the order reaction is :

A. 2

B. 1

C. $1/2$

D. 4

Answer: C

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148. For the reaction : $2N_2O_5 \rightarrow 4NO_g + O_2(g)$ if the concentration of NO_2 increases by $5.2 \times 10^{-3} M$ in 100 sec, then the rate of reaction is :

A. $1.3 \times 10^{-5} Ms^{-1}$

B. $5 \times 10^{-4} Ms^{-1}$

C. $7.6 \times 10^{-4} Ms^{-1}$

D. $2 \times 10^{-3} Ms^{-1}$

Answer: A

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149. A first order reaction is 10% complete in 20 min. the time taken for 19% completion is :

A. 30 min

B. 40 min

C. 50 min

D. 38 min

Answer: B

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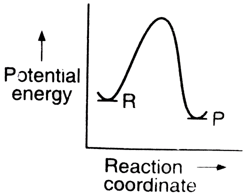
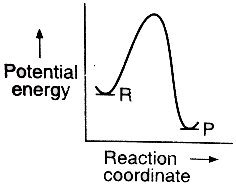
150. An endothermic reaction with high activation energy for the forward reaction is given by the diagram

A.



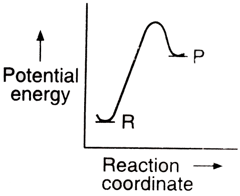
(a)

B.



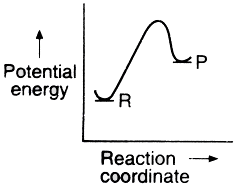
(b)

C.



(c)

D.



(d)

Answer: C

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151. For reaction $aA \rightarrow xP$ when [A] =2.2 m M, the rate was found to be 2.4 m Ms^{-1} . On reducing concentration of A to half, rate changes to $0.06 mMs^{-1}$. The order of reaction with respect to A is :

A. 1.5

B. 2.0

C. 2.5

D. 3.0

Answer: B

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152. Arrehnius equation for a reaction is given by $k = 24 \times 10^{14} e^{-25000/RT}$

Which of the following statement is correct about this expression ?

A. log k versus log T will be a plot of straight line with a slope of 25000

B. log k versus log T will be a plot of straight line with a slope of -25000

C. log k versus T will be a plot of straight line with a slope of -25000

D. log k versus $\frac{1}{T}$ will gie a straight line.

Answer: D

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153. Consider the endothermic reaction $X \to Y$ with the activation energies E_b and E_f for backward and forward reaction respectively . In general.

A. $E_b < E_f$

B. $E_b > E_f$

C. $E_b = E_f$

D. there is no definite relation between E_f and E_b

Answer: A

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154. Which one the following statement for order of reactions is not correct ?

A. Order can be detemined experimentally

B. Order of reaction is equal to sum of powrs of concentration temrs in differential rate law.

C. It is not affected by the by the stoichiometric coefficient of the reactants.

D. Order cannot be fractional.

Answer: D

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155. The rate constant of a reaction is found to be $3 \times 10^{-3} \text{mol} L^{-1} \text{min}^{-1}$. The order of the reaction is :

A. zero

B. 1

C. 2

D. 1.5

Answer: A

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156. In a first order reaction, the concentration of the reactants is reduced to 25% in one hour. The half-life period of the reactions is

A. 2 hrs

B. 2hrs

C. $1/2$ hrs

D. $1/4$ hrs

Answer: C

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

A. $\frac{k}{a}$

B. $\frac{a}{2k}$

C. $\frac{a}{k}$

D. $\frac{2k}{a}$

Answer: C

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158. Rate of a reaction can be expressed by Arrhenius equation as:

$k = Ae^{-E_a/RT}$

In this equation, E_a represents:

A. the energy abvoe which all the collinding moleuces will react

B. the energy below which colliding molecules will not react

C. the total energy of the reacting molecules at a temperature T

D. the fraction of molecules with energy greater than the activation energy of the reaction

Answer: B

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159. The rate constant of a first order reaction at $27^\circ C \text{is} 10^{-3} \text{min}^{-1}$.The constant (in min^{-1}) at $17^\circ C$ for this reaction ?

A. 10^{-3}

B. 5×10^{-4}

C. 2×10^{-3}

D. 10^{-2}

Answer: B

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160. A chemical reaction involves two reacting species. The rate of reaction is directly proportional to the conc. Of one of them and inversely proportional to the concentration of the other. The order of reaction is

A. zero

B. 1

C. 2

D. 4

Answer: A

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161. Accroding to Arrhenius equation, the rate constnat (k) is related to temperature (T)as

A. $\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

B. $\ln\left(\frac{k_2}{k_1}\right) = -\frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

C. $\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} + \frac{1}{T_2}\right)$

D. $\ln\left(\frac{k_2}{k_1}\right) = -\frac{E_a}{R}\left(\frac{1}{T_1} + \frac{1}{T_2}\right)$

Answer: A

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162. Conisder a reaction $aG + bH \rightarrow$ Products. When concentration of both the reactants G and H is doubled, the rate increases eight times.

However, when the concentration of G is doubled, keeping the concentration of H fixed, the rate is doubled. The overall order of reaction is

A. 0

B. 1

C. 2

D. 3

Answer: D

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163. The temperature dependence of rate constant (k) of a chemical reaction is written in terms of Arrhenius equation, $k = Ae^{-E_a/RT})$ Activation energy (E_a) of the reaction can be calculate by plotting

A. log k vs T

B. log k vs $\frac{1}{T}$

C. $kvsT$

D. $kvs.\ \frac{1}{\log T}$

Answer: B

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164. Consider a reaction $2A + B \rightarrow$ Products. When the concentration of B alone was doubled, the half life did not change. When concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for the reaction is:

A. s^{-1}

B. $L\text{mon}^{-1}s^{-1}$

C. unitless

D. $\text{mol}L^{-1}s^{-1}$

Answer: B

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165. In a first-order reaction $A \rightarrow B$, if K is the rate constant and initial concentration of the reactant is $0.5M$, then half-life is

A. $\frac{\log 2}{k}$

B. $\frac{\log 2}{k\sqrt{0.5}}$

C. $\frac{\ln 2}{k}$

D. $\frac{0.693}{0.5k}$

Answer: C

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166. For a first order reaction half life is 14 sec. The time required for the initial concentration to reduce 1/8 of the value is

A. $(14)^3$ sec

B. 28 sec

C. 42 sec

D. $(14)^2$ sec

Answer: C

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167. 75% of a first order reaction was completed in 32 min. When was 50% of the reaction completed ?

A. 24 min

B. 16 min

C. 8 min

D. 48 min

Answer: B

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168. For a zero order reaction $A \rightarrow B, t_{1/2}$ is (k is rate constant)

A. $\frac{[A]_o}{2k}$

B. $\frac{\ln 2}{k}$

C. $\frac{1}{k[A]_0}$

D. $\frac{\ln 2}{[A]_0 k}$

Answer: A

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169. The rate constant 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

A. 2000 K

B. $\frac{1000}{2.303}K$

C. $1000K$

D. $\frac{2000}{2.303}K$

Answer: B

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170. Under the same reaction conditions, the intial concentration of $1.386moldm^{-3}$ of a substance becomes half in $40s$ and $20s$ theough first order and zero order kinetics, respectively.

The ratio (k_1/k_0) of the rate constants for first order (k_1) and zero order (k_0) of the reaction is

A. $0.5\text{mol}^{-1}dm^3$

B. 1mol dm^{-3}

C. 1.5mol dm^{-3}

D. $2\text{mol}^{-1}dm^3$

Answer: A

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171. The decomposition of HI on the surface of gold is :

A. Pseudo first order

B. zero order

C. first order

D. second order

Answer: B

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172. Consider following two reactions

$$A \rightarrow \text{Product}, \frac{d[A]}{dt} = k_1[A]_0^0$$

$$B \rightarrow \text{Product}, \frac{d[B]}{dt} = k_1[A]_0^0$$

k_a and k_2 are expressed are expressed in term of molarity (mol L^{-1})

and time $\left(s^{-1}\right)$ as :

A. $s^{-1}, Ms^{-1}L^{-1}$

B. Ms^{-1}, Ms^{-1}

C. $s^{-1}, M^{-1}s^{-1}$

D. Ms^{-1}, s^{-1}

Answer: D

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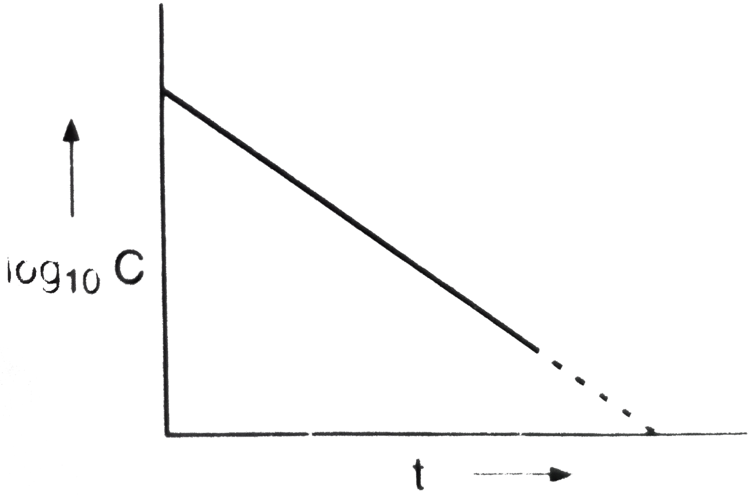
173. If a plant of $\log_{10}$ C versust t gives a straight line for a given reaction, then the reaction is :



A. zero order

B. first order

C. second order

D. third order

Answer: B

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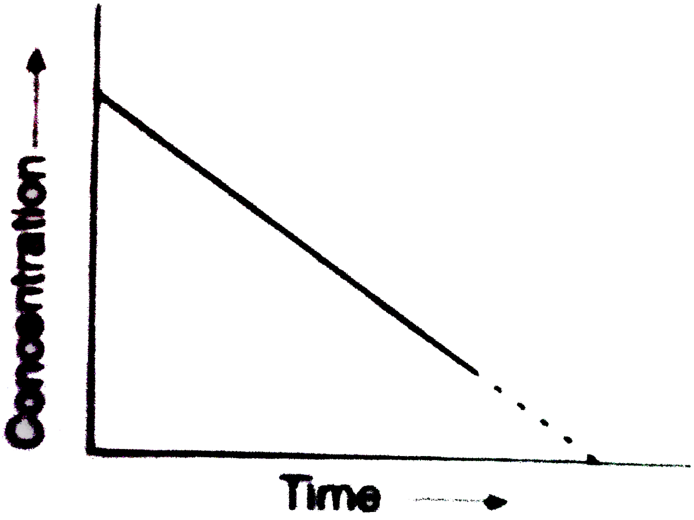
174. For a zero order reaction the plot of concentration of reactant versus time is : (intercept refers to concentration axis)



A. linear with +ve slop and zero intercept

B. linear with -ve slop and zero intercept

C. linear with +ve slop and non-zero intercept

D. curve asymptotic to concentration axis

Answer: C

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175. T_{50} of first order reaction is 10 min. starting with 10 mol^{-1} rate after 20 min is :

A. $0.0693 \times \text{mol}L^{-1}\overset{-1}{\text{min}}$

B. $0.0693 \times 2.5\text{mol}L^{-1}\overset{-1}{\text{min}}$

C. $0.0693 \times 5\text{mol}L^{-1}\overset{-1}{\text{min}}$

D. $0.0693 \times 10\text{mol}L^{-1}\overset{-1}{\text{min}}$

Answer: B

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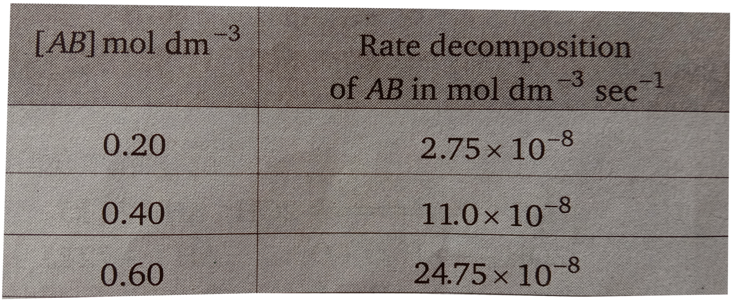
176. For the decomposition of a compount AB at 600 K, the following data were obtained.



$[AB]$ mol dm^{-3}	Rate decomposition of AB in mol dm^{-3} sec^{-1}
0.20	2.75×10^{-8}
0.40	11.0×10^{-8}
0.60	24.75×10^{-8}

Find the order for the decomposition of AB.

A. 0

B. 1

C. 2

D. 1.5

Answer: C

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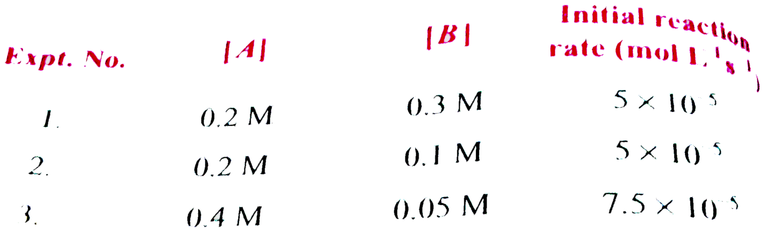
177. For a reaction between A and B, the initial rate of reaction is measured for various initial concentrations of A and B . The data provided are :



Expt. No.	[A]	[B]	Initial reaction rate (mol $L^{-1}s^{-1}$)
1.	0.2 M	0.3 M	5×10^{-5}
2.	0.2 M	0.1 M	5×10^{-5}
3.	0.4 M	0.05 M	7.5×10^{-5}

The overall order of the reaction is :

A. one(1)

B. two (2)

C. two and a half (2.5)

D. between 0 and 1

Answer: D

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178. For a first order reaction $A \to P$, the temperature (T) dependent rate constant (k) was found to follow the equation $\log k = -2000(1/T) + 6.0$. The pre-exponential factor A and the activation energy E_a, respective, are

A. $1 \times 10^6 s^{-1}$ and $9.2kJ\text{mol}^{-1}$

B. $6s^{-1}$ and $16.6kJ\text{mol}^{-1}$

C. $1 \times 10^6 s^{-1}$ and $16.6kJ\text{mol}^{-1}$

D. $1 \times 10^6 s^{-1}$ and $38.3kJ\text{mol}^{-1}$

Answer: D

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179. The time for half-life period of a certain reaction, $A \to$ products is $1h$. When the initial concentration of the reactant $'A'$ is $2.0\text{mol}L^{-1}$, how much time does it take for its concentration to come from 0.50 to $0.25\text{mol}L^{-1}$, if it is zero order reaction ?

A. $0.25h$

B. 1h

C. 4h

D. $0.5h$

Answer: A

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180. 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 ?

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

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

(II) $H_2S \Leftrightarrow H^+ + HS^-$ (fast equilibrium)

$Cl^+ + HS^- \rightarrow 2Cl^- + H^+ + S$ (slow)

A. neither A nor B

B. A only

C. B only

D. both A and B

Answer: B

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181. Which one of the following statements for the order of a reaction is incorrect ?

