CHEMISTRY

BOOKS - KALYANI CHEMISTRY (ENGLISH)

CHEMICAL KINETICS

EXAMPLE

1. Consider the reaction,

$aA + bB \rightarrow cD.$

if 4M of A are allowed to react with 2 Mof B and concentration of A after 4 seconds is 3 M, calculate the rate of reaction. Mention it in terms of A as well as D.

2. Ammonia and oxygen react at high temperature as :

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

In an experiment, rate of formation of NO is 2.4×10^{-3} mol $L^{-}s^{-}$.

Calculate

rate of disappearance of ammonia

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4. In a reaction, $2A \rightarrow$ Products, the concentration of A decreases from 0.5 mol L^{-1} to 0.4 mol L^{-1} in 10 minutes. Calculate the rate during this interval?

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5. The reaction $A + 3B \rightarrow 2C$ obeys the rate equation Rate $= k[A]^{1/2}[B]^{3/2}$

What is the order of the reaction ?

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6. The reaction $A + B \rightarrow C$ has zero order. Write rate equation.

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7. A reaction is of second order with respect to a reactant. How will the rate of reaction be affected if the concentration of this reactant is doubled

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8. A reaction is of second order with respect to a reactant. How will the rate of reaction be affected if the concentration of this reactant is reduced to half?

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9. For the reaction $2A + B \rightarrow A_2B$, the rate $= k[A][B]^2$ with $k = 2.0 \times 10^{-6} M^{-2} s^{-1}$. Calculate the initial rate of the reaction when [A] = 0.1M, [B] = 0.2 M. If the rate of reverse reaction is negligible then calculate the rate of reaction after [A] is reduced to 0.06 M.

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10. Time required to decompose SO_2Cl_2 to half of its initial amount is 60 minutes. If the decomposition is a first order reaction, calculate the rate constant of the reaction.

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11. A first order reaction has a rate constant of $1.15 \times 10^{-3} s^{-1}$ How long will 5 g of this reactant take to reduce to 3g?

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12. The decomposition of a compound is found to follow a first order rate law. If it takes 15 minutes for 20 per cent of original material to react, calculate.

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13. The decomposition of a compound is found to follow a first order rate law. If it takes 15 minutes for 20 per cent of original material to react, calculate.

the time at which 10% of the original material remains unreacted.

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14. The thermal decomposition of HCO_2H is a first order reaction with a rate constant of $2.4 \times 10^{-3} s^{-1}$ at a certain temperature. Calculate how long will it take for three-fourth of initial quantity of HCO_2H to decompose. (log 0.25 =-0.6021)

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$4PH_3(g) \rightarrow P_4(g) + 6H_2(g)$

It is found that the reaction follows the following rate equation:

Rate $= k[PH_3]$

The half-life of PH_3 is 37.9s at 120° C.

How much time is required for 3/4th of PH_3 to decompose?

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The half-life of PH_3 is 37.9s at 120°C.

What fraction of the original sample of PH_3 remains behind after 1 minute?

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17. A reactant has a half-life of 10 minutes.

Calculate the rate constant for the first order reaction.

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18. A reactant has a half-life of 10 minutes.

What fraction of the reactant will be left after an hour of the reaction has occurred ?

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19. Rate constant k for first order reaction has been found to be $2.54 \times 10^{-3} s^{-1}$. Calculate its three-fourth life.

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20. A first order gas reaction

$$A_2B_{2(g)} \rightarrow 2A_{(g)} + 2B_{(g)}$$

at the temperature $400^{\circ} C$ has the rate constant $k = 2.0 \times 10^{-4} s^{-1}$. What percentage of A_2B_2 is decomposed on heating for 900 seconds?

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21. A first order reaction takes 40 minutes for 30% decomposition. Calculate $t_{1/2}$ for this reaction (Given log 1.428 = 0.1548)

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22. For a first order reaction show that time required for 99% completion is twise the time required for the complation of 90% of reaction .

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23. The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume :

$SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_{2(g)}$

Experiment	Time/s	Total pressure/atm
1	0	0.4
2	100	0.7

Calculate the rate constant

(given : log $4 = 0.6021, \log 2 = 0.3010$)

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in gas phase at 318 K are given below:

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Find the half-life period for the reaction

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30. In a reaction between A and B, the initial rate of reaction was measured for different initial concentrations of A and B as given below:

A/M	0.20	0.20	0.40
B/M	0.30	0.10	0.05
r_0/Ms^{-1}	5.07×10^{-5}	5.07×10^{-5}	7.6×10^{-5}

What is the order of reaction with respect to A and B ?

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31. The following rate data were obtained at 303 K for the following reaction :

$2A + B \rightarrow C + D$

Experiment	[A] mol L^-	[B] mol L^-	Initial rate of formation of D
I	0.1	0.1	6.0×10^{-3} mol L^- min^-
II	0.3	0.2	7.2×10^{-2} mol L^- min^-
III	0.3	0.4	2.88×10^{-1} mol L^- min^-
IV	0.4	0.1	2.4×10^{-2} mol L^- min^-

What is the rate law? What is the order with respect to each reactant and the overall order? What are the units of rate constant?

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t (seconds)	1200	1800	2400	∞
x (mL)	11.4	15.53	18.90	34.75

where x denotes the volume of oxygen evolved in seconds. Show that reaction is of first order and also calculate the rate constant.

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[Ester]/M	0.55	0.31	0.17	0.085

Calculate the average rate of reaction between the time interval 30 to 60 seconds.

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Calculate the pseudo first order rate constant for the hydrolysis of ester.

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t (sec) :	0	360	720
P (mm Hg) :	35.00	54.00	63

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Pressure in mm. Hg	707	79	3.5
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the experimentally determined rate expression below 400 K is: rate $= k[NO_2]^2$. What mechanism can be proposed for the above reaction ?

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42. Nitric oxide reacts with oxygen to produce nitrogen dioxide.

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

What is the predicted rate law and order if the mechanism is:

$(i) NO + O_2 \overset{K}{\Longleftrightarrow} NO_3$ (fast)

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$K_1 = 2.15 \times 10^{-8} Lmol^{-1} s^{-1} at 650K$

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Calculate the value of activation energy for this reaction. (R = $8.314 JK^{-1} mol^{-1}$)

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The rate constant is$6.0 \times 10^{-4} s^{-1}$ at 300 K and activation energy is $3.05 \times 10^5 J mol^{-1}$. What is the value of rate constant at 310 K? [R = $8.314 JK^{-1} mol^{-1}$]

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50. The rate constant for the decomposition of N2O5 at various temperatures is given below:

$\left(\#\#KAL_K LC_I SC_C HE_X II_C 04_S LV_{051} \_ Q01. png \text{ width=80 \% } > Draw$

30^@ C and 50^@` C.

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51. Rate constant 'k' of a reaction varies with temperature 'T' according to the equation:

$$\log, K = \log A - \frac{E_a}{2.303R}\left(\frac{1}{T}\right)$$

where E_a is the activation energy. When a graph is plotted for logk vs (1)/(T)$astraightl \in ewithaslopeof - 4250Kisobta \in ed. Calc\underline{a}te$‘E_a '$f$ or $thereaction. (R = 8.314$JK^(-1) mol^(-1)`)

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61. The rate of the reaction

$2N_2O_5 \rightarrow 4NO_2 + O_2$

can be written in three ways:

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

$$\frac{d[NO_2]}{dt} = k'[N_2O_5]$$
$$\frac{d[O_2]}{dt} = k''[N_2O_5]$$

The relationship between k and k' and between k and k" are-

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Calculate the rate constant for the first order reaction.

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(given : log $4 = 0.6021$, $\log 2 = 0.3010$)

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Find the half-life period for the reaction

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What is rate law?

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A/M	0.20	0.20	0.40
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r_0/Ms^{-1}	5.07×10^{-5}	5.07×10^{-5}	7.6×10^{-5}

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III	0.3	0.4	2.88×10^{-1} mol L^{-} min^{-}
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102. The rate constant for the decomposition of N2O5 at various temperatures is given below:

$\left(\#\#KAL_{K}LC_{I}SC_{C}HE_{X}II_{C}04_{S}LV_{051}\_Q01.png \text{ width=80\%} > Draw\right.$

30^@ C and 50^@` C.

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103. Rate constant 'k' of a reaction varies with temperature 'T' according to the equation:

$$\log K = \log A - E_{a} = \frac{E_{a}}{2.303R}\left(\frac{1}{T}\right)$$

where E_{a} is the activation energy. When a graph is plotted for log

, $k vs \frac{1}{T}$ a straight line with a slope of - 4250 K is obtained. Calculate 'E_a' for the reaction. (R= 8.314 $JK^{-1}mol^{-1}$)

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104. Consider the reaction,

$aA + bB \to cD.$

if 4M of A are allowed to react with 2 Mof B and concentration of A after 4 seconds is 3 M, calculate the rate of reaction. Mention it in terms of A as well as D.

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105. Ammonia and oxygen react at high temperature as :

$4NH_3(g) + 5O_2(g) \to 4NO(g) + 6H_2O(g)$

In an experiment, rate of formation of NO is 2.4×10^{-3} mol $L^- s^-$. Calculate

rate of disappearance of ammonia

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106. Ammonia and oxygen react at high temperature as :

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

In an experiment, rate of formation of NO is 2.4×10^{-3} mol $L^{-}s^{-}$.

Calculate

rate of formation of water.

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107. In a reaction, $2A \rightarrow$ Products, the concentration of A decreases from 0.5 mol L^{-1} to 0.4 mol L^{-1} in 10 minutes. Calculate the rate during this interval?

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108. The reaction $A + 3B \rightarrow 2C$ obeys the rate equation Rate $= k[A]^{1/2}[B]^{3/2}$

What is the order of the reaction ?

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109. The reaction $A + B \rightarrow C$ has zero order. Write rate equation.

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110. A reaction is of second order with respect to a reactant. How will the rate of reaction be affected if the concentration of this reactant is doubled

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111. A reaction is of second order with respect to a reactant. How will the rate of reaction be affected if the concentration of this reactant is reduced to half?

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112. For the reaction $2A + B \rightarrow A_2B$, the rate $= k[A][B]^2$ with $k = 2.0 \times 10^{-6} M^{-2} s^{-1}$. Calculate the initial rate of the reaction when [A] = 0.1M, [B] = 0.2 M. If the rate of reverse reaction is negligible then calculate the rate of reaction after [A] is reduced to 0.06 M.