A. Order of reaction is always whole number

B. Order can be determined by only experimentally .

C. Order is not influenced by stoichoiometric coefficient of the reactant .

D. Order of reaction is sum of of power of concentration terms or reactants to express the rate of reaction

Answer: A

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182. For a first order reaction , $A \rightarrow$ Products, the concentrations of A changes from 0.1 M to 0.025 M in 40 minutes. The rate of reaction when the concentration of A is 0.01 M is:

A. 1.73×10^{-3} M/min

B. 3.47×10^{-4} M/min

C. 3.47×10^{-5} M/min

D. 1.73×10^{-4} M/min

Answer: B

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183. At 100 K, a reaction is 30% complete in 10 minutes, while at 200 K, 30% is complete in 5 minutes . The activation energy of the reaction is :

A. $2050J$

B. 4000 J

C. 3000 J

D. 1150 J

Answer: D

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184. The correct statement regarding the functioining of a catalyst is that it :

$I \rightarrow$ alters the energy lelvels of the reactants and products

$II \rightarrow$ provides an alternae path for climbing the activation energy barrier

$III \rightarrow$ makes the reacton thermodynamically feasible

$IV \rightarrow$ provides a different mechanism for the reaction

A. I and II

B. I and IIII

C. II and IV

D. III and IV

Answer: C

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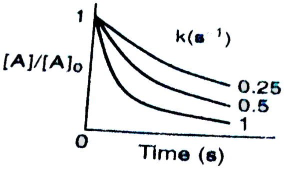
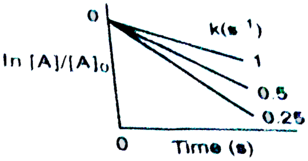
185. For a Ist order reaction of the form

$A \xrightarrow{k} B$

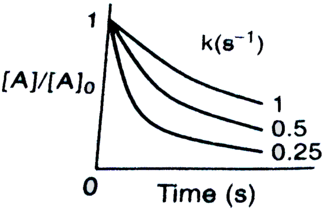
the correct representations are :



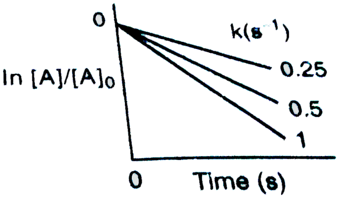
(I)



(II)



(III)



(IV)

A. I and II

B. III and IV

C. I and IV

D. II and III

Answer: C

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186. The rate of a reaction doubles when its temperature changes form $300K$ to $310K$. Activation energy of such a reaction will be:

$\left(R = 8.314JK^{-1}mol^{-1} \text{ and } \log 2 = 0.301\right)$

A. $58.5kJ\text{mol}^{-1}$

B. $60.5kJ\text{mol}^{-1}$

C. $53.6kJ\text{mol}^{-1}$

D. $48.6kJ\text{mol}^{-1}$

Answer: C

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187. For the non-stoichiometric reaction $2A + B \rightarrow C + D$

The following kinetic data were obtained in theee separate experiment, all at $98K$

Initial concentration (A)	Initial concentration (B)	Initial rate of forma
$0.1M$	$0.1M$	1.2×10^{-3}
$0.1M$	$0.2M$	1.2×10^{-3}
$0.2M$	$0.1M$	2.4×10^{-3}

The rate law for the formation of C is:

A. $\frac{dc}{dt} = k[A][B]^2$

B. $\frac{dc}{dt} = k[A]$

C. $\frac{dc}{dt} = k[A][B]$

D. $\frac{dc}{dt} = k[A]^2[B]$

Answer: B

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188. Higher order (> 3) reaction are rare due to :

A. loss of active species on collision

B. low probaility of simultaneous collision energy of all the reacting species

C. increase inentropy and activation energy as more molecules are involved

D. shifting of equilibrium towards reactants due to elastic collisions

Answer: B

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189. Decompsition of H_2O_2 follows a frist order reactions. In 50 min the concentrations 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 fromation of O_2 will be

A. $6.93 \times 10^{-2} \text{mol min}^{-1}$

B. $6.93 \times 10^{-4} \text{mol min}^{-1}$

C. $2.66 L \text{min}^{-1}$ at STP

D. $1.34 \times 10^{-2} \text{mol min}^{-1}$

Answer: B

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190. Two reactions R_2 and R_2 have identical pre - exponential factors. Activations enery of R_1 exceeds that of R_2 by 10 kJ mol_{-1} . If k_1 and k_2 are rate constants for rate constants for reactions R_1 and R_2 respectively at 300k , then In $\left(\frac{k_2}{k_1}\right)$is equal to $\left(R = 8.314 Jmol^{-1} K^{-1}\right)$

A. 8

B. 12

C. 6

D. 4

Answer: D

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191. At $518^{\circ}C$ the rate of decomposition of a smaple of gaseous acetaldehyde, initially at a pressure of 363 torr, was 1.00 torr s^{-1} when 5% had reacted and $0.5 \text{torr} s^{-1}$ when 33% had reacted. The order of the reaction is :

A. 2

B. 3

C. 1

D. 0

Answer: A

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192. The temeperature coefficient of a reaction is 2. When the temperature is increased from $30^{\circ}C \text{to} 90^{\circ}C$, the rate of reaction is increased by :

A. 150 times

B. 410 times

C. 72 times

D. 64 times

Answer: D

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OBJECTIVE QUESTIONS (LEVEL-B) SET I

1. Which of the following is correct ?

A. Molecularity of a reaction can be fractional

B. Zero order reaction never stops

C. A first order reaction never stops

D. the frequency factor 'A' in Arrhenius equations $\left(k = Ae^{-E_a/RT}\right)$ increases with increase in temperature

Answer: D

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2. The rate constant of the reaction

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$ is $3 \times 10^{-3} \min^{-1}$

At what concentration of H_2O_2, the rate of the reaction will be $2 \times 10^{-4} Ms^{-1}$?

A. $6.67 \times 10^{-3} M$

B. 2 M

C. 4 M

D. $0.08M$

Answer: C

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3. The mechanism of the reaction

$2NO(g)+H_2(g) \rightarrow N_2(g)+2H_2O(g)$, is:

Step1: $2NO(g)+H_2(g) \xrightarrow{(\text{slow})} N_2+H_2O_2$

Step2: $H_2O_2+H_2 \xrightarrow{\text{fast}} 2H_2O$

A. rate=$k[NO]^2[H_2]^2$

B. rate =$k[H_2O_2][H_2]$

C. on doubling the concentration of H_2 keeping the concentration of NO constant, the rate will become double

D. if the intial concentration of $H_2 \text{ and } NO\text{is}C_0$ and after time 't' the concentration of N_2 is x, then

$\therefore$ Rate $k=(C_0-2x)^x$

Answer: C

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4. Consider following two competing first ordr reactions,

$P \xrightarrow{k_1} A + B, Q \xrightarrow{k_2} C + D$

if 50% of the reaction oof P wascompleted when 96% of Q was complete ,then the ratio (k_2 / k_1) will be :

A. 4.6

B. 4.06

C. 1.123

D. 2.303

Answer: A

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5. The reaction $A \xrightarrow{k}$ Product, is zero order while the reaction $B \xrightarrow{k}$ Product, is first order reaction. For what intial concentration of A are the half lives of the two reacions equal?

A. $(\log_2 4)M$

B. 2M

C. 2 log 2 M

D. ln 2 M

Answer: A

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6. Which of the following is pseudo-unimolecular reaction ?

A. $2H_2O_2 \rightarrow 2H_2O + O_2$

B. $C_6H_5Cl + HOH \rightarrow C_6H_5OH + N_2 + HCl$

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

D. $2O_3 \rightarrow 3O_3$

Answer: B

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7. The order and molecularity of the chain reaction,

$H_2(g)Cl_2(g) \xrightarrow{kv} 2HCl(g)$are :

A. 2,0

B. 0,2

C. 1,1

D. 3,0

Answer: B

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8. A reactant (A) forms two products

$A \xrightarrow{k_1} B$, Activation energy E_{a1}

$A \xrightarrow{k_2} C$, Activation energy E_{a2}

If $E_{a_2} = 2E_{a_1}$ then k_1 and k_2 are related as

A. $k_2 = k_1 e^{E_{a_1} / RT}$

B. $k_2 = k_1 e^{E_{a_2} / RT}$

C. $k_2 = k_2 e^{E_{a_1} / RT}$

D. $k_2 = 2k_2 e^{E_{a_2} / RT}$

Answer: A

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9. Collision theory is satisfactory for:

A. First order reaction

B. second order reactions

C. bimolecular reactions

D. zeroth order reaction

Answer: C

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10. Initial concentration of reactant for nth order reaction is 'a'. Which of the following relations is correct about $t_{1/2}$ of the reaction?

A. $\ln t_{1/2}$= ln (constant)-(n-1) $\log_e a$

B. $\ln t_{1/2}$=ln n+ln (constant)-ln a

C. $t_{1/2}$ ln n =ln (constant) + ln a_0

D. $\ln t_{1/2}$= n ln a_0

Answer: A

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11. Half life of a reaction becomes half when intial concentrations of reactants are made double. The order of the reaction will be:

A. 1

B. 2

C. 0

D. 3

Answer: B

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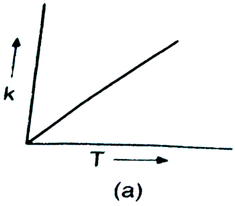
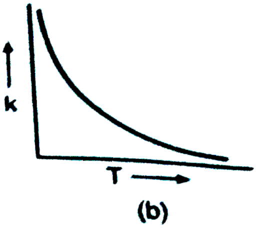
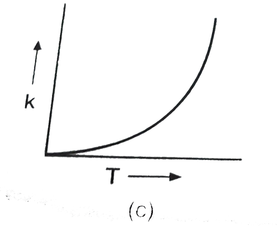
12. Arrehnius equation is :

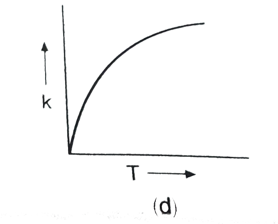
$k = Ae^{-E_a/RT}$

Which of the following graphs represents the variation of rate constant k against temerature T?

A. 

B. 

C. 

D. 

Answer: C

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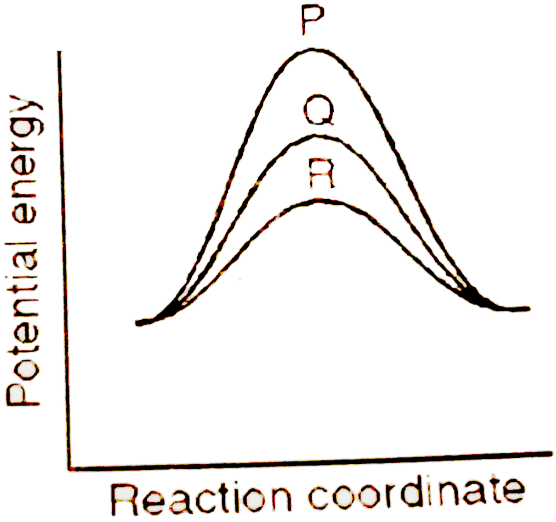
13. If a homogeneous catalytic reaction can take place through three alternative paths as depicted below, the catalytic efficiency of P,Q R representing the relative case would be



A. $A > B > C$

B. $C > B > A$

C. $A > C > B$

D. A=B=C

Answer: B

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14. The rate constant for the reaction:

$2N_2O_5 \rightarrow 4NO_2 + O_2$ is $3.0 \times 10^{-5}\sec^{-1}$. If the rate is $2.40 \times 10^{-5} M \sec^{-1}$, then the concentration of N_2O_5 (in M) is:`

A. 1.4

B. 2.1

C. 1.27

D. 0.8

Answer: D

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15. Consider the following statement :

1 The rate of reaction is always proportinal to the concentration of reactants.

2 The order of an elementary chemical reaction step can be determined by examing its stoichimoetry.

3 The first order reactions follows an exponential time course.

Of these statements :

A. 1,2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 3 are correct

D. 1 and 3 are correct

Answer: C

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16. Two different first order reactions have rate consants $k_1 \text{ and } k_2\text{at}T_1(k_1 > k_2)$. If temperature is increased form $T_1\text{to}T_2$,then new consant become $k_3 \text{ and } k_4$ respeectively. Which among the following relartions is correct

A. $k_1 > k_2 = k_3 = k_4$

B. $k_1 < k_3 \text{ and } k_2 < k_4$

C. $k_1 = k_3 = k_4$

D. $k_1 > k_2 > k_3 > k_4$

Answer: B

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17. In the reaction $A + B \rightarrow C + D$, the rate $\left(\frac{dx}{dt}\right)$ when plotted against time 't' gives a straight line parallel to time aixs.

The order and rate of reaction will be:

A. 1,k+1

B. 0,k

C. (1+k),1

D. k,k+1

Answer: B

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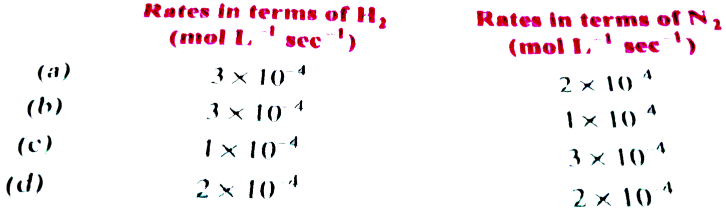
18. In the hober's process of ammonia manufacture,

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

the rate of appearance of NH_3 is :

$$\frac{d[NH_3]}{dt} = 2 \times 10^{-4} \text{mol} L^{-1} \text{sec}^{-1}$$

The rates of the reaction expressed in terms of N_2 and H_2 will be :



	Rates in terms of H_2 ($\text{mol L}^{-1} \text{sec}^{-1}$)	Rates in terms of N_2 ($\text{mol L}^{-1} \text{sec}^{-1}$)
(a)	3×10^{-4}	2×10^{-4}
(b)	3×10^{-4}	1×10^{-4}
(c)	1×10^{-4}	3×10^{-4}
(d)	2×10^{-4}	2×10^{-4}

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19. A reaction $A \rightarrow B$, involes following mechanism :

Step1 : $A \xrightarrow{k_1} B \qquad \text{(fast)}$

Step2 : $B \xrightarrow{k_2} C \qquad \text{(slow)}$

Step3: $C \xrightarrow{k_3} D \qquad \text{(fast)}$

The rate law of the reaction may be given as :

A. rate=$k_1[A]$

B. rate=$k_2[B]$

C. rate=$k_3[C]$

D. rate=$k_1k_2k_3[B][C]$

Answer: B

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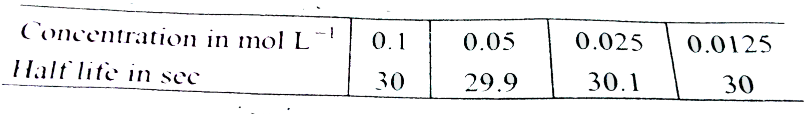
20. For a gaseous reaction, the following data were recorded :



Concentration in mol L^{-1}	0.1	0.05	0.025	0.0125
Half life in sec	30	29.9	30.1	30

The order of reaction is :

A. second

B. first

C. zero

D. fractional

Answer: B

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21. The half of second order reactin is :

A. inversely proportional to the square of the initial concentration of the reactants

B. inversely proportional to the intial concentration of reactants

C. proportional to the initial concentration of reactanst

D. independent of the initial concentration of reactants

Answer: B

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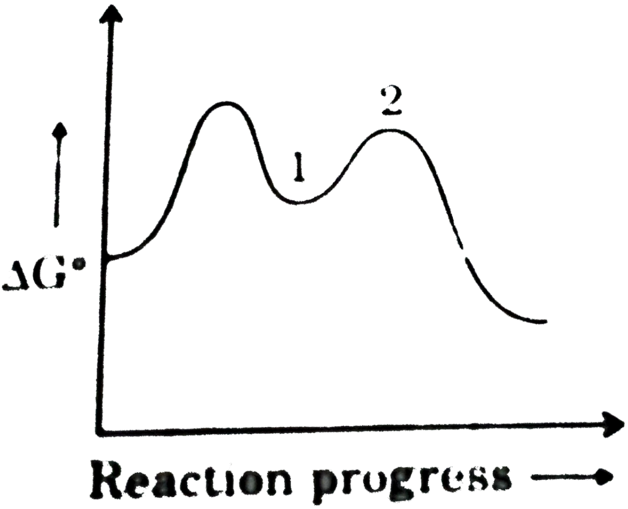
22. What names apply to chemical species corresponding to locations 1 and 2 on this reaction coordiante diagram ?



A.

	Location I	Location II
(a)	Activated complex	Activated complex

B.

	Location I	Location II
(b)	Reaction intermediate	Activated complex

C.

	Location I	Location II
(c)	Activated complex	Intermediat

D.

	Location I	Location II
(d)	Reaction intemediate	Intermediat

Answer: B

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23. Consider this reaction :

$2NO_2(g) + O_3(g) \rightarrow N_2O_5(g) + O_2(g)$

The reaction of nitrogen diozidd and ozone represented is first order in $NO_2(g)$ and i $nO_3(g)$. Which of these possible reaction mechanisms is consistent with the rate law?

Mechanism I: $NO_2(g) + O_3 \rightarrow NO_3(g) + O_2(\text{slow })$

$NO_3(g) + NO_2(g) \rightarrow N_2O_5(g) \qquad (\text{fast})$

Mechanism II $O_3(g) \Leftrightarrow O_2(g) + [O] \qquad (\text{fast})$

$NO_3(g) + [O](g) \rightarrow NO_3(g) \qquad (\text{slow})$

$NO_3(g) + NO_2(g) \rightarrow N_2O_5(g) \qquad (\text{fast})$

A. I only

B. II only

C. Both I and II

D. Neither I nor II

Answer: C

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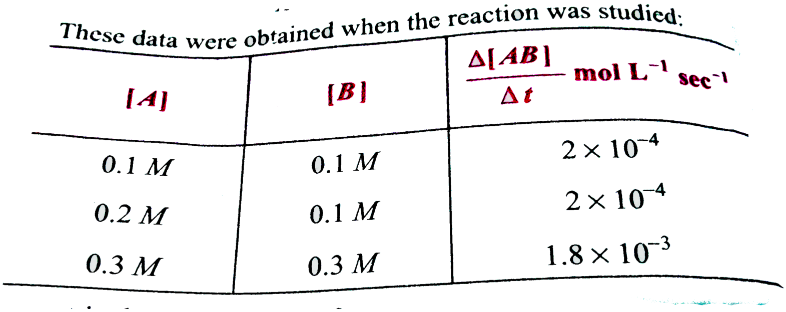
24. Use the experimental data in the table to determine was studies



These data were obtained when the reaction was studied:

$[A]$	$[B]$	$\frac{\Delta[AB]}{\Delta t}$ mol L^{-1} sec^{-1}
0.1 M	0.1 M	2×10^{-4}
0.2 M	0.1 M	2×10^{-4}
0.3 M	0.3 M	1.8×10^{-3}

What is the rate equation for the reaction ?

A. Rate= k[A][B]

B. Rate= $k[A]^2$

C. Rate= $k[B]$

D. Rate= $k[B]^2$

Answer: D

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25. In which of the following reactions, the increase in the rate of reaction will be maximum?

A. $\begin{array}{ccc} & E_a & \text{Temperature rise} \\ (a) & 40kJ/\text{mol} & 200-210K \end{array}$

B. $\begin{array}{ccc} & E_a & \text{Temperature rise} \\ (b) & 90kJ/\text{mol} & 300-320K \end{array}$

C. $\begin{array}{ccc} & E_a & \text{Temperature rise} \\ (c) & 80kJ/\text{mol} & 300-310K \end{array}$

D. All will have same rate

Answer: B

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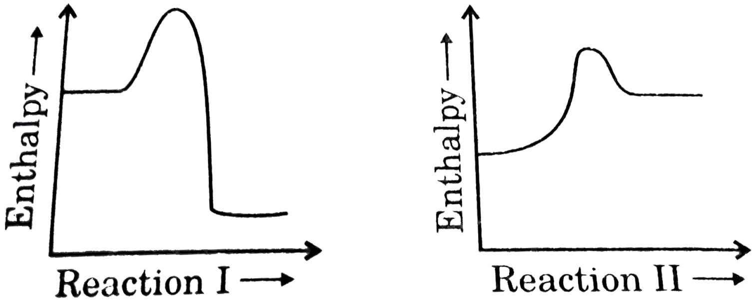
26. Which of the reactions represented in these diagrams will show the greatest increase in rate for the same increase in temperature ?



A. Reaction I forward

B. Reaction I reversed

C. Reaction II foraward

D. Reaction II reversed

Answer: B

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27. Which function of [X] . Polleted against time, will give a straight line for a second order reaction ?

$X \rightarrow \text{Products}$

A. [X]

B. $[X]^2$

C. ln [X]

D. $\frac{1}{[X]}$

Answer: D

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28. Decomposition of H_2O_2, is a first order reaction. A 16 volume solution of H_2O_2 of half life 30 min is present at start. When will the solution become one volume?

A. After 120 min

B. After 90 min

C. After 60 min

D. After 150 min

Answer: A

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29. What is the activation energy for the reverse of this reaction?

$N_2O_4(g) \rightarrow 2NO_2(g)$

Data for the given reaction is : $\Delta H = +54kJ$ and $E_a = +57.2kJ$:

A. $-54kJ$

B. $+3.2kJ$

C. $+60.2kJ$

D. $+111.2kJ$

Answer: B

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30. The reaction between chloroform, $CHCl_3(g)$ and chlorine $Cl_2(g)$ to from CCl_4 is believed to occur by this series of steps :

Step1 : $Cl_2(g) \rightarrow Cl(g) + Cl(g)$

Step2 : $CHcl_3(g) + Cl(g) \rightarrow CCl_3(g) + HCl(g)$

Step3 : $CCl_3(g) + Cl(g) \rightarrow CCl_4(g)$

If this reaction is first order in $CHcl_4$ and half order in Cl_2 which statement about the relative rates of steps 1,2 and 3 is correct?

A. Step 1 is the slowest

B. Step 1 and 2 must both be slow

C. Step 2 must be slower than step 1

D. Step 3 must be the slowest

Answer: C

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31. In the reaction,

$3BrO^{-} \rightarrow BrO_{3}^{-} + 2Br^{-}$ (aqueous alkaline medium at $80^{\circ}C$) the vlaue of the rate constant in the rate law in terms of $- -\frac{d}{dt}\left[BrO^{-}\right]$ is $0.056L\text{mol}^{-1}s^{-1}$. What will be the rate constant when the law is stated in terms of $\frac{d}{dt}\left[BrO^{-}\right]$?

A. $18.7 \times 10^{-3}L\text{mol}^{-1}s^{-1}$

B. $37.4 \times 10^{-3}L\text{mol}^{-1}s^{-1}$

C. $0.0187L\text{mol}^{-1}s^{-1}$

D. $0.0187 \times 10^{-2}L\text{mol}^{-1}s^{-1}$

Answer: C

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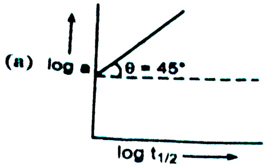
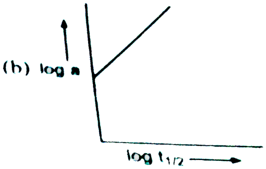
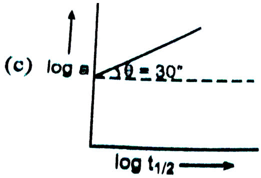
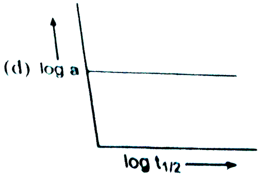
32. Which of the following graphs is correct for the following reaction?

$CH_3 - CH_2CH = CH_2 \xrightarrow[300^{\circ}C]{H_2 / Ni} CH_3 - CH_2 - CH_2 - CH_3$

A. 

B. 

C. 

D. 

Answer: A

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33. The activation energy of a certain reaction is 87 kJ mol^{-1}. What is the ratio of the rate constants for this reaction when the temperature is decreases from $37^\circ C \text{to} 15^\circ C$?

A. $5/1$

B. $8.3/1$

C. $13/1$

D. $24/1$

Answer: C

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34. Consider the reaction :

$2H_2(g) + 2NO(g) \rightarrow N_2(g) + 2H_2(g)$

The rate law for this reaction is :

Rate = $k[H_2][NO]^2$

Under what conditions could these steps represent mechanism?

$$\begin{array}{ll} \text{Step 1:} & 2NO(g) \Leftrightarrow N_2O_2(g) \\ \text{Step 2:} & N_2O_2 + H_2 \rightarrow N_2O + H_2O \\ \text{Step 3:} & N_2O + H_2 \rightarrow H_2O + N_2 \end{array}$$

A. These steps cannot be he mechanism under any circumstaces

B. These steps could be the mechanism if step 1 is the slow step

C. These steps could be the mechanism if step 2 is the slow step

D. These steps could be the mechanism if step 3 is the slow step

Answer: C

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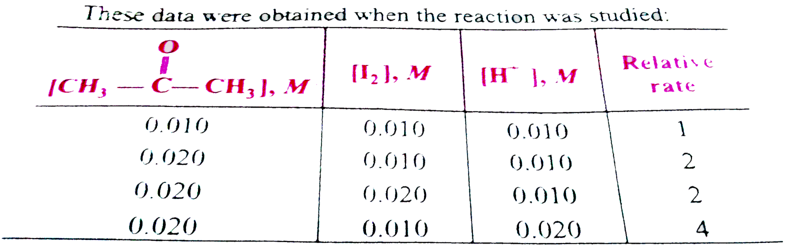
35. Propane reacts with iodine in acid medium accroding to the following equation:

$$CH_3 - \overset{O}{\overset{||}{C}} - CH_2 + I_2 \xrightarrow{H^+} CH_3 - \overset{O}{\overset{||}{C}} - CH_2I + HI$$

These data were obtained when the reaction was studied :



These data were obtained when the reaction was studied:

$[CH_3 - \overset{O}{\overset{\|}{C}} - CH_3]$, M	$[I_2]$, M	$[H^+]$, M	Relative rate
0.010	0.010	0.010	1
0.020	0.010	0.010	2
0.020	0.020	0.010	2
0.020	0.010	0.020	4

What is the rate equation for the reaction?

A. Rate = $k\left[CH_3 - \overset{O}{\overset{||}{C}} - CH_3\right][I_2]$

B. Rate $k\left[CH_3-\overset{\overset{O}{||}}{C}-CH_3\right]^2$

C. Rate = $k\left[CH_3-\overset{\overset{O}{||}}{C}-CH_3\right][I_2]\left[H^+\right]$

D. Rate= $k\left[CH_3-\overset{\overset{O}{||}}{C}-CH_3\right]\left[H^+\right]$

Answer: D

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36. Arrhenius equation $k=Ae^{-E_a/RT}$

If the activation energy of the reaction is found to be equal to RT then,

A. the rate of reaction oes not depnend upon initial concentration

B. the rate constant becomes about 37% of the Arrhenius constant A

C. the rate constant becomes equal to 37% of the Arrhenius constant A

D. the rate of the reaction becomes inifinite or zero

Answer: B

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37. At $25^\circ C$, the values of rate constant activation energy and Arhenius constant of a raction ar $3 \times 10^{-4}\text{sec}^{-1}$, 129k/J mol and $2 \times 10^{15}\text{sec}^{-1}$ respectively .

The value of rarte constant as $T \rightarrow \infty$ is :

A. zero

B. 2×10^{15}

C. 2×10^{-4}

D. 2×10^{11}

Answer: B

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38. The observed rat of acemical reaction is substantially lower than the collision frequecy. One or more of the following statements is/are true to account for this fact.

A. The reactants to do not have the required energy

B. The partnes do not collide in the proper orientation

(C) Collision complex eists for a very short time.

D. Collision frequecny over estimates the number of effective collisions.

A. A,B and C

B. A,B and D

C. B,C and D

D. A,C and D

Answer: A

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39. The reaction between NO and Cl_2 takes place in the following two steps :

I $\overset{k_1}{\underset{k_2}{NO + Cl_2 \Leftrightarrow NOCl_2}}$

fast

II. $NOCl_2 \xrightarrow[\text{fast}]{k_2} 2NOCl$

The rate law of overall reaction,

$2NO + Cl_2 \rightarrow 2NOCl$ can be given by:

A. rate= $k[NO]^2[Cl_2]$

B. rate= $k[NO][Cl_2]$

C. rate= k[NOCl][NO]

D. rate = $k[NO][Cl_2]^2$

Answer: A

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40. which of the following reactions will not have fractional order for A_2 or B_2?

A. $A_2 \Leftrightarrow , A+A(\text{fast})$

$A+B_2 \Leftrightarrow AB+B(\text{slow})$

$A+B \Leftrightarrow AB(\text{fast})$

B. $A_2 \Leftrightarrow C(\text{slow})$

$C+B_2 \Leftrightarrow d(\text{fast})$

$D+A_2 \Leftrightarrow \text{Products}$

C. $B_2 \Leftrightarrow B+B(\text{fast})$

$A_2+Bg \Leftrightarrow AB+B(\text{fast})$

$AB \Leftrightarrow \text{Products}$

D. All have fractional, order

Answer: B

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41. In which of the following, E_a for backward reaction is greater than E_a for forward reaction?

A. $A \xrightarrow{E_a - 50\text{kcal}} B, \Delta H = -10$ kcal

B. $A \xrightarrow{E_a - 50\text{kcal}} B, \Delta H = +10$ kcal

C. $A \xrightarrow{E_a - 60\text{kcal}} B, \Delta H = +20$ kcal

D. all of the above

Answer: A

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42. For n th order reaction $\frac{t_{1/2}}{t_{3/4}}$ depends on $(n \neq 1)$:

A. initial concentration only

B. n' only

C. initial concentration and 'n' both

D. sometimes 'n' and sometimes initial concentration concentration

Answer: C

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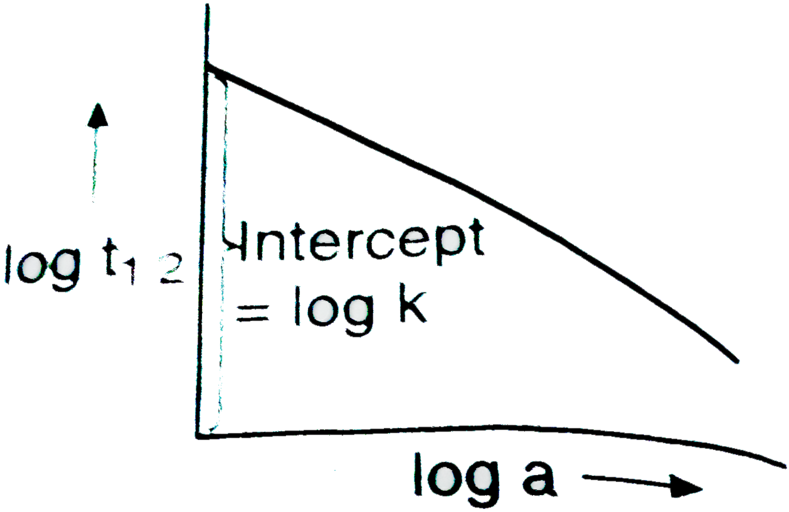
43. For a second order reaction, $2A \rightarrow$ Products, a plot of log $t_{1/2}$ vs log a (where a is initial concentration) will give an intercept equal to which one of the following?



A. $\frac{1}{k}$

B. $\log\left(\frac{1}{2k}\right)$

C. $\log\left(\frac{1}{k}\right)$

D. log k

Answer: D

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44. For a reaction taking place in three steps, the rate consatnt are k_1, k_2 and k_3. The oveall constant $k = \frac{k_1 k_2}{k_3}$. If the energy of activation values of for the first, second and third stage are 40,50 and 60 kJ mol^{-1} is :

A. 30

B. 40

C. 60

D. 50

Answer: A

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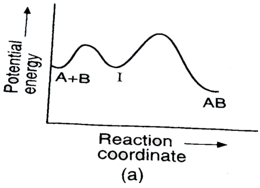
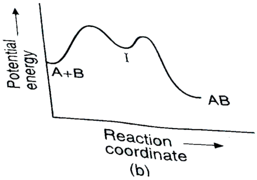
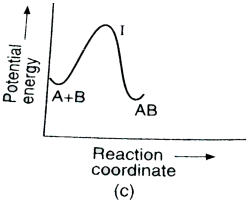
45. For an exothermic chemical process ocuuring in two process occuring in two steps as follows

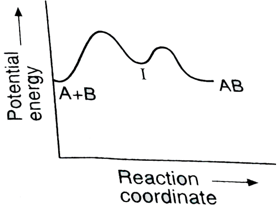
$(i) A + B \rightarrow X(\text{slow})$ $(ii) X \rightarrow AB(\text{fast})$

The progress of reaction can be best described by :

A. 