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113. Time required to decompose SO_2Cl_2 to half of its initial amount is 60 minutes. If the decomposition is a first order reaction, calculate the rate constant of the reaction.

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114. A first order reaction has a rate constant of $1.15 \times 10^{-3} s^{-1}$ How long will 5 g of this reactant take to reduce to 3g?

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115. The decomposition of a compound is found to follow a first order rate law. If it takes 15 minutes for 20 per cent of original material to react, calculate.

the rate constant

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116. The decomposition of a compound is found to follow a first order rate law. If it takes 15 minutes for 20 per cent of original material to react, calculate.

the time at which 10% of the original material remains unreacted.

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117. The thermal decomposition of HCO_2H is a first order reaction with a rate constant of $2.4 \times 10^{-3} s^{-1}$ at a certain temperature. Calculate how long will it take for three-fourth of initial quantity of HCO_2H to decompose. (log 0.25 =-0.6021)

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118. The decomposition of phosphine, PH_3 proceeds according to the following equation:

$4PH_3(g) \rightarrow P_4(g) + 6H_2(g)$

It is found that the reaction follows the following rate equation:

Rate $= k[PH_3]$

The half-life of PH_3 is 37.9s at 120°C.

How much time is required for 3/4th of PH_3 to decompose?

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119. The decomposition of phosphine, PH_3 proceeds according to the following equation:

$4PH_3(g) \rightarrow P_4(g) + 6H_2(g)$

It is found that the reaction follows the following rate equation:

Rate $= k[PH_3]$

The half-life of PH_3 is 37.9s at 120°C.

What fraction of the original sample of PH_3 remains behind after 1 minute?

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120. A reactant has a half-life of 10 minutes.

Calculate the rate constant for the first order reaction.

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121. A reactant has a half-life of 10 minutes.

What fraction of the reactant will be left after an hour of the reaction has occurred ?

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122. Rate constant k for first order reaction has been found to be $2.54 \times 10^{-3} s^{-1}$. Calculate its three-fourth life.

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123. A first order gas reaction

$A_2B_{2(g)} \rightarrow 2A_{(g)} + 2B_{(g)}$

at the temperature $400^\circ C$ has the rate constant $k = 2.0 \times 10^{-4} s^{-1}$.

What percentage of A_2B_2 is decomposed on heating for 900 seconds?

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124. A first order reaction takes 40 minutes for 30% decomposition. Calculate $t_{1/2}$ for this reaction (Given log 1.428 = 0.1548)

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125. For a first order reaction show that time required for 99% completion is twise the time required for the complation of 90% of reaction .

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126. The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume :

$SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_{2(g)}$

Experiment	Time/s	Total pressure/atm
1	0	0.4
2	100	0.7

Calculate the rate constant

(given : log $4 = 0.6021, \log 2 = 0.3010$)

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127. The experimental data for decomposition of

$N_2O_5[2N_2O_5 \rightarrow 4NO_2 + O_2]$

in gas phase at 318 K are given below:

$(\#\#KAL_KLC_ISC_CHE_XII_C04_SLV_{025}\_Q01.png \text{ width=80 \%} > Plot$

[N_2 O_5]` against

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128. The experimental data for decomposition of

$N_2O_5[2N_2O_5 \rightarrow 4NO_2 + O_2]$

in gas phase at 318 K are given below:

` (##KAL_KLC_ISC_CHE_XII_C04_SLV_026_Q01.png" width="80%">

Find the half-life period for the reaction

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129. The experimental data for decomposition of

$N_2O_5[2N_2O_5 \rightarrow 4NO_2 + O_2]$

in gas phase at 318 K are given below:

$(\#\#KAL_K LC_I SC_C HE_X II_C 04_S LV_{027} - Q01.\,png \ \ \text{width=80}\,\% \ > Drawa$

[N_2 O_5]` and t .

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130. The experimental data for decomposition of

$N_2O_5[2N_2O_5 \rightarrow 4NO_2 + O_2]$

in gas phase at 318 K are given below:

`(##KAL_KLC_ISC_CHE_XII_C04_SLV_028_Q01.png" width="80%">

What is rate law?

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131. The experimental data for decomposition of

$N_2O_5[2N_2O_5 \rightarrow 4NO_2 + O_2]$

in gas phase at 318 K are given below:

`(##KAL_KLC_ISC_CHE_XII_C04_SLV_029_Q01.png" width="80%">

Calculate the rate constant.

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132. The experimental data for decomposition of

$N_2O_5[2N_2O_5 \rightarrow 4NO_2 + O_2]$

in gas phase at 318 K are given below:

`(##KAL_KLC_ISC_CHE_XII_C04_SLV_030_Q01.png" width="80%">

Calculate the half life period fromk and compare with (b).

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133. In a reaction between A and B, the initial rate of reaction was measured for different initial concentrations of A and B as given below:

A/M	0.20	0.20	0.40
B/M	0.30	0.10	0.05
r_0/Ms^{-1}	5.07×10^{-5}	5.07×10^{-5}	7.6×10^{-5}

What is the order of reaction with respect to A and B ?

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134. The following rate data were obtained at 303 K for the following reaction :

$2A + B \rightarrow C + D$

Experiment	[A] mol L^{-}	[B] mol L^{-}	Initial rate of formation of D
I	0.1	0.1	6.0×10^{-3} mol L^{-} min^{-}
II	0.3	0.2	7.2×10^{-2} mol L^{-} min^{-}
III	0.3	0.4	2.88×10^{-1} mol L^{-} min^{-}
IV	0.4	0.1	2.4×10^{-2} mol L^{-} min^{-}

What is the rate law? What is the order with respect to each reactant and the overall order? What are the units of rate constant?

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135. The following results were obtained in the decomposition of N_2O_5 in CCl_4 at 315 K:

t (seconds)	1200	1800	2400	∞
x (mL)	11.4	15.53	18.90	34.75

where x denotes the volume of oxygen evolved in seconds. Show that reaction is of first order and also calculate the rate constant.

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136. In a pseudo first order hydrolysis of ester in water, the following results were obtained:

t/s	0	30	60	90
[Ester]/M	0.55	0.31	0.17	0.085

Calculate the average rate of reaction between the time interval 30 to 60 seconds.

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137. In a pseudo first order hydrolysis of ester in water, the following results were obtained:

t/s	0	30	60	90
[Ester]/M	0.55	0.31	0.17	0.085

Calculate the pseudo first order rate constant for the hydrolysis of ester.

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138. From the following data for the decomposition of azoisopropane at 543 K into hexane and nitrogen, calculate the average value of rate constant and also show that it is a first order reaction.

t (sec) :	0	360	720
P (mm Hg) :	35.00	54.00	63

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139. The decomposition of H_2O, is a first order reaction. When 5 mL portions of H_2O_2 are titrated with $KMnO_4$ solution at the start of the reaction and 5 minutes later, the volumes of KMnO4 solution required are 37.0 mL and 29.5 mL respectively. Calculate the rate constant of the reaction.

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140. From the following data, show that the decomposition of hydrogen peroxide is a reaction of the first order

$(\#\#KAL_KLC_ISC_CHE_XII_C04_SLV_{038}\_Q01.png\ \ \text{width=80}\,\% > where$

KMnO_4` solution required for titrating the same volume of the reaction mixture.

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141. The half-life of a chemical reaction at a particular concentration is 50 minutes. When the concentration is doubled, the half-life become 100 minutes. Find out the order of the reaction.

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142. The half-life period for the thermal decomposition of phosphine at three different pressures are given below:

Pressure in mm. Hg	707	79	3.5
Half-life period in seconds	84	84	83

Find the order of the reaction.

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143. In the thermal decomposition of a gaseous substance, the time taken for the decomposition of half of the reactants was 105 minutes when the initial pressure was 750 mm and 950 minutes when the initial pressure was 250 mm. Find the order of reaction.

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144. For the reaction

$NO_2(g) + CO(g) \rightarrow CO_2(g) + NO(g)$

the experimentally determined rate expression below 400 K is: rate $= k[NO_2]^2$. What mechanism can be proposed for the above reaction ?

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145. Nitric oxide reacts with oxygen to produce nitrogen dioxide.

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

What is the predicted rate law and order if the mechanism is:

$(i) NO + O_2 \overset{K}{\Longleftrightarrow} NO_3$ (fast)

$(ii) NO_3 + NO \overset{K_1}{\Longleftrightarrow} NO_2 + NO_2$ (slow)

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146. Suggest a mechanism for the decomposition of ozone, O_3 into O_2.

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147. Explain the mechanism of the photochemical reaction occurring between hydrogen and chlorine gas.

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148. For a decomposition reaction, the values of rate constant k at two different temperatures are given below:

$K_1 = 2.15 \times 10^{-8} Lmol^{-1}s^{-1} at 650K$

$K_2 = 2.39 \times 10^{-7} Lmols^{-1} at 700K$

Calculate the value of activation energy for this reaction. (R = $8.314 JK^{-1}mol^{-1}$)

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149. The decomposition of phosphine $4PH_3(g) \rightarrow P_4(g) + 6H_2(g)$ has the rate law, Rate $= k[PH_3]$

The rate constant is$6.0 \times 10^{-4} s^{-1}$ at 300 K and activation energy is $3.05 \times 10^{5} J mol^{-1}$. What is the value of rate constant at 310 K? [R = $8.314 J K^{-1} mol^{-1}$]

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150. In general, it is observed that the rate of a chemical reaction doubles with every 10° rise in temperature. If this generalisation holds for a reaction in the temperature range 298 K to 308 K, what would be the value of activation energy for this reaction ? (R $= 8.314 J K^{-1} mol^{-1}$)

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151. The slope of the line in the graph of logk (k = rate constant) versus $\frac{1}{T}$ for a reaction is - 5841 K. Calculate the energy of activation for this reaction. [R $= 8.314 J K^{-1} mol^{-}$]

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152. The activation energy of a reaction is 75.2 kJ mol^{-1} in the absence of a catalyst and 50.14 kJ mol^{-1} with a catalyst. How many times will the rate of reaction grow in the presence of the catalyst if the reaction proceeds at $25^{\circ}C$? $[R = 8.314 JK^{-1}$ mole^{1}]

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153. The rate constant for the decomposition of N2O5 at various temperatures is given below:

$\left(##KAL_{K}LC_{I}SC_{C}HE_{X}II_{C}04_{S}LV_{051}\_Q01.png\ \text{width=80\%} > Draw$

30^@ C and 50^@` C.