B. 

C. 

D. 

(d)

Answer: A

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46. A reaction takes place in three steps with individual rate constant and activation energy,

	Rate constant	Activation energy
Step 1	k_1	$E_{a_1} = 180 kJ / \text{mol}$
Step2	k_2	$E_{a_2} = 180 kJ / \text{mol}$
Step3	k_3	$E_{a_3} = 180 kJ / \text{mol}$

oveall rate constant, $k = \left(\frac{k_1 k_2}{k_3}\right)^{2/3}$ overall activation energy of the reaction will be :

A. 140 kJ/mol

B. 150 kJ/mol

C. 130 kJ/mol

D. 120 kJ/mol

Answer: A

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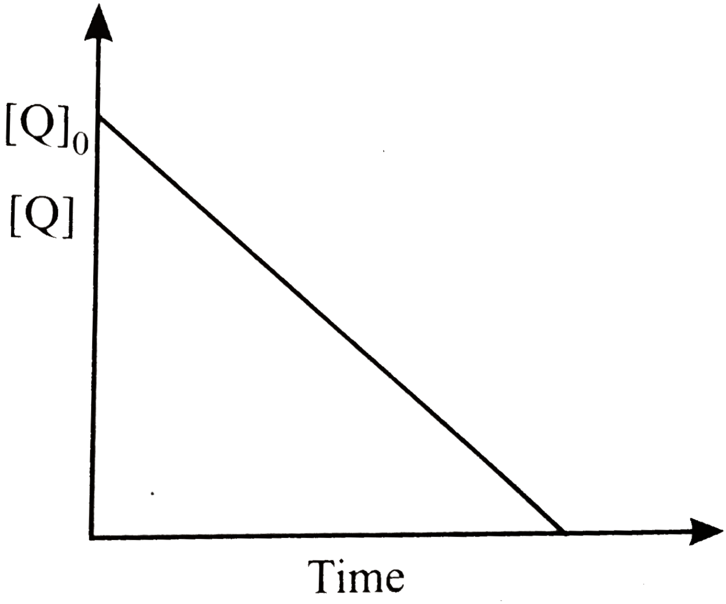
47. In the reaction, $P + Q \rightarrow R + S$

the time taken for 75% reaction of P is twice the time taken for 50% reaction of P. The concentration of Q varies with reaction time as shown in the figure. The overall order of the reaction is



A. 2

B. 3

C. 0

D. 1

Answer: D

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48. For the elementary reaction $M \rightarrow N$, the rate of disappearance of M increases by a factor of 8 upon doubling the concentration of M. The order of the reaction will respect to M is

A. 4

B. 3

C. 2

D. 1

Answer: B

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OBJECTIVE QUESTIONS (LEVEL-B) SET II

1. In the Arrhenius eqution $k=Ae^{-E_a/RT}$, the rate constant (k) becomes equal to the Arrhenius constant (A), when :

A. the temperture becomes inifinte

B. the 100% reactants of are converted to product

C. the fraction of molecules crossing over the barrier is unity

D. the temperature of the reaction mixture is very low

Answer: A::B::C

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2. Select the correct realation among the following :

A. $t_{1/2} \propto \frac{1}{a^{n-1}}$, where n is the order of reaction and 'a' is the initila concentration of the reaction

B. $t_{1/2} = \frac{00693}{k}$ for the order reaction

C. Average life $\tau = 1.44 \times t_{1/2}$ for the first order reaction

D. $t_{3/4} = 2t_{1/2}$, for the first order reaction

Answer: A::B::C::D

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3. Which of the following statement are correct about the reaction in presence of catalyst?

A. Catalyst does not alter the heat of reaction

B. Catalyst alters the equilibrium constant of the reaction

C. Catalyst does not alter the ΔG° of the reaction

D. Catalyst change the rate constant of forward and backward reaction to the extent

Answer: A::C::D

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4. In the Arrhenius equation , $k = Ae^{-E_a / RT}$ the Arrhenius constant A will be equal ot the rate constant when :

A. $E_a = 0$

B. $T = \infty$

C. T=0

D. $E_a = \infty$

Answer: A::B

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5. Which of the following arepseudo uimolecular reaction?

A. $CH_3COOC_2H_5 + HOH \xrightarrow{H^+} CH_3COOH + C_2H_5OH$

B. $CH_3COOC_2H_5 + HOH \xrightarrow{H^-} CH_3COOH + C_2H_5OH$

C. $C_{12}H_{22}O_{11} + HOH \xrightarrow{H^+} \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$

D. $SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$

Answer: A::C

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6. Rate law expression of a reaction is :

Rate = $k[A]^{2/3}[B]$

Which of the following are correct about the corresponding reaction ?

A. Order of reaction $= \frac{2}{3} + 1 = \frac{5}{3}$

B. Unit of rate constant = $L^{2/3}\text{mol}^{-2/3}\text{sec}^{-1}$

C. Unit of rate constant = $\text{atm}^{-2/3}\text{sec}^{-1}$

D. Unit of rate constant = mol $L^{-1}\sec^{-1}$

Answer: A::B::C

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7. Which of the following are correct exression for Arrhenius equation?

A. $A = ke^{-E_a/RT}$

B. ln $k = \ln A + \frac{E_a}{RT}$

C. $\log_{10} = \log_{10} A - \frac{E_a}{2.303RT}$

D. $\ln A = \ln k + \frac{E_a}{RT}$

Answer: C::D

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8. Which of the following values of the molecularity are not possible ?

A. 0

B. 2

C. 3

D. 4

Answer: A::D

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9. Which of the following are true for the first order reaction?

A. $t_{3/4} = 2t_{1/2}$

B. $t_{15/16} = 2t_{1/2}$

C. $t_{15/16} = 2t_{3/4}$

D. $t_{7/8} = 2t_{3/4}$

Answer: A::B

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10. Activation energy of forward and backward process of reaction are 60 kJ and 40 kJ mol^{-1} respectively . Which of the following are true the reaction ?

A. It is endothermic reaction

B. It is exothermic reaction

C. Heat of reaction is +20kJ mol^{-1}

D. Thershol enregy of reaction is 100 kJ mol^{-1}

Answer: A::B::C::D

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11. Accroding to the Arrhenius equation

A. a high activation energy usually implies a fast reaction.

B. rate constant increases with increases temperature. This is due to a greater number of colliision whose energy exceeds the activation energy

C. higher the magnitude of activation energy, stronger is the temperature dependence of the rate constant.

D. the pre-exponential factor is a measure of the rate at which collisions occur, irrespective of their energy.

Answer: B::C::D

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12. In a bimolecular reaction, the steric factor P was experimentally determined to be 4.5. The correct options among the following is (are):

A. The value of frequecny factor predicted by Arrhenius equation is higher thatn that determined experimentally

B. The activation energy of the reaction is unaffected by the value of the steric factor

C. Since P=4.5 the reaction will not proceed unless an effective catalyst is added

D. Experimentally determined value of frequecny factor

Answer: B::D

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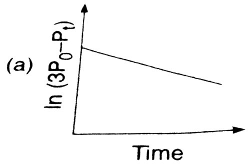
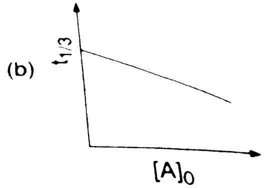
13. For a first order reaction $A(g) \rightarrow 2B(g) + C(g)$ at constant volume and 300 K, the total pressure at the beginning (t=0) and at time t ae P_0 and P_t respectively. Initially, only A is present with concentration $[A]_0$ and $t_{1/3}$ is the time required for the partial pressure of A to reach 1/3rd of its initial value. The correct options (s) is (are) :

(Assume that all these behave as ideal gases)



A.



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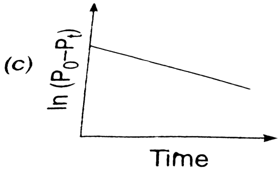
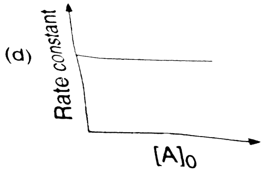


C.



D.

Answer: A::D

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ASSERTION- REASON TYPE QUESTIONS

1. Assertion (A): The rate of reaction sometimes does not depends on concentration.

Reason(R): The order of reaction can be negative.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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2. Assertion (A): The rate of reaction increases generally by 2 to 3 times for every $10^\circ C$ rise in temperature.

Reason (R): An increase intemperature increases the colliison frequency.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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3. Assertion (A): Hydrolyiss of ethyl acetate in the presence of acid is a reaction of first order whereas in the presence of alkali, it is a reaction of second order.

Reason (R): Acid acts as catalyst only whereas alkali act as one of the reactant.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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4. Assertion (A) : The molecularity of the reaction

$H_2 + Br_2 \rightarrow 2HBr$ is 2.

Reason (R): The order of the reaction is $3/2$.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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5. Assertion (A): Poistive catalyst lowers the activation energy of the reaction whereas the heat of reaction remains same.

Reason (R): The heat of reaction is equal to the difference between activation energies for forward and backward reactions.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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6. (A) Positive catalyst increases the rate of reaction

(R) Catalyst decrease the value of ΔG°

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

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7. Assertion (A) : $k = Ae^{-E_a/RT}$, the Arrhenius equation represents the dependence of rate constant with temperature.

Reason (R): Plot of $\log. k$ against $1/T$ is linear and the activation energy can be calculated with this plot.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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8. Assertion (A) : If the activation energy of a reaction is zero, temperature will have no effect on the rate constant. Reason (R): Lower the activation energy, faster is the reaction.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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9. Assertion (A) : An order with respect to any reactant or Product can be zero, poistive, negative, and fractional. Reason (R): Rate cannot decrease with increase in the concentration of a reactant or Product.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

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10. Assertion (A) : Formation of HI is a bimolecular reaction.

Reason (R): Two molecules of reactants are involved in this reaction.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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11. Assertion (A) : The order of the reaction,

$$CH_3COOC_2H_5 + H_2O \Leftrightarrow CH_3COOH + C_2H_5OH$$

is 2. Reason (R): The molecularity of this reaction is 2.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: D

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12. Assertion (A) : For: $aA + bB \rightarrow$ Product. The order of reaction is equal to $(a+b)$.

Reason (R): Rate of reaction $= k[A]^a[B]^b$.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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13. (A) The hydrolysis of methyl acetate by dil HCl is a pseudo first order reaction

(R) HCl acts as a catalyst for the hydrolysis

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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14. Assertion (A) : The order of a reaction can have fractional value

Reason (R) : The order of a reaction cannot be written from balanced equation of a reaction.

A. If both (A) and (R) are correct but (R) is the correct explanation of (A) .

B. If both (A) and (R) are correct but (R) is not the correct exaplanation of (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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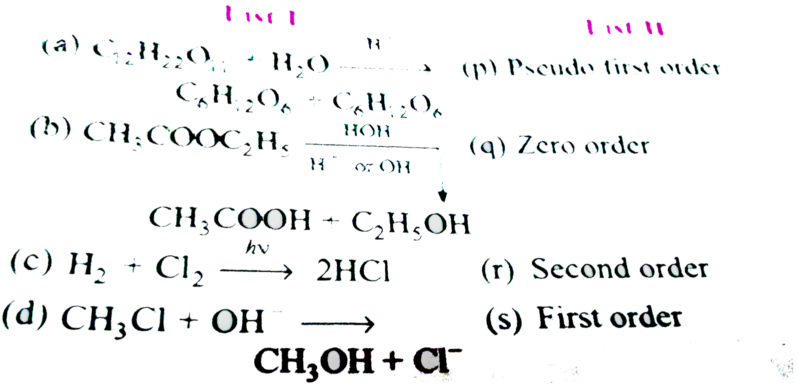
MATRIX MATCHING TYPE QUESTIONS

1. Match the reactions of List-I with their ordes in List-II:



List I	List II
(a) $C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} C_6H_{12}O_6 + C_6H_{12}O_6$	(p) Pseudo first order
(b) $CH_3COOC_2H_5 \xrightarrow[H^+ \text{ or } OH^-]{HOH} CH_3COOH + C_2H_5OH$	(q) Zero order
(c) $H_2 + Cl_2 \xrightarrow{h\nu} 2HCl$	(r) Second order
(d) $CH_3Cl + OH^- \longrightarrow CH_3OH + Cl^-$	(s) First order

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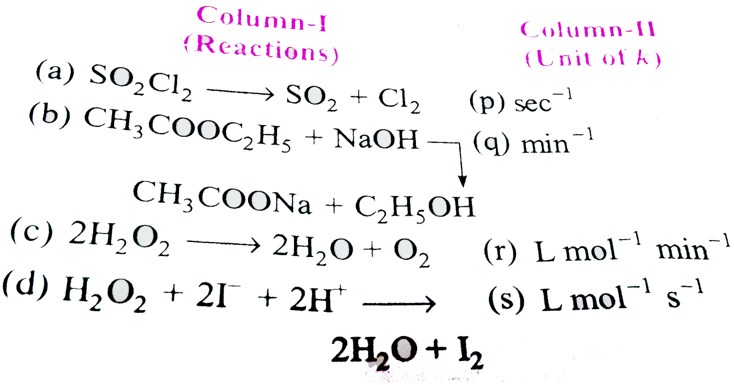
2. Match the reaction in Column-I with the units of their rate constant is Colum-II



Column-I (Reactions)	Column-II (Unit of k)
(a) $SO_2Cl_2 \longrightarrow SO_2 + Cl_2$	(p) sec^{-1}
(b) $CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa + C_2H_5OH$	(q) min^{-1}
(c) $2H_2O_2 \longrightarrow 2H_2O + O_2$	(r) $L\,mol^{-1}\,min^{-1}$
(d) $H_2O_2 + 2I^- + 2H^+ \longrightarrow 2H_2O + I_2$	(s) $L\,mol^{-1}\,s^{-1}$

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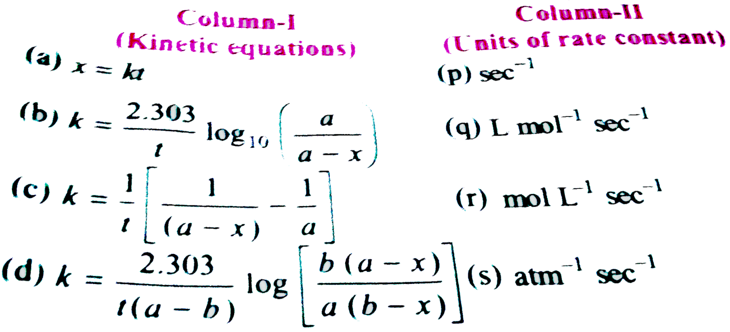
3. Match the kinetic equtions of Column-I with the units of their rate constant in Collumn-II



Column-I (Kinetic equations)	Column-II (Units of rate constant)
(a) $x = kt$	(p) sec^{-1}
(b) $k = \frac{2.303}{t} \log_{10}\left(\frac{a}{a-x}\right)$	(q) $L\ mol^{-1}\ sec^{-1}$
(c) $k = \frac{1}{t}\left[\frac{1}{(a-x)} - \frac{1}{a}\right]$	(r) $mol\ L^{-1}\ sec^{-1}$
(d) $k = \frac{2.303}{t(a-b)} \log\left[\frac{b(a-x)}{a(b-x)}\right]$	(s) $atm^{-1}\ sec^{-1}$