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154. Rate constant k of a reaction varies with temperature according to equation:

$\log k =$ constant $- \dfrac{E_a}{2.303R} \cdot \dfrac{1}{T}$

What is the activation energy for the reaction. When a graph is plotted for log k versus $\frac{1}{T}$ a straight line with a slope-6670 K is obtained. Calculate energy of activation for this reaction (R=8.314 $JK^{-1}mol^{-}$ 1)

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PROBLEM

1. From the data given below, calculate the average rate of the reaction :

$C_4H_9Cl + H_2O \rightarrow C_4H_9OH + HCl$ during different intervals of time.

t/s	0	50	100	150	200
$[C_4H_9Cl]$/mol L^{-1}	0.100	0.0905	0.0820	0.0741	0.0671
t/s	300	400	700	800	
$[C_4H_9Cl]$/mol L^{-1}	0.0549	0.0439	0.0210	0.017	

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2. When 50 mL of 2M solution of N_2O_5 was heated, 0.28 L of O_2 at NTP was formed after 30 minutes. Calculate the concentration of unreacted N_2O_5 at that time and also find the average rate of reaction.

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3. Consider the following reaction which proceeds in a closed vessel.

$3X \rightarrow 2Y + Z$

The rate of disappearance of $X, \ -\dfrac{\Delta[X]}{\Delta t}$ is found to be 0.075 mol $L^{-} s^{-}$ calculate $\dfrac{\Delta[y]}{\Delta t}$ and $\dfrac{\Delta[Z]}{\Delta t}$

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4. Express the rate of following reactions

$PCl_5 \rightarrow PCl_3 + Cl_2$

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5. Express the rate of following reactions

$2NO_2 \rightarrow 2NO + O_2$

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6. Express the rate of following reactions.

$H_2 + I_2 \Leftrightarrow 2HI$

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7. Express the rate of following reactions.

$N_2 + 3H_2 \Leftrightarrow 2NH_3$

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8. Identify the reaction order from each of the following rate constants

$(i)k = 3 \times 10^{-5} s^{-}$

$(ii)k = 9 \times 10^{-4} mol^{-} \text{litre } \ s^{-}$

$(iii)k = 6 \times 10^{-2}$ litre $mol^{-} s^{-}$

$(iv)k = 2.3 \times 10^{-5} Lmol^{-1} s^{-1}$

$(v)k = 3 \times 10^{-3} molL^{-1} s^{-1}$

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9. Nitrogen dioxide (NO_2) reacts with fluorine (F_2) to yield nitryl fluoride (NO_2F).

$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of formation of NO_2F

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10. Nitrogen dioxide (NO_2) reacts with fluorine (F_2) to yield nitryl fluoride (NO_2F).

$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of disappearance of NO_2

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11. Nitrogen dioxide (NO_2) reacts with fluorine (F_2) to yield nitryl fluoride (NO_2F).

$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of disappearance of F_2

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12. For the reaction, $X + Y \rightarrow Z$, the rate is given as $k[X]^{1/3}[Y]^1$.

Calculate the order of the reaction.

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13. Carbonyl chloride gas decomposes to give carbon monoxide gas and chlorine gas

$COCl_2(g) \rightarrow CO(g) + Cl_2(g)$

It follows the rate law: rate. $= K[COCI_2]^{1/3}$ Calculate the units of its rate constant.

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14. The reaction $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$ is of first order in N_2O_5. Its rate constant is $6.2 \times 10^{-6}s^{-}$. If in the beginning, $[N_2O_5]$ is 15 mol L^{-}, calculate the rate of reaction in the beginning.

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15. Consider the following first order reaction.

$2H_2O_2(aq) \xrightarrow{I^{-}(aq)} 2H_2O(l) + O_2(g)$

If the rate constant of the reaction is $1.01 \times 10^{-2} \overline{\min}$

What concentration of H_2O_2 would give rate of $1.12 \times 10^{-2} molL^{-} \overline{\min}$?

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16. Consider the following first order reaction.

$2H_2O_2(aq) \xrightarrow{I^{-}(aq)} 2H_2O(l) + O_2(g)$

If the rate constant of the reaction is $1.01 \times 10^{-2} \overline{\min}$

Calculate rate of reaction when $[H_2O_2] = 0.5 molL^{-}$

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17. For the reaction 2X+Y+Z $\rightarrow X_2YZ$, the rate equation is : Rate $= k[X][Y]^2$ with k $= 3.0 \times 10^{-6} mol^{-2} L^2 s^{-}$ If[X]=0.1 mol L^{-} ,[Y]=0.2 mol L-and [Z]=0.7 molL^{-}, determine

the initial rate of reaction.

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18. For the reaction 2X+Y+Z $\rightarrow X_2YZ$, the rate equation is : Rate $= k[X][Y]^2$ with k $= 3.0 \times 10^{-6} mol^{-2} L^2 s^{-}$ If[X]=0.1 mol L^{-} ,[Y]=0.2 mol L-and [Z]=0.7 molL^{-}, determine

the rate after 0.02 mole of X has been reacted.

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19. A substance decomposes following first order kinetics. If the half-life of the reaction is 35 minutes, what is the rate constant of reaction ?

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20. The rate constant of a first order reaction is $2.31 \times 10^{-2} s^{-1}$. What will be the time required for the initial concentration, 0.1M, of the reactant to be reduced to 0.05 M?

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21. The half-life period of a first order reaction is 60 minutes. What percentage of the reactant will be left behind after 120 minutes ?

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22. A first order reaction is 15% complete in 20 minutes. In what time will the reaction 60% complete ?

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23. Decomposition of a gas is of first order. It takes 80 minutes for 80% of the gas to be decomposed when its initial concentration is 8×10^{-3} mole/litre. Calculate the specific reaction rate.

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24. The half-life of a first order reaction is 30 min.

Calculate the specific rate constant of the reaction.

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25. The half-life of a first order reaction is 30 min.

What fraction of the reactant remains after 70 min?

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26. The half-life of a first order reaction is 30 min.

How long would be required for 25% of the reactant to be decomposed ?

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27. The reaction $SO_2Cl_2 \Leftrightarrow SO_2 + Cl_2$ is a first order gas reaction with $t_{1/2} = 3.15 \times 10^4 s$at 320°C. What percentage of SO_2Cl_2 is decomposed on heating this gas for 90 minutes ?

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28. Show that in case of a first order reaction, the time required for 99.9% of the reaction to take place is about ten times than that required for half the reaction.

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29. The following rate data were obtained at 300 K for the reaction

$2A + B \rightarrow C + D$

$$2A + B \longrightarrow C + D$$

Experiment No.	[A] mol L^{-}	[B] mol L^{-}	Rate of formation of D mol L^{-} min^{-}
1.	0.1	0.1	5.0×10^{-3}
2.	0.3	0.2	6.0×10^{-2}
3.	0.3	0.4	2.4×10^{-1}
4.	0.4	0.1	2.0×10^{-2}

Calculate the rate of formation of D when : [A]=0.5 mol L^{-} and [B]=0.2 mol L^{-}

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30. The rate of reaction, $2NO + Cl_2 \rightarrow 2NOCI$ is doubled when concentration of Cl_2 is doubled and it becomes 8 times when concentrations of both NO and Cl_2 are doubled. Deduce the order of this reaction.

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31. For the following reaction,

$$2H_2 + 2NO \Leftrightarrow 2H_2O + N_2$$

the following rate data was obtained

Experiment	[NO] (mol L^{-1})	[H_2] (mol L^{-1})	rate (mol L^{-1} s^{-1})
1	0.40	0.40	4.8×10^{-3}
2	0.80	0.40	19.2×10^{-3}
3	0.40	0.80	9.6×10^{-3}

Determine the rate equation and calculate the value of rate constant, k.

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32. The initial concentration of N_2O_5 in the following first order reaction, $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ was $1.24 \times 10^{-2} molL^{-1}$ at 318 K. The concentration of N_2O_5 after 60 minutes was $0.20 \times 10^{-2} molL^{-1}$. Calculate the rate constant of the reaction at 318 K.

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33. For the thermal decomposition of azomethane, $CH_3N_2CH_3$ at 600 K to N_2 and C_2H_6 the following data was obtained:

t (sec)	0	1000	2000	3000	4000
P_A (10^{-2} torr)	8.20	5.72	3.99	2.78	1.94

where P_A is the partial pressure of azomethane. Show that the decomposition is a first order reaction and find the rate constant.

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34. The following data were obtained during the first order thermal decomposition of N_2O_5(g) at constant volume:

$2N_2O_5(g) \rightarrow 2N_2O_4(g) + O_2(g)$

S.No.	Time/s	Total pressure/atm
1.	0	0.5
2.	100	0.512

Calculate rate constant.

Watch Video Solution

35. Hydrolysis of methyl acetate in aqueous solution has been studied by titrating the liberated acetic acid against sodium hydroxide. The concentration of the ester at different times is given below:

t/min	0	30	60	90
C/mol L^{-1}	0.8500	0.8004	0.7538	0.7096

Show that it follows a pseudo first order reaction, as the concentration of water remains nearly constant (55 mol L^{-1}) during the course of the reaction. What is the value of k'in this equation? Rate $= k'[CH_3COOCH_3][H_2O]$

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36. The kinetics of hydrolysis of methyl acetate in excess of hydrochloric acid solution at 298K were followed by withdrawing 2 mL of the reaction mixture at intervals of time (t), adding 50 mL of water and titrating against baryta-water. The following results were obtained :

t (min)	0	10	28	58	115	∞
Titre (mL)	18.5	19.1	20.1	21.6	24.6	34.8

Determine the velocity constant of the hydrolysis.

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37. While studying the kinetics of the reaction involving conversion of ammonium cyanate into urea, the following data were obtained:

Time (min)	0	45	72	157
Unchanged ammonium cyanate	0.0916	0.0740	0.0656	0.0512

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38. For the reaction $A \rightarrow B + C$, the following data were obtained

Time in second	0	900	1800
Concentration of A	60.6	19.7	7.82

find the order of the reaction .

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39. The optical rotation of sucrose in 0.90 N HCl at various times is given below:

Time (minutes)	0	7.18	18	27.04	∞
Rotation (degrees)	+24.09	+21.4	+17.7	+15	−10.74

find the order of reaction

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40. The half-life period of a substance is 50 minutes at a certain concentration. When the concentration is reduced to one half of the initial concentration, the half-life period is 25 minutes. Calculate order of the reaction.

Watch Video Solution

41. At a certain temperature, the half-life period for the decomposition for the substance A is as follows:

P (mm)	500	700	900 mm
Half-life period	18	17.9	18

what is order of reaction ?

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42. Following data were obtained for the catalytic decomposition of ammonia :

Initial pressure (mm)	50	100	200
Half-life (hrs)	3.52	1.92	1.00

Find the order of reaction.

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43. The rate constants of a reaction at 500 K and 700 K are $0.02s^{-1}$ and $0.07s^{-1}$ respectively. Calculate the values of E_a and A.

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44. The first order rate constant for the decomposition of ethyl iodide by the reaction $C_2H_5I_{(g)} \rightarrow C_2H_4(g) + HI_{(g)}$ at 600 K is $1.60 \times 10^{-5}s^{-1}$. Its energy of activation is 209 kJ/mol. Calculate the rate constant of the reaction at 700 K.

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45. The value of rate constant for a second order reaction is $6.7 \times 10^{-5} mol^{-} Ls^{-}$ at 298 K and $1.64 \times 10^{-4} mol^{-} Ls^{-}$ at 313 K. Find the Arrhenius frequency factor A and activation energy of the reaction.

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46. Rate constant k of a reaction varies with temperature according to equation:

$\log k =$ constant $- \frac{E_a}{2.303R} \cdot \frac{1}{T}$

What is the activation energy for the reaction. When a graph is plotted for log k versus $\frac{1}{T}$ a straight line with a slope-6670 K is obtained. Calculate energy of activation for this reaction (R=8.314 $JK^{-1} mol^{-}$ 1)

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47. If a first order reaction has activation energy of 25000 cal and a frequency factor of $5 \times 10^{12} \sec^{-1}$, at what temperature will the reaction rate have a half-life of

1 minute

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48. If a first order reaction has activation energy of 25000 cal and a frequency factor of $5 \times 10^{12} \sec^{-1}$, at what temperature will the reaction rate have a half-life of

1 minute

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49. The activation energy for a first order reaction is 60 kJ mol^{-1} in the absence of a catalyst and 50 kJ mol^{-1} in the presence of a catalyst. How many times will the rate of reaction grow in the presence of the catalyst if the reaction proceeds at 27° C ?

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50. For a reaction, the energy of activation is zero. What is the value of rate constant at 300 K, if $k = 1.6 \times 10^6 s^{-1}$ at 280 K?

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51. The rate constant for the decomposition of hydrocarbons is $2.418 \times 10^{-5} s^{-1}$ at 546 K. If the energy of activation is $179.9 kJ / mol$, what will be the value of pre-exponential factor.

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52. The decomposition of a hydrocarbon follows the equationk $= (4.5 \times 10^{11} s^{-1}) e^{-28000} \dfrac{K}{T}$. Calculate E_a.

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53. The rate of a reaction triples when temperature changes from 50° C to 100°C. Calculate the energy of activation for such a reaction. (

$R = 8.314 JK^{-1} mol^{-1} \log 3 = 0.4771)$

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54. A certain reaction is 50% complete in 20 minutes at 300 K and the same reaction is again 50% complete in 5 minutes at 350 K, Calculate the activation energy if it is a first order reaction. [$R = 8.314 JK^{-1} mol^{-1}, \log 4 = 0.602]$

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55. The rate of a reaction increases four times when the temperature changes from 300 K to 320 K. Calculate the energy of activation of the reaction, assuming that it does not change with temperature. (R = 8.314 $JK^{-1} mol^{-1}$)

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56. From the data given below, calculate the average rate of the reaction :

$C_4H_9Cl + H_2O \rightarrow C_4H_9OH + HCl$ during different intervals of time.

t/s	0	50	100	150	200
$[C_4H_9Cl]/mol\ L^{-1}$	0.100	0.0905	0.0820	0.0741	0.0671
t/s	300	400	700	800	
$[C_4H_9Cl]/mol\ L^{-1}$	0.0549	0.0439	0.0210	0.017	

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57. When 50 mL of 2M solution of N_2O_5 was heated, 0.28 L of O_2 at NTP was formed after 30 minutes. Calculate the concentration of unreacted N_2O_5 at that time and also find the average rate of reaction.

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58. Consider the following reaction which proceeds in a closed vessel.

$3X \rightarrow 2Y + Z$

The rate of disappearance of X, $-\dfrac{\Delta[X]}{\Delta t}$ is found to be 0.075 mol $L^{-}s^{-}$ calculate $\dfrac{\Delta[y]}{\Delta t}$ and $\dfrac{\Delta[Z]}{\Delta t}$

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59. Express the rate of following reactions

$PCl_5 \rightarrow PCl_3 + Cl_2$

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60. Express the rate of following reactions

$2NO_2 \rightarrow 2NO + O_2$

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61. Express the rate of following reactions.

$H_2 + I_2 \Leftrightarrow 2HI$

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62. Express the rate of following reactions.

$N_2 + 3H_2 \Leftrightarrow 2NH_3$

Watch Video Solution

63. Identify the reaction order from each of the following rate constants

$(i) k = 3 \times 10^{-5} s^{-}$

$(ii) k = 9 \times 10^{-4} mol^{-} \text{litre} \ \ s^{-}$

$(iii) k = 6 \times 10^{-2}$ litre $mol^{-} s^{-}$

$(iv) k = 2.3 \times 10^{-5} Lmol^{-1} s^{-1}$

$(v) k = 3 \times 10^{-3} molL^{-1} s^{-1}$

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64. Nitrogen dioxide (NO_2) reacts with fluorine (F_2) to yield nitryl fluoride (NO_2F).

$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of formation of NO_2F

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65. Nitrogen dioxide (NO_2) reacts with fluorine (F_2) to yield nitryl fluoride (NO_2F).

$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of disappearance of NO_2

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$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of disappearance of F_2

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67. For the reaction, $X + Y \rightarrow Z$, the rate is given as $k[X]^{1/3}[Y]^1$.

Calculate the order of the reaction.

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68. Carbonyl chloride gas decomposes to give carbon monoxide gas and chlorine gas

$COCl_2(g) \rightarrow CO(g) + Cl_2(g)$

It follows the rate law: rate. $= K[COCI_2]^{1/3}$ Calculate the units of its rate constant.

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69. The reaction $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$ is of first order in N_2O_5. Its rate constant is $6.2 \times 10^{-6} s^{-}$. If in the beginning, $[N_2O_5]$ is 15 mol L^{-} , calculate the rate of reaction in the beginning.

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70. Consider the following first order reaction.

$2H_2O_2(aq) \xrightarrow{I^-(aq)} 2H_2O(l) + O_2(g)$

If the rate constant of the reaction is $1.01 \times 10^{-2} \overline{\min}$

What concentration of H_2O_2 would give rate of $1.12 \times 10^{-2} molL^- \overline{\min}$?

Watch Video Solution

71. Consider the following first order reaction.

$2H_2O_2(aq) \xrightarrow{I^-(aq)} 2H_2O(l) + O_2(g)$

If the rate constant of the reaction is $1.01 \times 10^{-2} \overline{\min}$

Calculate rate of reaction when $[H_2O_2] = 0.5 molL^-$

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72. For the reaction 2X+Y+Z $\rightarrow X_2YZ$, the rate equation is : Rate $= k[X][Y]^2$ with k $= 3.0 \times 10^{-6} mol^{-2} L^2 s^-$ If[X]=0.1 mol L^- ,[Y]=0.2 mol L-and [Z]=0.7 molL^-, determine

the initial rate of reaction.

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73. For the reaction 2X+Y+Z $\rightarrow X_2YZ$, the rate equation is : Rate $= k[X][Y]^2$ with k $= 3.0 \times 10^{-6} mol^{-2} L^2 s^-$ If[X]=0.1 mol L^- ,[Y]=0.2 mol L-and [Z]=0.7 molL^-, determine

the rate after 0.02 mole of X has been reacted.

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74. A substance decomposes following first order kinetics. If the half-life of the reaction is 35 minutes, what is the rate constant of reaction ?

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75. The rate constant of a first order reaction is $2.31 \times 10^{-2} s^{-1}$. What will be the time required for the initial concentration, 0.1M, of the reactant to be reduced to 0.05 M?

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76. The half-life period of a first order reaction is 60 minutes. What percentage of the reactant will be left behind after 120 minutes ?

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77. A first order reaction is 15% complete in 20 minutes. In what time will the reaction 60% complete ?

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78. Decomposition of a gas is of first order. It takes 80 minutes for 80% of the gas to be decomposed when its initial concentration is 8×10^{-3} mole/litre. Calculate the specific reaction rate.

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Calculate the specific rate constant of the reaction.

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80. The half-life of a first order reaction is 30 min.

What fraction of the reactant remains after 70 min?

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81. The half-life of a first order reaction is 30 min.

How long would be required for 25% of the reactant to be decomposed ?

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82. The reaction $SO_2Cl_2 \Leftrightarrow SO_2 + Cl_2$ is a first order gas reaction with $t_{1/2} = 3.15 \times 10^4 s$at 320°C. What percentage of SO_2Cl_2 is decomposed on heating this gas for 90 minutes ?

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83. Show that in case of a first order reaction, the time required for 99.9% of the reaction to take place is about ten times than that required for half the reaction.

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84. The following rate data were obtained at 300 K for the reaction

$2A + B \rightarrow C + D$

$2A + B \longrightarrow C + D$

Experiment No.	[A] mol L^{-}	[B] mol L^{-}	Rate of formation of D mol L^{-} min^{-}
1.	0.1	0.1	5.0×10^{-3}
2.	0.3	0.2	6.0×10^{-2}
3.	0.3	0.4	2.4×10^{-1}
4.	0.4	0.1	2.0×10^{-2}

Calculate the rate of formation of D when : [A]=0.5 mol L^{-} and [B]=0.2 mol L^{-}

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85. The rate of reaction, $2NO + Cl_2 \rightarrow 2NOCI$ is doubled when concentration of Cl_2 is doubled and it becomes 8 times when concentrations of both NO and Cl_2 are doubled. Deduce the order of this reaction.

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86. For the following reaction,

$2H_2 + 2NO \Leftrightarrow 2H_2O + N_2$

the following rate data was obtained

Experiment	[NO] (mol L^{-1})	[H_2] (mol L^{-1})	rate (mol L^{-1} s^{-1})
1	0.40	0.40	4.8×10^{-3}
2	0.80	0.40	19.2×10^{-3}
3	0.40	0.80	9.6×10^{-3}

Determine the rate equation and calculate the value of rate constant, k.