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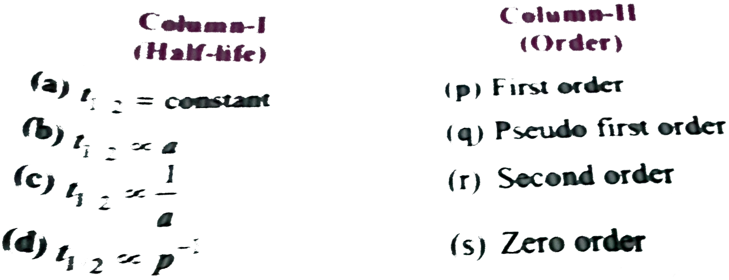
4. Match the half-life in Column-I with the orders in Column-II



Column-I (Half-life)	Column-II (Order)
(a) $t_{1/2} = constant$	(p) First order
(b) $t_{1/2} \propto a$	(q) Pseudo first order
(c) $t_{1/2} \propto \frac{1}{a}$	(r) Second order
(d) $t_{1/2} \propto p^{-1}$	(s) Zero order

Where, a= Initial concentration of the reactant

p= Initial pressure of the reactant

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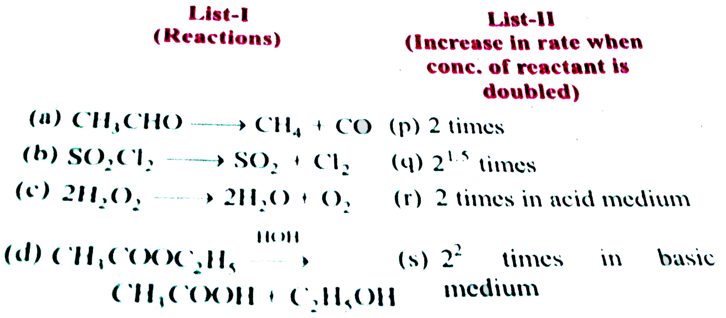
5. Match the reaction of List-I with the increases in rate when concentration is raised two times in List-II



List-I (Reactions)	**List-II (Increase in rate when conc. of reactant is doubled)**
(a) $CH_3CHO \longrightarrow CH_4 + CO$	(p) 2 times
(b) $SO_2Cl_2 \longrightarrow SO_2 + Cl_2$	(q) $2^{1.5}$ times
(c) $2H_2O_2 \longrightarrow 2H_2O + O_2$	(r) 2 times in acid medium
(d) $CH_3COOC_2H_5 \xrightarrow{HOH} CH_3COOH + C_2H_5OH$	(s) 2^2 times in basic medium

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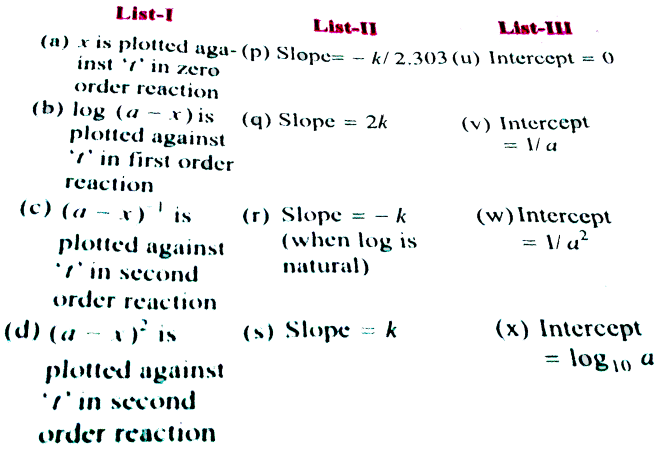
6. Match the List-I with List-II and List-III:



List-I	List-II	List-III
(a) x is plotted against 't' in zero order reaction	(p) Slope$= -k/2.303$	(u) Intercept $= 0$
(b) $\log(a-x)$ is plotted against 't' in first order reaction	(q) Slope $= 2k$	(v) Intercept $= 1/a$
(c) $(a-x)^{-1}$ is plotted against 't' in second order reaction	(r) Slope $= -k$ (when log is natural)	(w) Intercept $= 1/a^2$
(d) $(a-x)^2$ is plotted against 't' in second order reaction	(s) Slope $= k$	(x) Intercept $= \log_{10} a$

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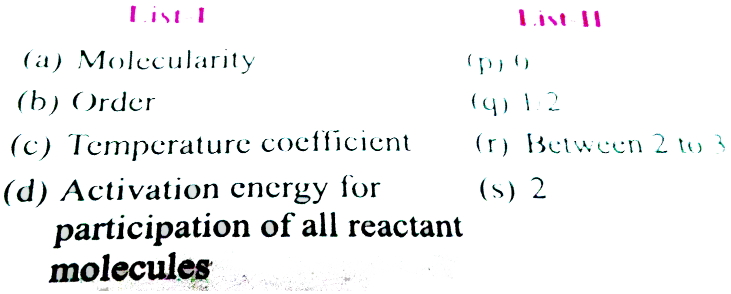
7. Match the List-I with List-II :



List-I	List-II
(a) Molecularity	(p) 0
(b) Order	(q) 1/2
(c) Temperature coefficient	(r) Between 2 to 3
(d) Activation energy for participation of all reactant molecules	(s) 2

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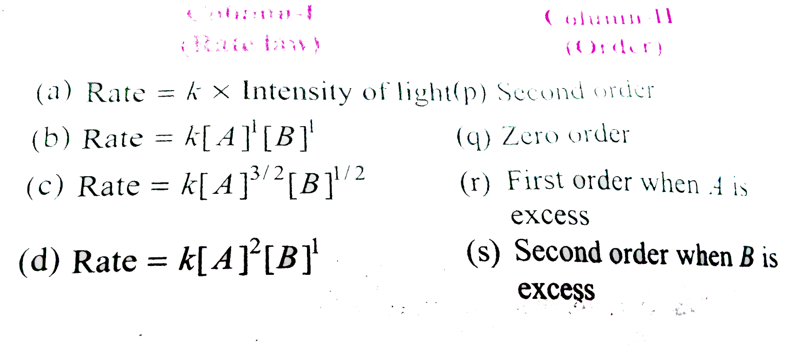
8. Match the Column-I with Column-II:



Column-I (Rate law)	Column-II (Order)
(a) Rate $= k \times$ Intensity of light	(p) Second order
(b) Rate $= k[A]^1[B]^1$	(q) Zero order
(c) Rate $= k[A]^{3/2}[B]^{1/2}$	(r) First order when A is excess
(d) Rate $= k[A]^2[B]^1$	(s) Second order when B is excess

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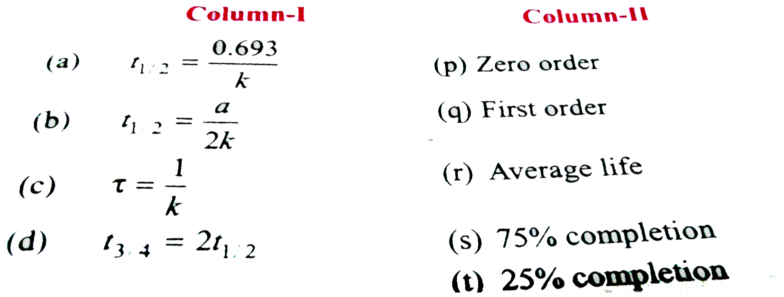
9. Match the Column-I with Column-II:



Column-I	Column-II
(a) $t_{1/2} = \frac{0.693}{k}$	(p) Zero order
(b) $t_{1/2} = \frac{a}{2k}$	(q) First order
(c) $\tau = \frac{1}{k}$	(r) Average life
(d) $t_{3/4} = 2t_{1/2}$	(s) 75% completion
	(t) 25% completion

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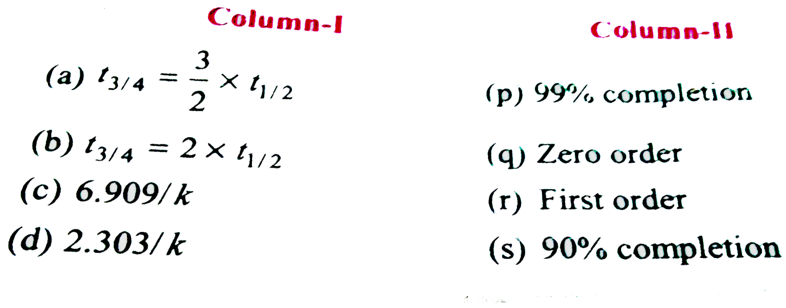
10. Match the Column-I with Column-II :



Column-I	Column-II
(a) $t_{3/4} = \frac{3}{2} \times t_{1/2}$	(p) 99% completion
(b) $t_{3/4} = 2 \times t_{1/2}$	(q) Zero order
(c) $6.909/k$	(r) First order
(d) $2.303/k$	(s) 90% completion

Here, $t_{1/2}$ = half life

$t_{2/3} = 3/4$ life

k= rate constant

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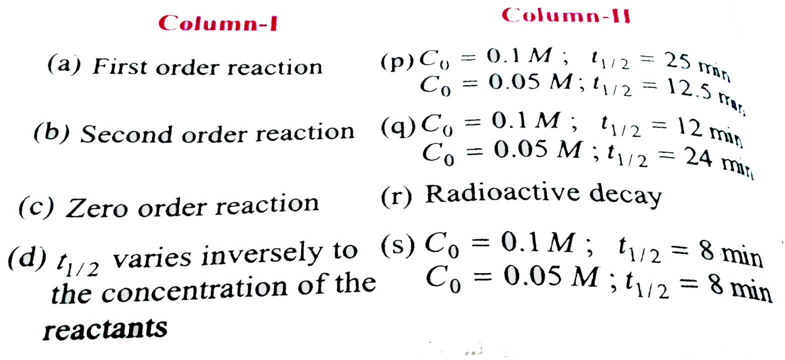
11. Match the Column-I with Column-II :



Column-I	Column-II
(a) First order reaction	(p) $C_0 = 0.1\ M$; $t_{1/2} = 25$ min $C_0 = 0.05\ M$; $t_{1/2} = 12.5$ min
(b) Second order reaction	(q) $C_0 = 0.1\ M$; $t_{1/2} = 12$ min $C_0 = 0.05\ M$; $t_{1/2} = 24$ min
(c) Zero order reaction	(r) Radioactive decay
(d) $t_{1/2}$ varies inversely to the concentration of the reactants	(s) $C_0 = 0.1\ M$; $t_{1/2} = 8$ min $C_0 = 0.05\ M$; $t_{1/2} = 8$ min

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INTEGER ANSWER TYPE QUESTIONS

1. In the reaction $A \to B$ when the initial concentration of reactant is halved. The half life increases by a factor of eight, what will be order or the reaction?

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2. Rate of a chemical reaction increases by 1024 times by $100^\circ C$ rise in temperature, the temperature coeffifcient of the reaction will be :

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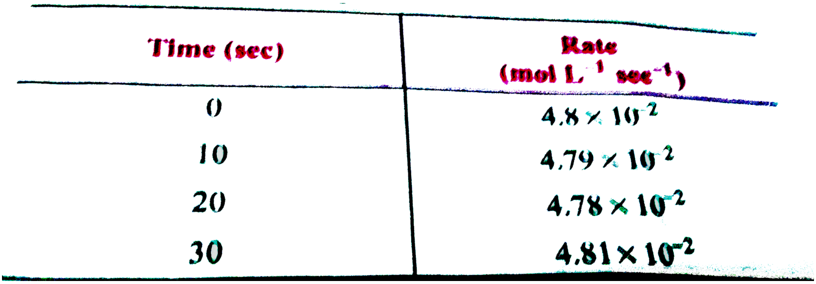
3. The rate of a reaction at 10 sec interval are as follows:



Time (sec)	Rate (mol L^{-1} sec^{-1})
0	4.8×10^{-2}
10	4.79×10^{-2}
20	4.78×10^{-2}
30	4.81×10^{-2}

What will be the order of the reaction?

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4. How many times of the half-life will require to complete 75% of a reaction of first order?

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5. Ozone deplection takes place as :

$2O_3(g) \rightarrow 3O_2(g)$

Step1: $O_3(g) \overset{k}{\Longleftrightarrow} O_2(g) + O(g)$ (fast)

Step2 : $O_3(g) + [O] \xrightarrow{k} 2O_2(g)$ (slow)

order of the raction will be :

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6. IF the $t_{1/2}$ for a first order reaction 0.4 min, the time of or 99.9% completion of the reaction is ....min.

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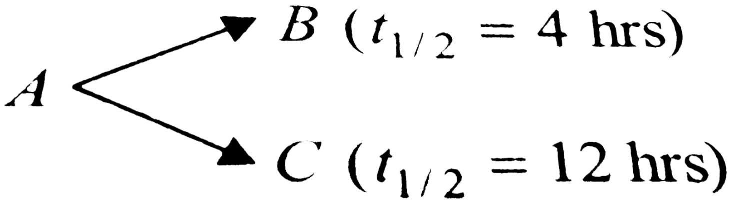
7. Consider the following parallel first order reactions



The half-life for the decay of A is ....hrs.

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8. The half-life period or a first order reaction is 1 hrs. What is the time in hour taken for 87.5% completion of the reaction?

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9. The half life for a given reaction was doubled as the initial concentration of a reactant was doubled. What is the order of reaction.

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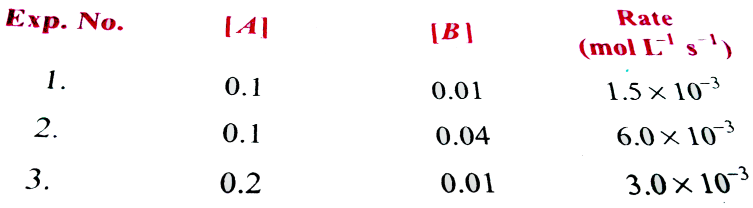
10. For the reaction $A_2, + 2B \rightarrow AB$, the following data were observed :



Exp. No.	[A]	[B]	Rate (mol L^{-1} s^{-1})
1.	0.1	0.01	1.5×10^{-3}
2.	0.1	0.04	6.0×10^{-3}
3.	0.2	0.01	3.0×10^{-3}

The ovarall orde of the reaction will be :

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11. An organic compound undergoes first decompoistion. The time taken for its decompoistion to $1/8$ and $1/10$ of its initial concentration are $t_{1/8}$ and $t_{1/10}$, respectively. What is the value of $\frac{[t_{1/8}]}{[t_{1/10}]} \times 10?$ $(\log_{10} 2 = 0.3)$

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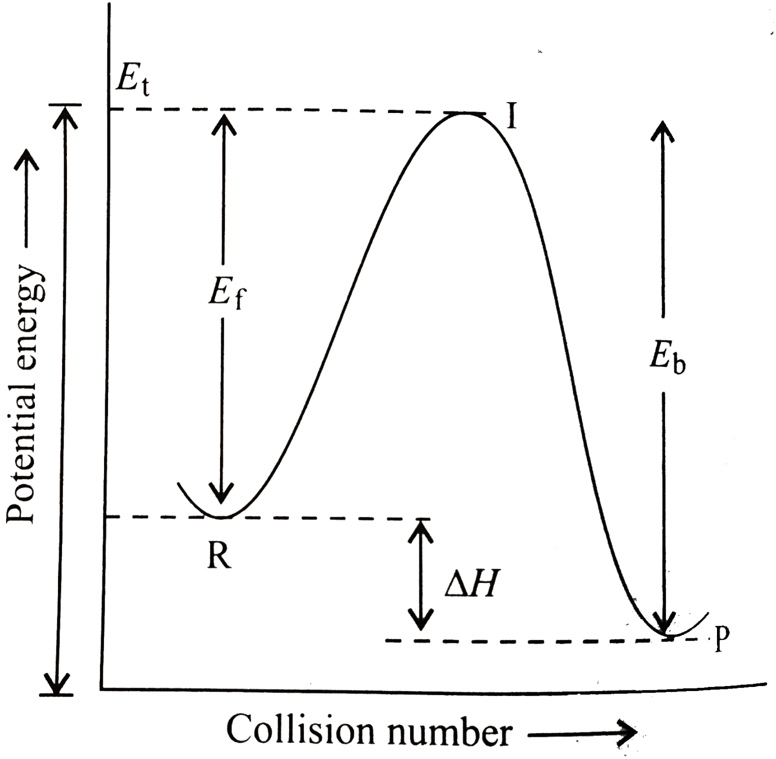
PASSAGE -1

1. A colliison between reactant molecules must occur with a certain minimum energy before it is effective in yielding Product molecules. This minimum energy is called activation energy E_a Large the value of activation energy, smaller the value of rate constant k. Larger is the value of activation energy, greater is the effect of temperature rise on rate constant k.



$E_f =$ Activation energy of forward reaction

$E_b =$ Activation energy of backward reaction

$\Delta H = E_f - E_b$

$E_f =$ threshold energy

If a reaction $A + B \rightarrow C$ is exothermic to the extent $30 kJmol^{-1}$ and the forward reaction has an activation energy of $249 kJmol^{-1}$ the activation energy for reverse reaction in $kJmol^{-1}$ is

A. 324

B. 279

C. 40

D. 100

Answer: D

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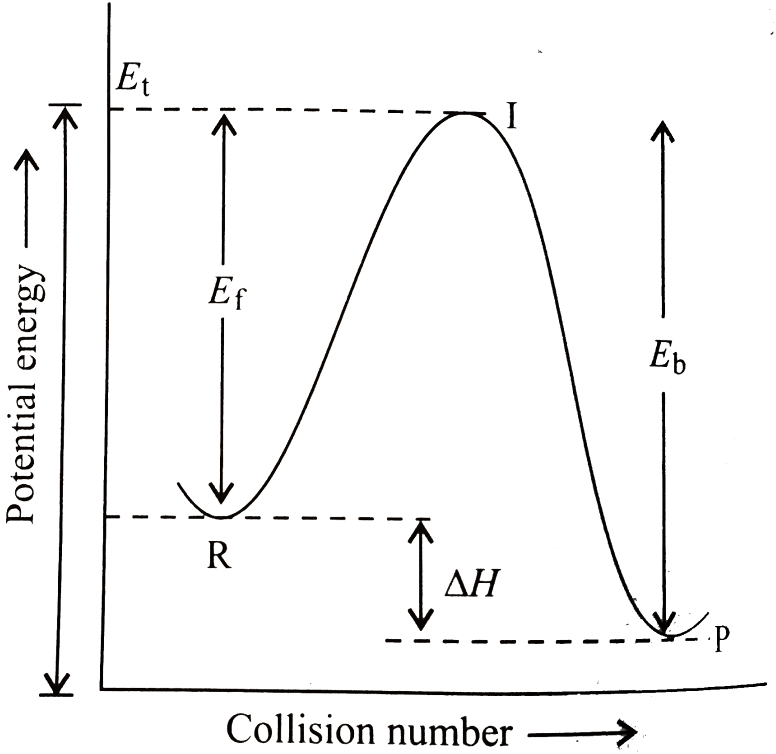
2. A colliison between reactant molecules must occur with a certain minimum energy before it is effective in yielding Product molecules. This minimum energy is called activation energy E_a Large the value of activation energy, smaller the value of rate constant k. Larger is the value of activation energy, greater is the effect of temperature rise on rate constant k.



$E_f =$ Activation energy of forward reaction

$E_b =$ Activation energy of backward reaction

$\Delta H = E_f - E_b$

$E_f =$ threshold energy

For the following reaction at a particular temperature, according to the equations

$2N_2O_5 \rightarrow 4NO_2 + O_2$

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

The activation energies are E_1 and E_2, respectively. Then

A. $E_1 > E_2$

B. $E_1 < E_2$

C. $E_1 = 2E_2$

D. $\sqrt{E_1 E_2^2} = 1$

Answer: A

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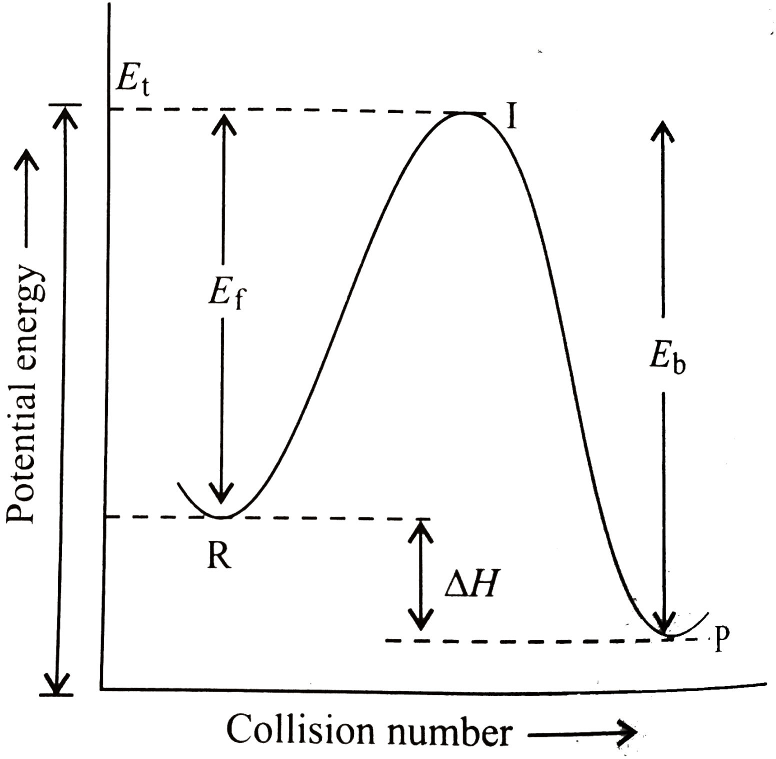
3. A colliison between reactant molecules must occur with a certain minimum energy before it is effective in yielding Product molecules. This minimum energy is called activation energy E_a Large the value of activation energy, smaller the value of rate constant k. Larger is the value of activation energy, greater is the effect of temperature rise on rate constant k.



$E_f =$ Activation energy of forward reaction

$E_b =$ Activation energy of backward reaction

$\Delta H = E_f - E_b$

$E_f =$ threshold energy

In a hypothetical reaction $A \rightarrow B$, the activation energies for the forward and backward reactions are 15 and $9 kJ mol^{-1}$, respectively. The potential energy of A is $10 kJ mol^{-1}$. Which of the following is wrong?

A. Threshold energy or the reaction is 25 kJ

B. The potential energy of B is 16 kJ

C. Heat of reaction is 6 kJ

D. The reaction is exothermic

Answer: D

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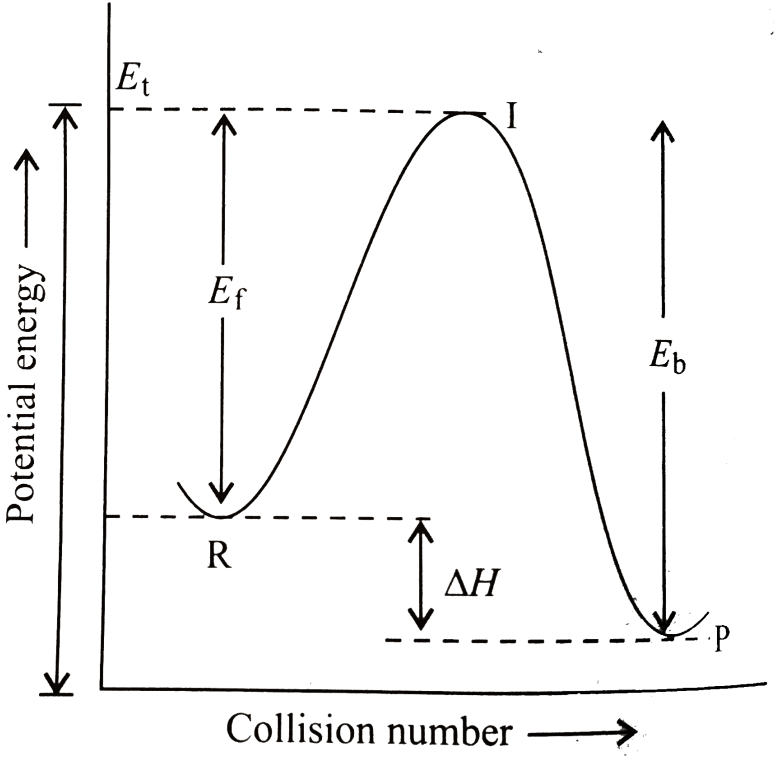
4. A colliison between reactant molecules must occur with a certain minimum energy before it is effective in yielding Product molecules. This minimum energy is called activation energy E_a Large the value of activation energy, smaller the value of rate constant k. Larger is the value of activation energy, greater is the effect of temperature rise on rate constant k.



$E_f =$ Activation energy of forward reaction

$E_b =$ Activation energy of backward reaction

$\Delta H = E_f - E_b$

$E_f =$ threshold energy

For two reactions, activation energies are E_{a1} and E_{a2}, rate constant are k_1 and k_2 at the same temperature. If $k_1 > k_2$, then

A. $E_{a_1} > E_{a_2}$

B. $E_{a_1} = E_{a_2}$

C. $E_{a_1} < E_{a_2}$

D. $E_{a_1} \geq E_{a_2}$

Answer: C

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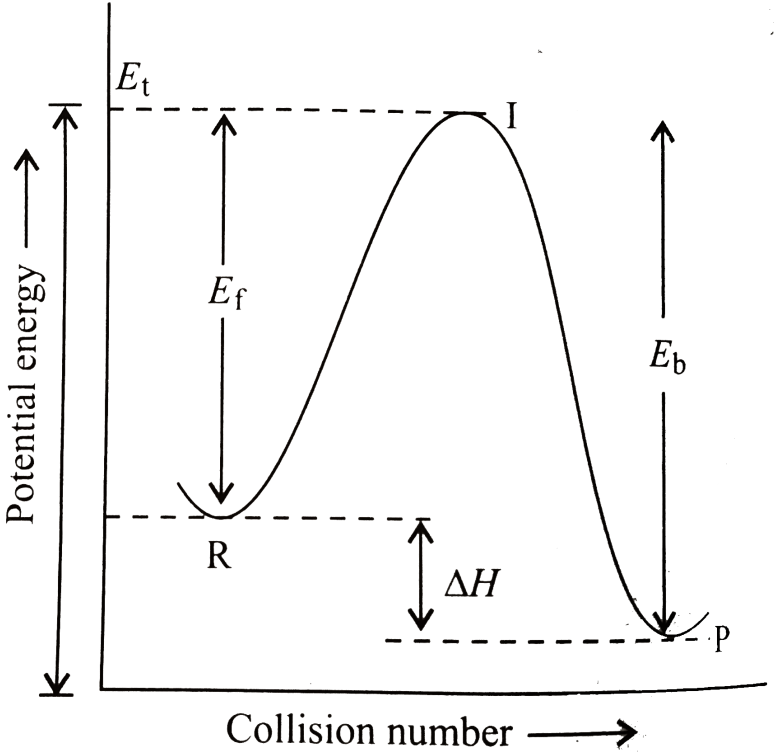
5. A colliison between reactant molecules must occur with a certain minimum energy before it is effective in yielding Product molecules. This minimum energy is called activation energy E_a Large the value of activation energy, smaller the value of rate constant k. Larger is the value of activation energy, greater is the effect of temperature rise on rate constant k.



$E_f =$ Activation energy of forward reaction

$E_b =$ Activation energy of backward reaction

$\Delta H = E_f - E_b$

$E_f =$ threshold energy

The rate constant of a certain reaction is given by $k = Ae^{-E_a/RT}$ (where $A =$ Arrhenius constant). Which factor should be lowered so that the rate of reaction may increase?

A. T

B. Z

C. A

D. E_a

Answer: D

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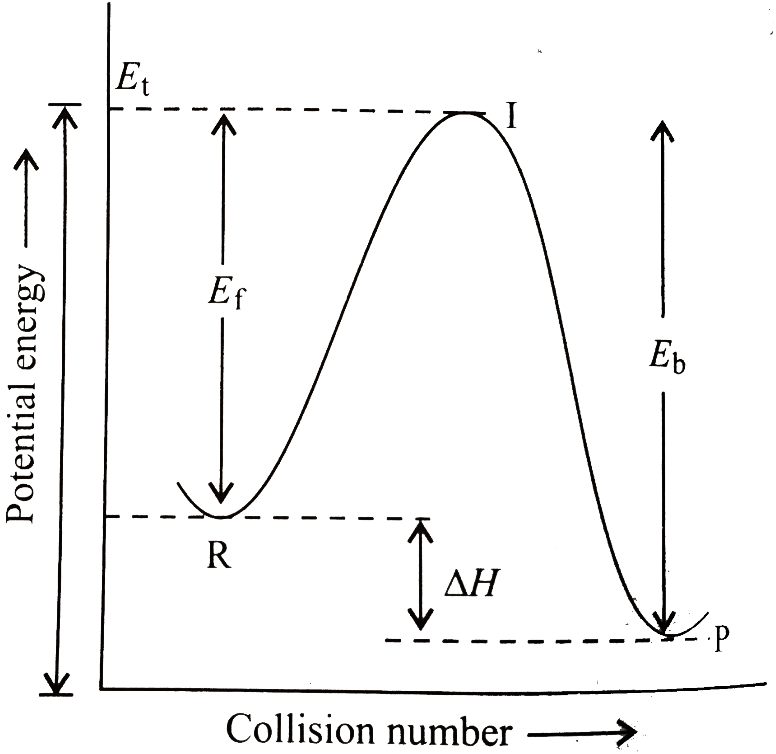
6. A colliison between reactant molecules must occur with a certain minimum energy before it is effective in yielding Product molecules. This minimum energy is called activation energy E_a Large the value of activation energy, smaller the value of rate constant k. Larger is the value of activation energy, greater is the effect of temperature rise on rate constant k.