87. The initial concentration of N_2O_5 in the following first order reaction, $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ was $1.24 \times 10^{-2} molL^{-1}$ at 318 K. The concentration of N_2O_5 after 60 minutes was $0.20 \times 10^{-2} molL^{-1}$. Calculate the rate constant of the reaction at 318 K.

88. For the thermal decomposition of azomethane, $CH_3N_2CH_3$ at 600 K to N_2 and C_2H_6 the following data was obtained:

t (sec)	0	1000	2000	3000	4000
P_A (10^{-2} torr)	8.20	5.72	3.99	2.78	1.94

where P_A is the partial pressure of azomethane. Show that the decomposition is a first order reaction and find the rate constant.

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89. The following data were obtained during the first order thermal decomposition of N_2O_5(g) at constant volume:

$2N_2O_5(g) \rightarrow 2N_2O_4(g) + O_2(g)$

S.No.	Time/s	Total pressure/atm
1.	0	0.5
2.	100	0.512

Calculate rate constant.

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90. Hydrolysis of methyl acetate in aqueous solution has been studied by titrating the liberated acetic acid against sodium hydroxide. The concentration of the ester at different times is given below:

t/min	0	30	60	90
C/mol L^{-1}	0.8500	0.8004	0.7538	0.7096

Show that it follows a pseudo first order reaction, as the concentration of water remains nearly constant (55 mol L^{-1}) during the course of the reaction. What is the value of k'in this equation? Rate $= k'[CH_3COOCH_3][H_2O]$

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91. The kinetics of hydrolysis of methyl acetate in excess of hydrochloric acid solution at 298K were followed by withdrawing 2 mL of the reaction mixture at intervals of time (t), adding 50 mL of water and titrating against baryta-water. The following results were obtained :

t (min)	0	10	28	58	115	∞
Titre (mL)	18.5	19.1	20.1	21.6	24.6	34.8

Determine the velocity constant of the hydrolysis.

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92. While studying the kinetics of the reaction involving conversion of ammonium cyanate into urea, the following data were obtained:

Time (min)	0	45	72	157
Unchanged ammonium cyanate	0.0916	0.0740	0.0656	0.0512

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93. For the reaction $A \rightarrow B + C$, the following data were obtained

Time in second	0	900	1800
Concentration of A	60.6	19.7	7.82

find the order of the reaction .

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94. The optical rotation of sucrose in 0.90 N HCl at various times is given below:

Time (minutes)	0	7.18	18	27.04	∞
Rotation (degrees)	+24.09	+21.4	+17.7	+15	−10.74

find the order of reaction

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95. The half-life period of a substance is 50 minutes at a certain concentration. When the concentration is reduced to one half of the initial concentration, the half-life period is 25 minutes. Calculate order of the reaction.

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96. At a certain temperature, the half-life period for the decomposition for the substance A is as follows:

P (mm)	500	700	900 mm
Half-life period	18	17.9	18

what is order of reaction ?

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97. Following data were obtained for the catalytic decomposition of ammonia :

Initial pressure (mm)	50	100	200
Half-life (hrs)	3.52	1.92	1.00

Find the order of reaction.

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98. The rate constants of a reaction at 500 K and 700 K are $0.02s^{-1}$ and $0.07s^{-1}$ respectively. Calculate the values of E_a and A.

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99. The first order rate constant for the decomposition of ethyl iodide by the reaction $C_2H_5I_{(g)} \rightarrow C_2H_4(g) + HI_{(g)}$ at 600 K is $1.60 \times 10^{-5}s^{-1}$. Its energy of activation is 209 kJ/mol. Calculate the rate constant of the reaction at 700 K.

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100. The value of rate constant for a second order reaction is $6.7 \times 10^{-5} mol^{-} Ls^{-}$ at 298 K and $1.64 \times 10^{-4} mol^{-} Ls^{-}$ at 313 K. Find the Arrhenius frequency factor A and activation energy of the reaction.

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101. Rate constant k of a reaction varies with temperature according to equation:

$\log k =$ constant $- \frac{E_a}{2.303R} \cdot \frac{1}{T}$

What is the activation energy for the reaction. When a graph is plotted for log k versus $\frac{1}{T}$ a straight line with a slope-6670 K is obtained. Calculate energy of activation for this reaction (R=8.314 $JK^{-1} mol^{-}$ 1)

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102. If a first order reaction has activation energy of 25000 cal and a frequency factor of $5 \times 10^{12} \sec^{-1}$, at what temperature will the reaction rate have a half-life of

1 minute

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111. From the data given below, calculate the average rate of the reaction :

$C_4H_9Cl + H_2O \rightarrow C_4H_9OH + HCl$ during different intervals of time.

t/s	0	50	100	150	200
$[C_4H_9Cl]$/mol L^{-1}	0.100	0.0905	0.0820	0.0741	0.0671
t/s	300	400	700	800	
$[C_4H_9Cl]$/mol L^{-1}	0.0549	0.0439	0.0210	0.017	

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112. When 50 mL of 2M solution of N_2O_5 was heated, 0.28 L of O_2 at NTP was formed after 30 minutes. Calculate the concentration of unreacted N_2O_5 at that time and also find the average rate of reaction.

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113. Consider the following reaction which proceeds in a closed vessel.

$3X \rightarrow 2Y + Z$

The rate of disappearance of X, $-\frac{\Delta[X]}{\Delta t}$ is found to be 0.075 mol $L^{-}s^{-}$ calculate $\frac{\Delta[y]}{\Delta t}$ and $\frac{\Delta[Z]}{\Delta t}$

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114. Express the rate of following reactions

$PCl_5 \rightarrow PCl_3 + Cl_2$

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115. Express the rate of following reactions

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116. Express the rate of following reactions.

$H_2 + I_2 \Leftrightarrow 2HI$

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117. Express the rate of following reactions.

$N_2 + 3H_2 \Leftrightarrow 2NH_3$

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118. Identify the reaction order from each of the following rate constants

$(i)k = 3 \times 10^{-5} s^{-}$

$(ii)k = 9 \times 10^{-4} mol^{-} \text{litre} \quad s^{-}$

$(iii)k = 6 \times 10^{-2}$ litre $mol^{-} s^{-}$

$(iv)k = 2.3 \times 10^{-5} Lmol^{-1} s^{-1}$

$(v)k = 3 \times 10^{-3} molL^{-1} s^{-1}$

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119. Nitrogen dioxide (NO_2) reacts with fluorine (F_2) to yield nitryl fluoride (NO_2F).

$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of formation of NO_2F

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120. Nitrogen dioxide (NO_2) reacts with fluorine (F_2) to yield nitryl fluoride (NO_2F).

$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of disappearance of NO_2

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121. Nitrogen dioxide (NO_2) reacts with fluorine (F_2) to yield nitryl fluoride (NO_2F).

$2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$

Write the rate of reaction in terms of

rate of disappearance of F_2

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$COCl_2(g) \rightarrow CO(g) + Cl_2(g)$

It follows the rate law: rate. $= K[COCI_2]^{1/3}$ Calculate the units of its rate constant.

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124. The reaction $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$ is of first order in N_2O_5. Its rate constant is $6.2 \times 10^{-6}s^{-}$. If in the beginning, $[N_2O_5]$ is 15 mol L^{-} , calculate the rate of reaction in the beginning.

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125. Consider the following first order reaction.

$$2H_2O_2(aq) \xrightarrow{I^-(aq)} 2H_2O(l) + O_2(g)$$

If the rate constant of the reaction is $1.01 \times 10^{-2}\ \overline{\min}$

What concentration of H_2O_2 would give rate of $1.12 \times 10^{-2} molL^{-}\ \overline{\min}\ ?$

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$$2H_2O_2(aq) \xrightarrow{I^-(aq)} 2H_2O(l) + O_2(g)$$

If the rate constant of the reaction is $1.01 \times 10^{-2}\ \overline{\min}$

Calculate rate of reaction when $[H_2O_2] = 0.5 molL^{-}$

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127. For the reaction 2X+Y+Z $\rightarrow X_2YZ$, the rate equation is : Rate $= k[X][Y]^2$ with k $= 3.0 \times 10^{-6} mol^{-2} L^2 s^-$ If[X]=0.1 mol L^- ,[Y]=0.2 mol L-and [Z]=0.7 molL^-, determine

the initial rate of reaction.

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the rate after 0.02 mole of X has been reacted.

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130. The rate constant of a first order reaction is $2.31 \times 10^{-2} s^{-1}$. What will be the time required for the initial concentration, 0.1M, of the reactant to be reduced to 0.05 M?

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133. Decomposition of a gas is of first order. It takes 80 minutes for 80% of the gas to be decomposed when its initial concentration is 8×10^{-3} mole/litre. Calculate the specific reaction rate.

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Calculate the specific rate constant of the reaction.

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What fraction of the reactant remains after 70 min?

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136. The half-life of a first order reaction is 30 min.

How long would be required for 25% of the reactant to be decomposed ?

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137. The reaction $SO_2Cl_2 \Leftrightarrow SO_2 + Cl_2$ is a first order gas reaction with $t_{1/2} = 3.15 \times 10^4 s$at 320°C. What percentage of SO_2Cl_2 is decomposed on heating this gas for 90 minutes ?

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138. Show that in case of a first order reaction, the time required for 99.9% of the reaction to take place is about ten times than that required for half the reaction.

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139. The following rate data were obtained at 300 K for the reaction

$2A + B \rightarrow C + D$

$2A + B \longrightarrow C + D$

Experiment No.	[A] mol L^{-}	[B] mol L^{-}	Rate of formation of D mol L^{-} min^{-}
1.	0.1	0.1	5.0×10^{-3}
2.	0.3	0.2	6.0×10^{-2}
3.	0.3	0.4	2.4×10^{-1}
4.	0.4	0.1	2.0×10^{-2}

Calculate the rate of formation of D when : [A]=0.5 mol L^{-} and [B]=0.2 mol L^{-}

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140. The rate of reaction, $2NO + Cl_2 \rightarrow 2NOCI$ is doubled when concentration of Cl_2 is doubled and it becomes 8 times when concentrations of both NO and Cl_2 are doubled. Deduce the order of this reaction.