$E_f =$ Activation energy of forward reaction

$E_b =$ Activation energy of backward reaction

$\Delta H = E_f - E_b$

$E_f =$ threshold energy

The activation eneries for forward and backward reactions in a chemical reaction are 30.5 and $45.4 kJ mol^{-1}$ respectively. The reaction is

A. exothermic

B. endothermic

C. neithter exothermic nor endothermic

D. idenpendent of temperature

Answer: A

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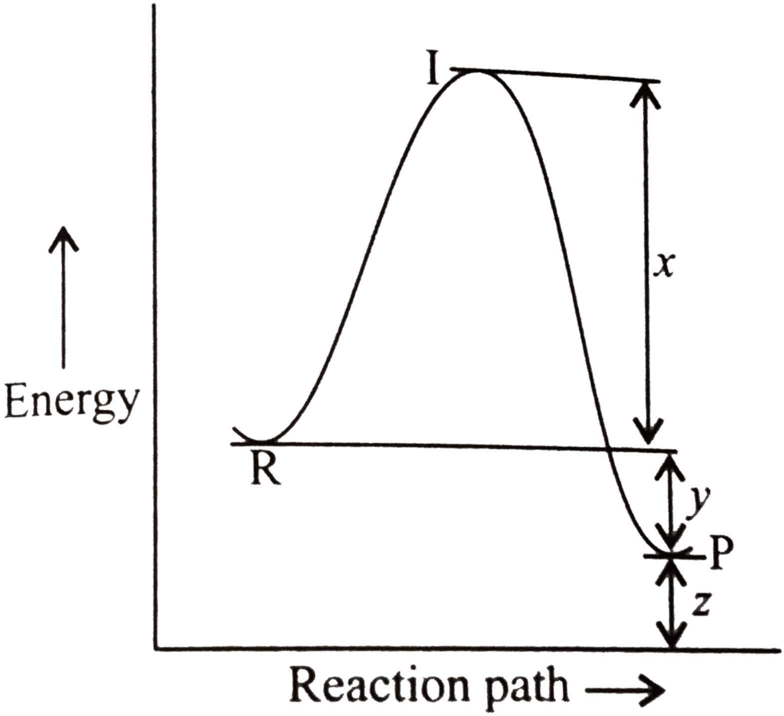
PASSAGE -2

1. The energy profile diagram for the reaction:

$CO(g) + NO_2(g) \Leftrightarrow CO_2(g) + NO(g)$ is given below:



The activation energy of the forward reaction is

A. x

B. y

C. x+y

D. x-y

Answer: A

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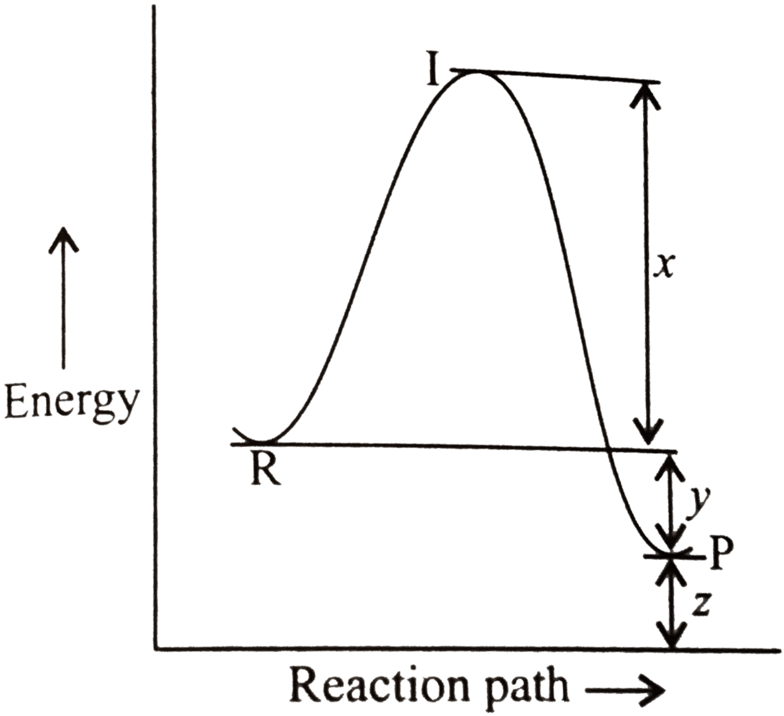
2. The energy profile diagram for the reaction:

$CO(g) + NO_2(g) \Leftrightarrow CO_2(g) + NO(g)$ is given below:



The activation energy of the backward reaction is

A. x

B. y

C. x+y

D. x-y

Answer: C

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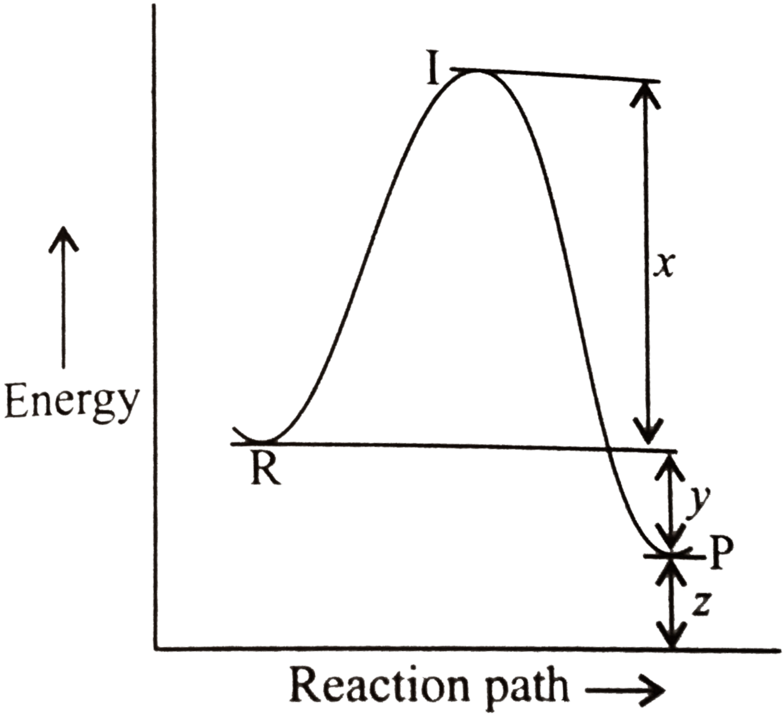
3. The energy profile diagram for the reaction:

$CO(g) + NO_2(g) \Leftrightarrow CO_2(g) + NO(g)$ is given below:



the heat of the reaction is

A. x

B. y

C. x+y

D. x-y

Answer: B

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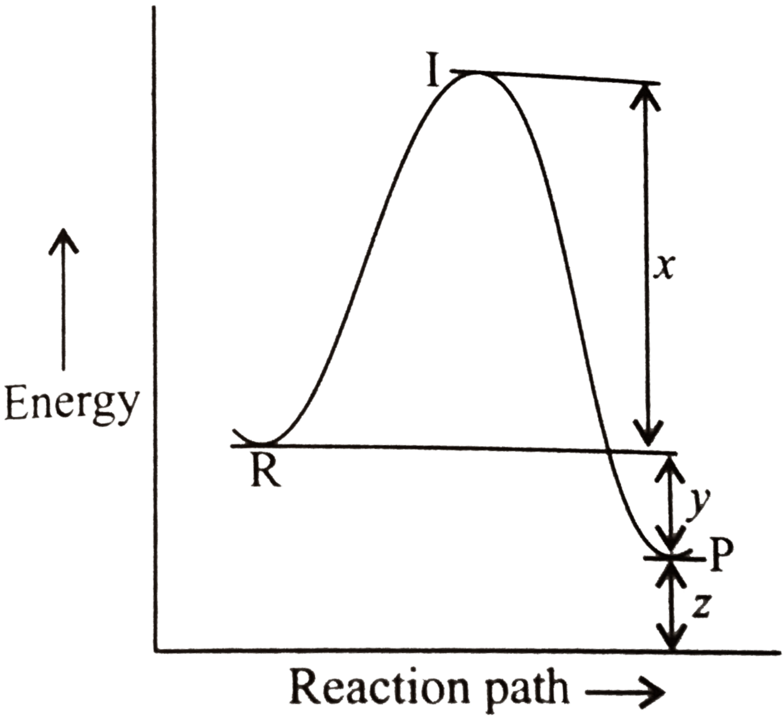
4. The energy profile diagram for the reaction:

$CO(g) + NO_2(g) \Leftrightarrow CO_2(g) + NO(g)$ is given below:



The threshold energy of the reaction is

A. x+y-z

B. x-y+z

C. x+y+x

D. x-y-z

Answer: C

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PASSAGE -3

1. Populatin growth of humans and bacteria follows first order growth kinetics. Suppose 50 bacteria are placed in a flask containing nutrients for the bacteria so that they can multiply . A study at $3.5^\circ C$ gave the following results :

Time (minutes)	0	15	30	45	60
Number of bacteria	100	200	400	800	1600

The rae constant of the first order growth of bacteria cab be calculated using :

A. $k = \frac{2.303}{t} \log_{10}\left(\frac{a}{a-x}\right)$

B. $k = -\frac{2.303}{t} \log\left(\frac{a}{a+x}\right)$

C. $tk = \frac{0.693}{t}$

D. $k = \frac{x}{t}$

Answer: B

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2. Populatin growth of humans and bacteria follows first order growth kinetics. Suppose 50 bacteria are placed in a flask containing nutrients for the bacteria so that they can multiply . A study at $3.5^{\circ}C$ gave the following results :

Time (minutes)	0	15	30	45	60
Number of bacteria	100	200	400	800	1600

Unit of rate constant for first order growth is:

A. $\min^{-1}$

B. $\min^{-2}$

C. $\min^{-3}$

D. unitless

Answer: A

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3. Populatin growth of humans and bacteria follows first order growth kinetics. Suppose 50 bacteria are placed in a flask containing nutrients for the bacteria so that they can multiply . A study at $3.5^{\circ}C$ gave the following results :

Time (minutes)	0	15	30	45	60
Number of bacteria	100	200	400	800	1600

The rate constant for the reaction is :

A. 0.0462min^{-1}

B. 0.462min^{-1}

C. 4.62min^{-1}

D. 46.2min^{-1}

Answer: A

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4. Suppose 50 bacterial are placed in a flask containing nutrients for the bacteria so that they can multiply. A study at $35^{\circ}C$ gave the following results:

Time: (minutes) $0, 15, 30, 45, 60$

Number of bacteria $100, , 200, 400, 800, 1600$

The rate of reaction initially is:

A. 4.62 bacteria per min

B. 23.1 bacteria per min

C. 23.1 bacteria per sec

D. 0.231 bacteria per sec

Answer: A

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5. Populatin growth of humans and bacteria follows first order growth kinetics. Suppose 50 bacteria are placed in a flask containing nutrients for the bacteria so that they can multiply . A study at $3.5^{\circ} C$ gave the following results :

Time (minutes)	0	15	30	45	60
Number of bacteria	100	200	400	800	1600

At what time, there will be 6400 bacteria in the flask?

A. 150 min

B. 90 min

C. 160 min

D. 120 min

Answer: B

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PASSAGE -4

1. The order of reaction is an experimentally determined quanity. It may be zero, poistive, negative, or fractional. The kinetic equation of nth order reaction is

$$k \times t = \frac{1}{(n-1)}\left[\frac{1}{(a-x)^{n-1}} - \frac{1}{a^{n-1}}\right] \text{ ...(i)}$$

Half life of nth order reaction depends on the initial concentration according to the following relation:

$t_{1/2} \propto \frac{1}{a^{n-1}}$ ...(ii)

The unit of the rate constant varies with the order but general relation for the unit of nth order reaction is

Units of $k = \left[\frac{1}{Conc}\right]^{n-1} \times \text{Time}^{-1}$ ...(iii)

The differential rate law for nth order reaction may be given as:

$\frac{dX}{dt} = k[A]^n$ ...(iv)

where A denotes the reactant.

The unit of rate and rate constant are same for

A. zero order reaction

B. first order reaction

C. Second order reaction

D. half order reaction

Answer: A

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2. The order of reaction is an experimentally determined quanity. It may be zero, poistive, negative, or fractional. The kinetic equation of nth order reaction is

$$k \times t = \frac{1}{(n-1)}\left[\frac{1}{(a-x)^{n-1}} - \frac{1}{a^{n-1}}\right] \text{ ...(i)}$$

Half life of nth order reaction depends on the initial concentration according to the following relation:

$$t_{1/2} \propto \frac{1}{a^{n-1}} \text{ ...(ii)}$$

The unit of the rate constant varies with the order but general relation for the unit of nth order reaction is

Units of $k = \left[\frac{1}{Conc}\right]^{n-1} \times \text{Time}^{-1}$ ...(iii)

The differential rate law for nth order reaction may be given as:

$$\frac{dX}{dt} = k[A]^n \text{ ...(iv)}$$

where A denotes the reactant.

The rate constant for zero order reaction is

where c_0 and c_t are concentration of reactants at respective times.

A. $k = \frac{C_0}{2t}$

B. $k = \frac{C_0 - C_t}{t}$

C. $k = \ln. \frac{C_0 - C_t}{2t}$

D. $k = \frac{C_0}{C_t}$

Answer: B

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3. The order of reaction is an experimentally determined quanity. It may be zero, poistive, negative, or fractional. The kinetic equation of nth order reaction is

$$k \times t = \frac{1}{(n-1)}\left[\frac{1}{(a-x)^{n-1}} - \frac{1}{a^{n-1}}\right] \text{ ...(i)}$$

Half life of nth order reaction depends on the initial concentration according to the following relation:

$$t_{1/2} \propto \frac{1}{a^{n-1}} \text{ ...(ii)}$$

The unit of the rate constant varies with the order but general relation for the unit of nth order reaction is

Units of $k = \left[\frac{1}{Conc}\right]^{n-1} \times \text{Time}^{-1}$ ...(iii)

The differential rate law for nth order reaction may be given as:

$$\frac{dX}{dt} = k[A]^n \text{ ...(iv)}$$

where A denotes the reactant.

The half life for a zero order reaction equals

A. $\frac{1}{2}\frac{k}{a^2}$

B. $\frac{a^2}{2k}$

C. $\frac{2k}{a}$

D. $\frac{a}{2k}$

Answer: D

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4. The order of reaction is an experimentally determined quanity. It may be zero, poistive, negative, or fractional. The kinetic equation of nth order reaction is

$$k \times t = \frac{1}{(n-1)}\left[\frac{1}{(a-x)^{n-1}} - \frac{1}{a^{n-1}}\right] \text{ ...(i)}$$

Half life of nth order reaction depends on the initial concentration according to the following relation:

$t_{1/2} \propto \frac{1}{a^{n-1}}$ ...(ii)

The unit of the rate constant varies with the order but general relation

for the unit of nth order reaction is

Units of $k = \left[\frac{1}{Conc}\right]^{n-1} \times \text{Time}^{-1}$ ...(iii)

The differential rate law for nth order reaction may be given as:

$\frac{dx}{dt} = k[A]^n$ ...(iv)

where A denotes the reactant.

For a reaction:

$I^{\ominus} + OCl^{\ominus} \to IO^{\ominus} + Cl^{\ominus}$

in an aqueous medium, the rate of the reaction is given by

$$\frac{d\left[IO^{\ominus}\right]}{dt} = k\frac{\left[I^{\ominus}\right]\left[OCl^{\ominus}\right]}{\left[\overset{\ominus}{O}H\right]}$$

The overall order of the reaction is

A. -1

B. 1

C. zero

D. 2

Answer: B

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5. The order of reaction is an experimentally determined quanity. It may be zero, poistive, negative, or fractional. The kinetic equation of nth order reaction is

$$k \times t = \frac{1}{(n-1)}\left[\frac{1}{(a-x)^{n-1}} - \frac{1}{a^{n-1}}\right] \text{ ...(i)}$$

Half life of nth order reaction depends on the initial concentration according to the following relation:

$$t_{1/2} \propto \frac{1}{a^{n-1}} \text{ ...(ii)}$$

The unit of the rate constant varies with the order but general relation for the unit of nth order reaction is

Units of $k = \left[\frac{1}{Conc}\right]^{n-1} \times \text{Time}^{-1}$ ...(iii)

The differential rate law for nth order reaction may be given as:

$$\frac{dx}{dt} = k[A]^n \text{ ...(iv)}$$

where A denotes the reactant.