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141. For the following reaction,

$$2H_2 + 2NO \Leftrightarrow 2H_2O + N_2$$

the following rate data was obtained

Experiment	[NO] (mol L^{-1})	[H_2] (mol L^{-1})	rate (mol L^{-1} s^{-1})
1	0.40	0.40	4.8×10^{-3}
2	0.80	0.40	19.2×10^{-3}
3	0.40	0.80	9.6×10^{-3}

Determine the rate equation and calculate the value of rate constant, k.

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142. The initial concentration of N_2O_5 in the following first order reaction, $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ was $1.24 \times 10^{-2} molL^{-1}$ at 318 K. The concentration of N_2O_5 after 60 minutes was $0.20 \times 10^{-2} molL^{-1}$. Calculate the rate constant of the reaction at 318 K.

Watch Video Solution

143. For the thermal decomposition of azomethane, $CH_3N_2CH_3$ at 600 K to N_2 and C_2H_6 the following data was obtained:

t (sec)	0	1000	2000	3000	4000
P_A (10^{-2} torr)	8.20	5.72	3.99	2.78	1.94

where P_A is the partial pressure of azomethane. Show that the decomposition is a first order reaction and find the rate constant.

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144. The following data were obtained during the first order thermal decomposition of N_2O_5(g) at constant volume:

$2N_2O_5(g) \rightarrow 2N_2O_4(g) + O_2(g)$

S.No.	Time/s	Total pressure/atm
1.	0	0.5
2.	100	0.512

Calculate rate constant.

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145. Hydrolysis of methyl acetate in aqueous solution has been studied by titrating the liberated acetic acid against sodium hydroxide. The concentration of the ester at different times is given below:

t/min	0	30	60	90
C/mol L^{-1}	0.8500	0.8004	0.7538	0.7096

Show that it follows a pseudo first order reaction, as the concentration of water remains nearly constant (55 mol L^{-1}) during the course of the reaction. What is the value of k'in this equation? Rate $= k'[CH_3COOCH_3][H_2O]$

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146. The kinetics of hydrolysis of methyl acetate in excess of hydrochloric acid solution at 298K were followed by withdrawing 2 mL of the reaction mixture at intervals of time (t), adding 50 mL of water and titrating against baryta-water. The following results were obtained :

t (min)	0	10	28	58	115	∞
Titre (mL)	18.5	19.1	20.1	21.6	24.6	34.8

Determine the velocity constant of the hydrolysis.

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147. While studying the kinetics of the reaction involving conversion of ammonium cyanate into urea, the following data were obtained:

Time (min)	0	45	72	157
Unchanged ammonium cyanate	0.0916	0.0740	0.0656	0.0512

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Time in second	0	900	1800
Concentration of A	60.6	19.7	7.82

find the order of the reaction .

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149. The optical rotation of sucrose in 0.90 N HCl at various times is given below:

Time (minutes)	0	7.18	18	27.04	∞
Rotation (degrees)	+24.09	+21.4	+17.7	+15	−10.74

find the order of reaction

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150. The half-life period of a substance is 50 minutes at a certain concentration. When the concentration is reduced to one half of the initial concentration, the half-life period is 25 minutes. Calculate order of the reaction.

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151. At a certain temperature, the half-life period for the decomposition for the substance A is as follows:

P (mm)	500	700	900 mm
Half-life period	18	17.9	18

what is order of reaction ?

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152. Following data were obtained for the catalytic decomposition of ammonia :

Initial pressure (mm)	50	100	200
Half-life (hrs)	3.52	1.92	1.00

Find the order of reaction.

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153. The rate constants of a reaction at 500 K and 700 K are $0.02s^{-1}$ and $0.07s^{-1}$ respectively. Calculate the values of E_a and A.

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154. The first order rate constant for the decomposition of ethyl iodide by the reaction $C_2H_5I_{(g)} \rightarrow C_2H_4(g) + HI_{(g)}$ at 600 K is $1.60 \times 10^{-5}s^{-1}$. Its energy of activation is 209 kJ/mol. Calculate the rate constant of the reaction at 700 K.

Watch Video Solution

155. The value of rate constant for a second order reaction is $6.7 \times 10^{-5} mol^{-} Ls^{-}$ at 298 K and $1.64 \times 10^{-4} mol^{-} Ls^{-}$ at 313 K. Find the Arrhenius frequency factor A and activation energy of the reaction.

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156. Rate constant k of a reaction varies with temperature according to equation:

$$\log k = \text{constant} - \frac{E_a}{2.303R} \cdot \frac{1}{T}$$

What is the activation energy for the reaction. When a graph is plotted for log k versus $\frac{1}{T}$ a straight line with a slope-6670 K is obtained. Calculate energy of activation for this reaction (R=8.314 $JK^{-1} mol^{-}$ 1)

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157. If a first order reaction has activation energy of 25000 cal and a frequency factor of $5 \times 10^{12} \sec^{-1}$, at what temperature will the reaction rate have a half-life of

1 minute

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Watch Video Solution

159. The activation energy for a first order reaction is 60 kJ mol^{-1} in the absence of a catalyst and 50 kJ mol^{-1} in the presence of a catalyst. How many times will the rate of reaction grow in the presence of the catalyst if the reaction proceeds at 27°C ?

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160. For a reaction, the energy of activation is zero. What is the value of rate constant at 300 K, if $k = 1.6 \times 10^6 s^{-1}$ at 280 K?

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161. The rate constant for the decomposition of hydrocarbons is $2.418 \times 10^{-5} s^{-1}$ at 546 K. If the energy of activation is $179.9 kJ / mol$, what will be the value of pre-exponential factor.

Watch Video Solution

162. The decomposition of a hydrocarbon follows the equationk $= \left(4.5 \times 10^{11} s^{-1}\right) e^{-28000 \frac{K}{T}}$. Calculate E_a.

Watch Video Solution

163. The rate of a reaction triples when temperature changes from 50° C to 100°C. Calculate the energy of activation for such a reaction. ($R = 8.314 JK^{-1} mol^{-1} \log 3 = 0.4771$)

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164. A certain reaction is 50% complete in 20 minutes at 300 K and the same reaction is again 50% complete in 5 minutes at 350 K, Calculate the activation energy if it is a first order reaction. [$R = 8.314 JK^{-1} mol^{-1}, \log 4 = 0.602$]

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165. The rate of a reaction increases four times when the temperature changes from 300 K to 320 K. Calculate the energy of activation of the reaction, assuming that it does not change with temperature. (R = 8.314 $JK^{-1} mol^{-1}$)

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INTEXT QUESRTIONS

1. What is reaction rate ?

Watch Video Solution

2. Why is that instantaneous rate of reaction does not change when a part of the reaction solution is withdrawn?

Watch Video Solution

3. For the reaction :

$A + H_2O \rightarrow B$ rate $\propto [A]$ what is its molecularity

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4. For the reaction :

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order of reaction ?

Watch Video Solution

5. For a reaction A $\rightarrow$ B, the rate of reaction can be denoted by $-\frac{dA}{dt}$ or $\frac{dB}{dt}$ State the significance of plus and minus signs in this case.

Watch Video Solution

6. What are the units of rate constant for a first order reaction?

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7. Why in general a reaction does not proceed with a uniform rate throughout?

Watch Video Solution

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8. When is the rate of reaction equal to specific reaction rate ?

Watch Video Solution

9. Give one example of a fractional order reaction.

Watch Video Solution

10. Rate of a reaction is given by the equation : Rate $= k[A]^2[B]$. What are the units for the rate and the rate constant for this reaction?

Watch Video Solution

11. Write the units of rate of a zero order reaction.

Watch Video Solution

12. The rate law for the reaction: Ester+H^{+} Acid + Alcohol is

$$\frac{dx}{dt} = k\,[\text{Ester}\,]\left[H^{+}\right]^{0}$$

What would be the effect on the rate if

concentration of ester is doubled

Watch Video Solution

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for a zero order reaction

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20. If concentration is expressed in mol L^{-1} units and time in seconds, what would be the units of k

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Watch Video Solution

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23. Rate of chlorination of methane is accelerated by light. Explain.

Watch Video Solution

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65. Write the units of rate of a zero order reaction.

Watch Video Solution

66. The rate law for the reaction: Ester+H^+ Acid + Alcohol is

$$\frac{dx}{dt} = k\,[\text{Ester}]\left[H^+\right]^0$$

What would be the effect on the rate if

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Watch Video Solution

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EXERCISE (PART- I (OBJECTIVE QUESRTIONS)A.FILL IN THE BLANKS)

1. In most reactions, the rate of reaction doubles or triples for ...... degree rise in temperature.

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2. A negative catalyst .... the activation energy.

Watch Video Solution

3. The order of a reaction rarely exceeds ....

Watch Video Solution

4. The order of reaction may .... same as molecularity of the same reaction.

Watch Video Solution

5. Threshold energy is always .... than activation energy.

Watch Video Solution

6. The rate of reaction .... with increase in temperature.

Watch Video Solution

7. The temperature coefficient of a reaction is the ratio of the rate constants at temperatures differing by ......

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8. The second order reaction becomes first order if one of reactants is ......

Watch Video Solution

9. Threshold energy minus the energy which the molecules actually possess is called ....

Watch Video Solution

10. The hydrolysis of ethyl acetate in .... medium is...... order reaction.

Watch Video Solution

11. .... of molecules containing more than activation energy is indicated by Boltzmann's curve

Watch Video Solution

12. Which reaction order obeys the expression $T_{1/2} = \frac{1}{K.A}$ in chemical kinetics ....?

Watch Video Solution

13. A catalyst decreases .... of a reaction.

Watch Video Solution

14. For a relatively fast reaction, the rate constant is relatively.............and half-change time is relatively............. .

Watch Video Solution

15. Reaction with low activation energy are .... and the reactions with high activation energy are ....

Watch Video Solution

16. Effective colliosions are those in which colloiding molecules must have energy equal or greater than the .... energy and proper ....

Watch Video Solution

17. In the equation k = A $e^{-Ea/RT}$, the constant A is known as .... factor and the equation is known as .... equation.

Watch Video Solution

18. The unit of the rate of reaction is .... and the unit of first order rate constant is

Watch Video Solution

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EXERCISE (PART- I (OBJECTIVE QUESRTIONS)B.COMPLE THE FOLLOWING STATEMENTS BY SELECTING THE CORRECT ALTERNATIVE FROM THE CHOICES GIVEN)

1. The role of a catalyst is to change

A. Gibbs energy of reaction

B. enthalpy of reaction

C. activation energy of reaction

D. equilibrium constant.

Answer: C

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

A. increases

B. decreases

C. remains unchanged

D. may increase or decrease.

Answer: C

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

A. determining the rate constant at standard temperature

B. determining the rate constant at two temperatures

C. determining probability of collision

D. using catalyst.

Answer: B

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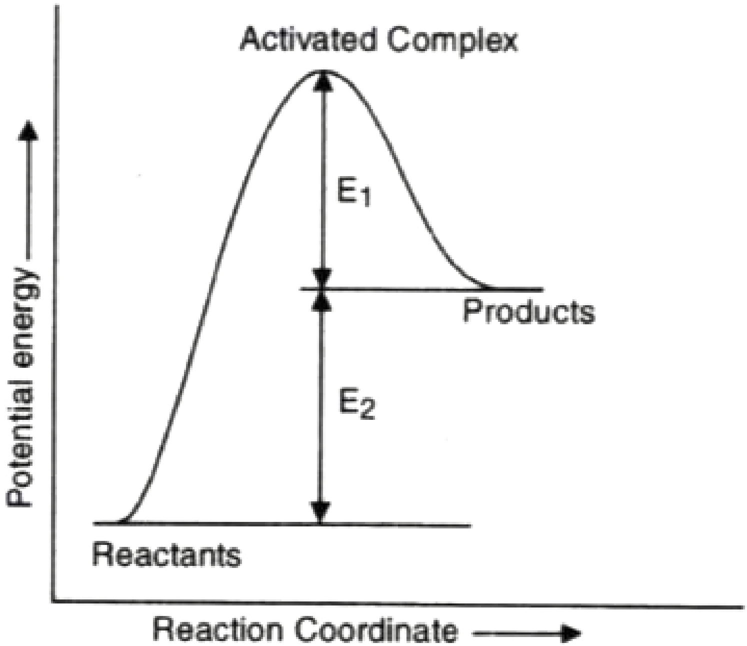
4. Consider the given figure and mark the correct option.



A. Activation energy of forward reaction is $E_1 + E_2$ andproduct is less stable than reactant

B. Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

C. Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

D. Activation energy of backward reaction is E_1 and product is more stable than reactant.

Answer: A

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5. Consider a first order gas phase decomposition reaction given below:

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

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

A. $k = \frac{2.303}{t} \log \frac{pi}{pI - x}$

B. $k = \frac{2.303}{t} \log \frac{2pi}{pI - x}$

C. $k = \frac{2.303}{t} \log \frac{pi}{pI - p_t}$

D. $k = \frac{2.303}{t} \log \frac{pi}{pi - x}$

Answer: B

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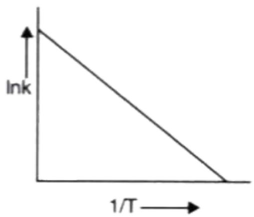
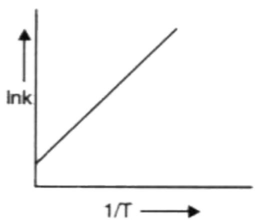
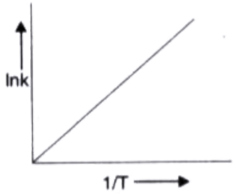
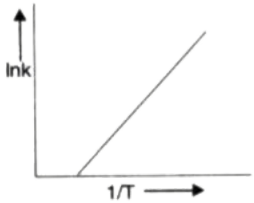
6. According to Arrhenius equation, rate constant k is equal to $Ae^{-E_a/RT}$

Which of the following options represents the graph of In k vs $\frac{1}{T}$?

A. 

B. 

C. 

D. 

Answer: A

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

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

A. Rate constant increases exponentially with increasing activation energy and decreasing temperature

B. Rate constant decreases exponentially with increasing activation energy and increasing temperature

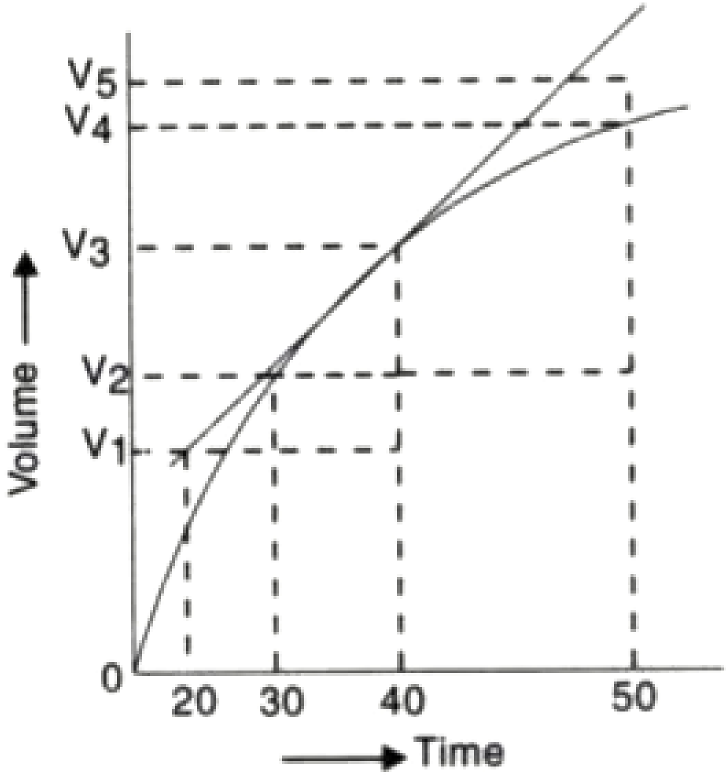
C. Rate constant increases exponentially with decreasing activation energy and decreasing temperature

D. Rate constant increases exponentially with decreasing activation energy and increasing temperature.

Answer: D

Watch Video Solution

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



A. Average rate upto 40 second is $\frac{V_3 - V_2}{40}$

B. Average rate up to 40 seconds is $\frac{V_3 - V_2}{40 - 30}$

C. Average rate upto 40 seconds is $\frac{V_3}{40}$

D. Average rate upto 40 seconds is $\frac{V_3 - V_1}{40 - 20}$

Answer: C

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

A. The order of a reaction can be a fractional number.

B. Order of a reaction is experimentally determined quantity

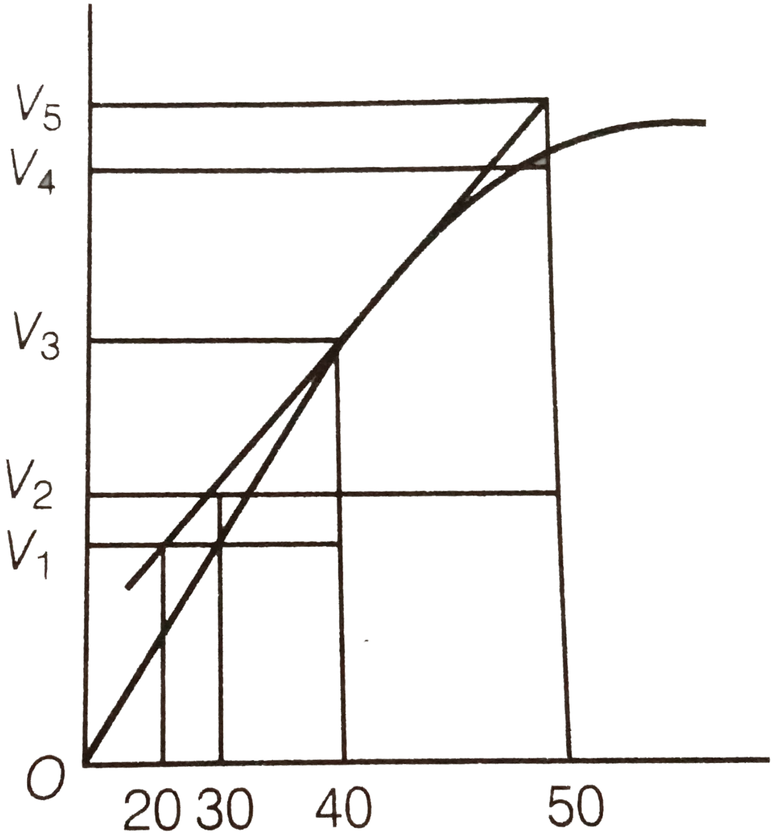
C. Order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction.

D. The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression.

Answer: C

Watch Video Solution

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



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

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

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

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

A. $\frac{V_5 - V_2}{50 - 30}$

B. $\frac{V_4 - V_2}{50 - 30}$

C. $\frac{V_3 - V_2}{40 - 30}$

D. $\frac{V_3 - V_1}{40 - 20}$

Answer: B

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11. Which of the following statement is correct? A)The rate of a reaction decreases with passage of time as the concentration of reactants decreases. B)The rate of a reaction is same at any time during the reaction C)The rate of a reaction is independent of temperature change D)The rate of a reaction decreases with increase in concentration of reactant(s)

A. The rate of a reaction decreases with passage of time as the concentration of reactants decreases.

B. The rate of a reaction is same at any time during the reaction

C. The rate of a reaction is independent of temperature change

D. The rate of a reaction decreases with increase in concentration of reactant(s)

Answer: A

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

$5Br^-(aq) + BrO_3^-(aq) + 6H^+(aq) \rightarrow 3Br_2(aq) + 2H_2O(l)$

A. $\frac{\Delta[Br^-]}{\Delta t} = 5\frac{\Delta[H^+]}{\Delta t}$

B. $\frac{\Delta[Br^-]}{\Delta t} = \frac{6}{5}\frac{\Delta[H^+]}{\Delta t}$

C. $\frac{\Delta[Br^-]}{\Delta t} = \frac{5}{6}\frac{\Delta[H^+]}{\Delta t}$

D. $\frac{\Delta[Br^-]}{\Delta t} = 6\frac{\Delta[H^+]}{\Delta t}$

Answer: C

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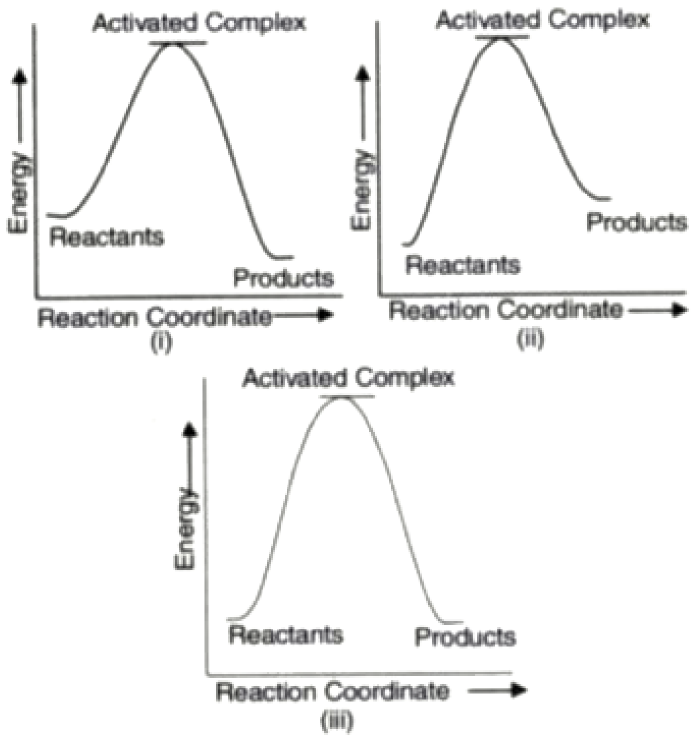
13. Which of the following graphs represents exothermic reaction ?