In a chemical reaction $A \rightarrow B$, it is found that the rate of the reaction doubles when the concentration of A is increased four times. The order of the reaction with respect to A is:

A. 0

B. $1/2$

C. 1

D. 2

Answer: B

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PASSAGE -5

1. Conisder the reaction represented by the equation:

$CH_3Cl(g) + H_2O(g) \rightarrow CH_3OH(g) + HCl(g)$

These kinetics data were obtained for the given reaction concentrations:

Initial conc (M)		Initial rate of disappearance
$[CH_3Cl]$	$[H_2O]$	of $CH_3Cl(Ms^{-1})$
0.2	0.2	1
0.4	0.2	2
0.4	0.4	8

The rate law for the reaction will be

A. $r = k[CH_3Cl][H_2O]$

B. $r = k[CH_3Cl]^2[H_2O]$

C. $r = k[CH_3Cl][H_2O]^2$

D. $r = k[CH_3Cl]^2[H_2O]^4$

Answer: C

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2. Conisder the reaction represented by the equation:

$$CH_3Cl(g) + H_2O(g) \rightarrow CH_3OH(g) + HCl(g)$$

These kinetics data were obtained for the given reaction concentrations:

Initial conc (M)		Initial rate of disappearance of $CH_3Cl(Ms^{-1})$
$[CH_3Cl]$	$[H_2O]$	
0.2	0.2	1
0.4	0.2	2
0.4	0.4	8

Order with respect to $[CH_3Cl]$ will be

A. 0

B. 1

C. 2

D. 3

Answer: B

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3. Conisder the reaction represented by the equation:

$$CH_3Cl(g) + H_2O(g) \rightarrow CH_3OH(g) + HCl(g)$$

These kinetics data were obtained for the given reaction concentrations:

Initial conc (M)		Initial rate of disappearance
$[CH_3Cl]$	$[H_2O]$	of $CH_3Cl(Ms^{-1})$
0.2	0.2	1
0.4	0.2	2
0.4	0.4	8

Overall order of the reaction will be

A. 0

B. 1

C. 2

D. 3

Answer: D

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4. Conisder the reaction represented by the equation:

$$CH_3Cl(g) + H_2O(g) \rightarrow CH_3OH(g) + HCl(g)$$

These kinetics data were obtained for the given reaction concentrations:

Initial conc (M) $[CH_3Cl]$	$[H_2O]$	Initial rate of disappearance of $CH_3Cl(Ms^{-1})$
0.2	0.2	1
0.4	0.2	2
0.4	0.4	8

Unit of rate constant will be

A. sec^{-1}

B. $\text{litre}^2\text{mole}^2\text{sec}^{-1}$

C. $\text{litre mole}^2\text{sec}^{-1}$

D. $\text{mol litre}^{-1}\text{sec}^{-1}$

Answer: B

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5. Conisder the reaction represented by the equation:

$$CH_3Cl(g) + H_2O(g) \rightarrow CH_3OH(g) + HCl(g)$$

These kinetics data were obtained for the given reaction concentrations:

Initial conc (M)		Initial rate of disappearance
$[CH_3Cl]$	$[H_2O]$	of $CH_3Cl(Ms^{-1})$
0.2	0.2	1
0.4	0.2	2
0.4	0.4	8

If H_2O is taken in large excess, the order of the reaction will be

A. 1

B. 0

C. 3

D. 2

Answer: A

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SELF ASSESSMENT (SECTION-I)

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

$A_2 \Leftrightarrow A + A(\text{fast})$

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

$A + B \rightarrow AB$ (fast)

The order of the overall reaction is

A. 2

B. 1

C. $3/2$

D. $1/2$

Answer: C

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2. For a gaseous reaction, $A(g) \rightarrow$ Products, which one of the following is correct relation among $\frac{dp}{dt}, \frac{dn}{t}$ and $\frac{dc}{dt}$?
($\frac{dt}{dt}$ = Rate of reaction in atm $\sec^{-1}$, $\frac{dc}{dt}$ = Rate reaction in molarity $\sec^{-1}$, $\frac{dn}{dt}$ = Rate of reaction in mol $\sec^{-1}$)

A. $\frac{dc}{dt} = \frac{dc}{dt} = \frac{dP}{dt}$

B. $\frac{dc}{dt} = -\frac{1}{V}\frac{dn}{dt} = -\frac{dP}{dt}$

C. $\frac{dc}{dt} = \frac{V}{RT}\frac{dn}{dt} = \frac{dP}{dt}$

D. None of these

Answer: B

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3. The rate law for a reaction between 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 becomes

A. $\frac{1}{2^{m+n}}$

B. m+n

C. m-n

D. 2^{n-m}

Answer: D

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4. Reactant 'A' (initial concentration, a) reacts according to zero order kinetics, the time takews for the completion of the reaction is

A. $\frac{a}{k}$

B. $\frac{k}{a}$

C. $\frac{a}{2k}$

D. $\frac{2k}{a}$

Answer: A

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5. The rate constant for the reaction:

$2N_2O_5 \rightarrow 4NO_2 + O_2$ is $3.0 \times 10^{-5} \sec^{-1}$. If the rate is

$2.40 \times 10^{-5} M \sec^{-1}$, then the concentration of N_2O_5 (in M) is:`

A. 1.4

B. 1.2

C. 0.04

D. 0.8

Answer: D

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

A. 4

B. 3

C. 5

D. 2

Answer: A

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7. The oxidation of ammonia takes place as,

$4NH_2(g) \to 3O_2(g) \to 2N_2(g) + 6H_2O(g)$ If the rate of formation of $N_2 \text{is} 0.7M / s$, detemine the rate at which NH_3 is consumed.

A. $1.4 \text{mol} L^{-1} s^{-1}$

B. $0.7 \text{mol} L^{-1} s^{-1}$

C. $1.5 \text{mol} L^{-1} s^{-1}$

D. none of these

Answer: A

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8. Consider the reaction :

$$2H_2(g) + 2NO(g) \rightarrow N_2(g) + 2H_2(g)$$

The rate law for this reaction is :

Rate = $k[H_2][NO]^2$

Under what conditions could these steps represent mechanism?

$$\begin{array}{ll} \text{Step 1:} & 2NO(g) \Leftrightarrow N_2O_2(g) \\ \text{Step 2:} & N_2O_2 + H_2 \rightarrow N_2O + H_2O \\ \text{Step 3:} & N_2O + H_2 \rightarrow H_2O + N_2 \end{array}$$

A. These steps can never satisfy the rate law

B. Step 1 should be the slowest step

C. Step 2 should be the slowest step

D. Step 3 should be the slowest step

Answer: C

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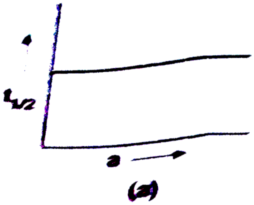
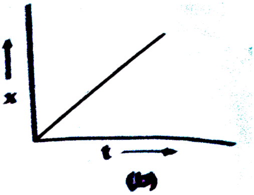
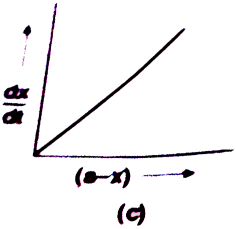
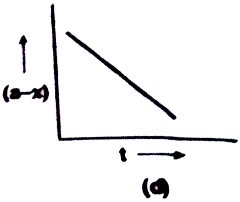
9. Which of the following is note for zero order reaction ?

A. 

B. 

C. 

D. 

Answer: C

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10.

$$\begin{array}{lll} I. & E_a = 15m\text{kJ mol}^{-1} & \Delta H = -70\text{kJ mol}^{-1} \\ II. & E_a = 30\text{kJ mol}^{-1} & \Delta H = -15\text{kJ mol}^{-1} \\ II. & E_a = 60\text{kJ mol}^{-1} & \Delta H = +250\text{kJ mol}^{-1} \end{array}$$

If above reactions are at same frequency factor then fastest and slowest reaction are:

A. III is fastest, II is slowest

B. I is fastest, III is slowest

C. II is fastest, III is slowest

D. III is fastest, I is slowest

Answer: B

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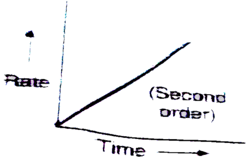
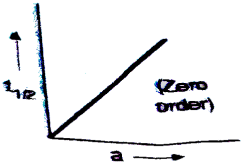
SELF ASSESSMENT (SECTION-II)

1. Which of the following graphs are correct?

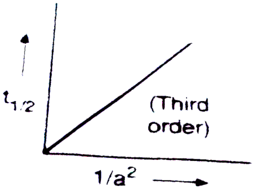
Here 'a' denotes intial concentration of reaction.

A. 

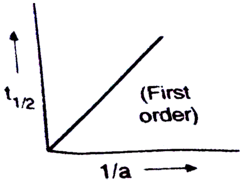
(a)

B. 

(b)

C. 

(c)

D. 

(d)

Answer: B::C

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2. Arrhenius equation may be given as :

A. $\ln. \frac{A}{k} = \frac{E_0}{RT}$

B. $\log A = \log k + \frac{E_a}{0.303RT}$

C. $\log\left[\frac{-\dot{E}_a}{RT}\right] = (k)$

D. $\frac{d\ln k}{dt} = \frac{E_a}{RT}$

Answer: A::B

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3. Which of the following is/are correct for second order reaction?

A. $t_{1/2}$ is inversely propotional to initial concentration

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

C. $k = \frac{2.303}{t}\log.\left(\frac{a}{a-x}\right)$

D. $k = \frac{1}{2t}\left[\frac{1}{(a-x)^2} - \frac{1}{a^2}\right]$

Answer: A::B

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4. For a first order reaction :

$A \rightarrow B$ with initial concentration =a

A. $t_{1/2} = \frac{k}{a}$

B. $t_{3/4} = 2t_{1/3}$

C. $t_{1/2} = \frac{0.693}{k}$

D. $t_{1/2} = k \times 0.693$

Answer: B::C

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5. For the first order reaction

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

A. The concentration of the reactantdecreases exponentially with time

B. The half-life of the reaction decreases with increasing temperature

C. The half-life of the reaction depends on the initial cocnetration of the reactant

D. The reaction proceeds to 99.6% completion in eight half-life duration

Answer: A::B::D

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6. Statement-1 , If temperature does not affect the rate of reaction $E_a = o.$

Because

Statement-2 : Lesser is the activation energy, slower is the rate.

A. Statement-1 is trre, Statement-2 is true, Statement-2 is a correct explantion for Statement-1

B. Statement-1 is true, Statement -2 is true, Statement-2 is not a correcte explanation for Statement-1

C. Statement-1 is true, Statement-2 is false.

D.

Answer: C

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7. Statement-2: In the reaction,

$NO_2(g) + CO(g) \rightarrow CO_2(g) + NO(g)$

Rate $= k[NO_2]^2$

The rate of reaction does not depend on the concentration of CO.

Because

Statement-2m: Carbon monoxide is involved in fast step.

A. Statement-1 is trre, Statement-2 is true, Statement-2 is a correct explantion for Statement-2

B. Statement-1 is true, Statement -2 is true, Statement-2 is not a correcte explanation for Statement-2

C. Statement-1 is true, Statement-2 is false.

D.

Answer: A

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8. Statement-2: The reciprocal of time in which 66% of the reactant is conveted to product is equal to the rate constant of first order reaction.

Because

Stetment-2 : The rate constant for first order reaction depends on initial concentration of reactants.

A. Statement-1 is trre, Statement-2 is true, Statement-2 is a correct explantion for Statement-2

B. Statement-1 is true, Statement -2 is true, Statement-2 is not a correcte explanation for Statement-2

C. Statement-1 is true, Statement-2 is false.

D. Both statement-1 and statement-2 are false

Answer: C

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MATRIX -MATCHING TYPE QUESTIONS (SECTION-IV)

1. Match the Column-I with Column-II :

	Column-I	Column-II
(a)	Rate of reaction	(p)May be fractional
(b)	Rate of constant	(q)Whole number
(c)	Order of reaction	(r)Indepdent of temperature
(d)	Molecularity of raction	(s)Increase with temperature

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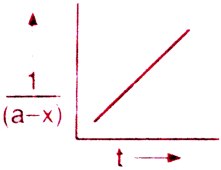
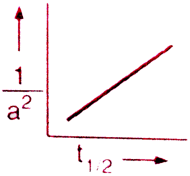
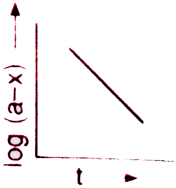
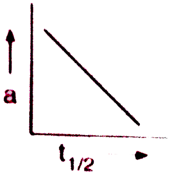
2. Match the Column-I with Column-II :

Column-I **(Order of reaction)**		Column-II (Graph)
(a) First order	(p)	
(b) Second order	(q)	
(c) Third order	(r)	
(d) Zero order	**(s)**	

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3. Match the Column-I with Column-II :

	Column-I	Column-II
(a)	First order	(p)Unit of$k = \sec^{-1}$
(b)	Pseudo first order	(q)Unit of$k = \text{dm}^6\text{mol}^{-2}s^{-1}$
(c)	Third order	$(r)t_{1/2} \propto 1/a^2$
(d)	second order	$(s)t_{1/2} \propto \frac{1}{a}$

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INTEGER ANSWER TYPE QUESTIONS (SECTIN-V)

1. When the initial cocentration of the reaction is doubled, the half-life is also doubled. The order of the reaction will be :

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2. Rate constant of reaction increases (2^n) times. Temperature coefficient of this reaction is '2' initial and final temperature of the reaction is $25^\circ C$ and $115^\circ C$. What will be the value of 'n'?

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3. The order of a reaction having rate constant $1.34 \times 10^{-3} \text{mol} L^{-1} \sec^{-1}$ will be :

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LINKED COMPRESHENSION TYPE QUESTIONS (SECTION-VI)

1. The rate of chemical reaction are strongly affected by temperature . Arrhenius (1889) gave following relation between rate contant and temperature .

$$k = Ae^{-E_a/RT} \qquad \text{.....} (i)$$

This equation is called Arrhenius equation. The constant 'A' is caleld Arrhenius of pre-exponential factor. Logarithm of equation (i) given :

$$\log_{10} k = \log_{10} A \frac{E_a}{2.3030RT} \qquad \text{.....} (ii)$$

The rate constant for a reaction is .

$$\log_{10} \sec^{-1} = 14 - \frac{1.25 \times 10^4 K}{T} \qquad \text{.....} (iii)$$

The pre-exponential factor or frequency factor of the reaction under consideration is :

A. $1.25 \times 10^4 \sec^{-1}$

B. $10^{-14} \sec^{-1}$

C. $10^{14} \sec^{-1}$

D. $14 \sec^{-1}$

Answer: C

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2. The rate of chemical reaction are strongly affected by temperature . Arrhenius (1889) gave following relation between rate contant and temperature .

$$k = Ae^{-E_a/RT} \qquad \ldots..(i)$$

This equation is called Arrhenius equation. The constant 'A' is caleld Arrhenius of pre-exponential factor. Logarithm of equation (i) given :

$$\log_{10} k = \log_{10} A \frac{E_a}{2.3030RT} \qquad \ldots..(ii)$$

The rate constant for a reaction is .

$$\log_{10} \sec^{-1} = 14 - \frac{1.25 \times 10^4 K}{T} \qquad \ldots . (iii)$$

At what temperature, rate constant of the reaction is equal to the pre-exponenntial factor ?

A. T=0K

B. $T = \infty K$

C. $T = \frac{1.25 \times 10^4}{14} K$

D. $T = \frac{14}{1.25 \times 10^4 K}$

Answer: B

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3. The rate of chemical reaction are strongly affected by temperature . Arrhenius (1889) gave following relation between rate contant and temperature .

$$k = Ae^{-E_a / RT} \qquad \ldots . (i)$$

This equation is called Arrhenius equation. The constant 'A' is caleld

Arrhenius of pre-exponential factor. Logarithm of equation (i) given :

$$\log_{10} k = \log_{10} A \frac{E_a}{2.3030RT} \qquad \ldots..(ii)$$

The rate constant for a reaction is .

$$\log_{10} \sec^{-1} = 14 - \frac{1.25 \times 10^4 K}{T} \qquad \ldots..(iii)$$

Energy of activation in K cal mol^{-1} is:

A. $14K\text{cal mol}^{-1}$

B. $57.6K\text{cal mol}^{-1}$

C. $1.25 \times 10^4 K\text{cal mol}^{-1}$

D. $\frac{14}{1.25 \times 10^4} K\text{cal mol}^{-1}$

Answer: B

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4. The rate of chemical reaction are strongly affected by temperature . Arrhenius (1889) gave following relation between rate contant and temperature .

$$k = Ae^{-E_a/RT} \qquad \ldots..(i)$$

This equation is called Arrhenius equation. The constant 'A' is caleld Arrhenius of pre-exponential factor. Logarithm of equation (i) given :

$$\log_{10} k = \log_{10} A \frac{E_a}{2.3030RT} \qquad \ldots . (ii)$$

The rate constant for a reaction is .

$$\log_{10} \sec^{-1} = 14 - \frac{1.25 \times 10^4 K}{T} \qquad \ldots . (iii)$$

The intercept of the plot oc $\log_{10} k$ agianst 1/T is equal to:

A. $\log_{10} A$

B. A

C. $\frac{E_a}{2.303A}$

D. E_a

Answer: A

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