A. (i) only

B. (ii) only

C. (iii) only

D. (i) and (ii)

Answer: A

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14. Rate law for the reaction $A + 2B \rightarrow C$is found to be Rate =k[A][B] Concentration of reactant 'B' is doubled. Keeping the concentration of 'A' constant, the value of rate constant will be:

A. the same

B. doubled

C. quadrupled

D. halved

Answer: A

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15. Which of the following statements is incorrect about the collison theory of chemical reaction?

A. It considers reacting molecules or atoms to be hard spheres and ignores their structural features.

B. Number of effective collisions determines the rate of reaction.

C. Collision of atoms or molecules possessing sufficient threshold energy results into the product formation.

D. Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective.

Answer: C

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

A. $1.26v \times 10^{15} s$

B. $2.52 \times 10^{14} s$

C. $2.52 \times 10^{28} s$

D. infinite

Answer: D

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

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

Concentration of either 'A' or 'B' were changed Keeping the concentration of one of the reactants constant and rates were measured as a function of initial concentration. Following result were obtained.

Choose the correct option for the rate equations for this reaction.

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

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

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

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

D. Rate $= k[A]^2[B]^\circ$

Answer: B

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18. Which of the following statements is not correct ?

A. It catalyses the forward and backward reactions to the same extent

B. It alters ΔG for the reaction

C. It is a substance that does not change the equilibrium constant of a reaction

D. It provides an alternate mechanism by reducing activation energy between reactants and products.

Answer: B

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19. The value of rate constant of a pseudo first order reaction______

A. depends on the concentration of reactants present in small amount.

B. depends on the concentration of reactants present in excess

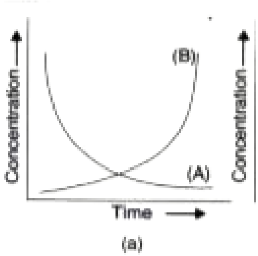
C. is independent of the concentration of reactants

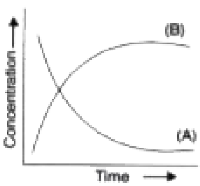
D. depends only on temperature.

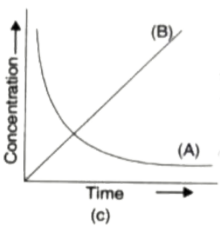
Answer: B

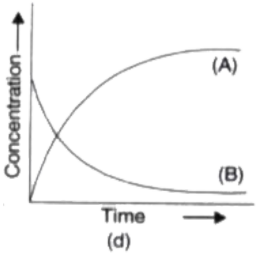
Watch Video Solution

20. Consider the reaction $A \to B$. The concentration of both the reactants and the products varies exponentially with time. Which of the following figure correctly describes the change in concentration of reactants and products with time ?

A. 

B. 

C. 

D. 

Answer: B

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21. The time of completion of 90% of a first order reaction is approximately

A. 1.1 times that of half-life

B. 2.2 times that of half-life

C. 3.3 times that of half-life

D. 4.4 times that of half-life

Answer: C

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22. The rate law for the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ is

A. $r - k[N_2O_5]$

B. $r = k[N_2O_5]^2$

C. $r = k[N_2O_5]^0$

D. $r = k[NO_2]^4[O_2]$

Answer: A

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23. At any stage of the reaction 3A $\rightarrow$ 2B, the reaction rate $+\frac{dB}{dt}$ will be equal to

A. $-3\frac{dA}{dt}$

B. $-\frac{dA}{dt}$

C. $\frac{-2}{3}\frac{dA}{dt}$

D. $\frac{-3}{2}\frac{dA}{dt}$

Answer: C

Watch Video Solution

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

A. Diminish to one-fourth of its initial value

B. Diminish to one-eighth of its initial value

C. Increase to eight times of its initial value

D. Increase to four times of its initial value.

Answer: C

Watch Video Solution

25. In respect of the equation $k = Ae^{-E_a/RT}$ in chemical kinetics, which one of the following statements is correct?

A. k is equilibrium constant

B. A is adsorption factor

C. E_a is energy of activation

D. R is Rydberg constant

Answer: C

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26. The time taken for the completion of 3/4 of a first order reaction is

A. (2.303/k) log 3/4

B. (2.303/k) log 4

C. (2.303/k) log 1/4

D. (2.3033/0.75) log k

Answer: B

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27. For a reaction $A + B \rightarrow C + D$, if concentration of A is doubled without altering that of B, rate doubles. If concentration of B is increased nine times without altering that of A, rate triples. Order of the reaction is

A. 2

B. 1

C. $1\frac{1}{2}$

D. $\frac{1}{3}$

Answer: C

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28. The half-life of a reaction is halved as the initial concentration of the reactant is doubled. The order of the reaction is

A. 0.5

B. 1

C. 2

D. 0

Answer: C

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29. The reaction $X \rightarrow$ Product follows first order kinetics. In 40 minutes the concentration of X changes from 0.1 M to 0.025 M. Then the rate of reaction when concentration of X is 0.01 M will be

A. $1.73 \times 10^{-4} \text{ min }^{-1}$

B. $3.47 \times 10^{-5} M \text{ min }^{-1}$

C. $3.47 \times 10^{-4} M \text{ min }^{-1}$

D. $1.73 \times 10^{-5} M \text{ min }^{-1}$

Answer: C

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30. 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 of to change from 0.1 M to 0.025 M is

A. 30 min

B. 15 min

C. 7.5 min

D. 60 min

Answer: A

Watch Video Solution

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

A. unit of k must be s^{-1}

B. $t_{1/2}$ is a constant

C. rate of formation of C is twice the rate of disappearance of A

D. value of k is independent of the initial concentration of A and B.

Answer: D

Watch Video Solution

32. The rate of first order reaction is 1.5×10^{-2} molL^{-1} $\overset{-1}{\min}$ at 0.5 M concentration of the reactant. The half-life of the reaction is

A. 7.53 min

B. 0.383min

C. 23.1 min

D. 8.73 min

Answer: C

Watch Video Solution

33. The half-lives of 2 samples are 0.1 and 0.4 seconds. Their initial conc. are 200 and 50 respectively. What is the order of the reaction ?

A. 0

B. 2

C. 1

D. 4

Answer: B

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34. The velocity constant of a reaction at 290 K was found to be $3.2 \times 10^{-3} s^{-1}$. When the temperature is raised to 310 K, it will be about

A. 6.4×10^{-3}

B. 3.2×10^{-4}

C. 9.6×10^{-3}

D. 1.28×10^{-2}

Answer: D

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

A. 30 s

B. 220 s

C. 300s

D. 347s

Answer: D

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36. The role of a catalyst is to change

A. Gibbs energy of reaction

B. enthalpy of reaction

C. activation energy of reaction

D. equilibrium constant.

Answer: C

Watch Video Solution

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

A. increases

B. decreases

C. remains unchanged

D. may increase or decrease.

Answer: C

Watch Video Solution

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

A. determining the rate constant at standard temperature

B. determining the rate constant at two temperatures

C. determining probability of collision

D. using catalyst.

Answer: B

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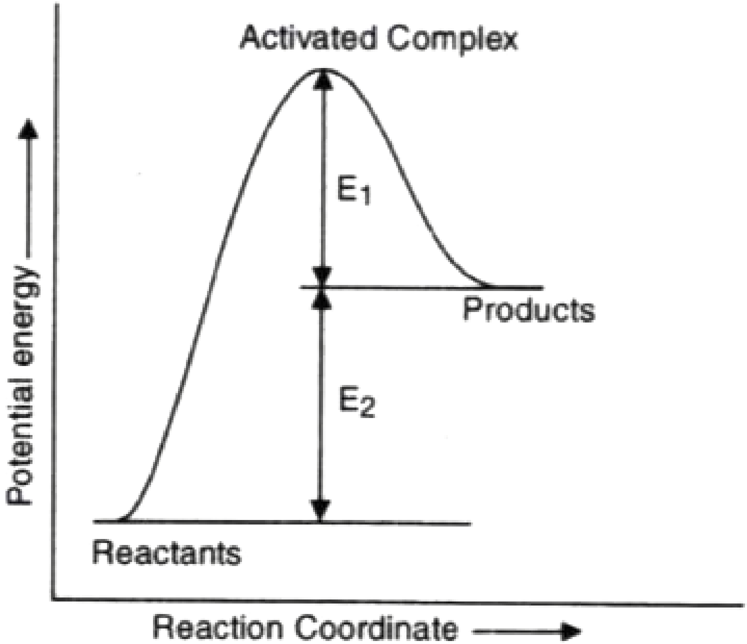
39. Consider the given figure and mark the correct option.



A. Activation energy of forward reaction is $E_1 + E_2$ andproduct is less stable than reactant

B. Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

C. Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

D. Activation energy of backward reaction is E_1 and product is more stable than reactant.

Answer: A

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40. Consider a first order gas phase decomposition reaction given below:

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

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

A. $k = \frac{2.303}{t} \log \frac{pi}{pI - x}$

B. $k = \frac{2.303}{t} \log \frac{2pi}{pI - x}$

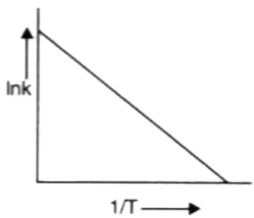
C. $k = \frac{2.303}{t} \log \frac{pi}{pI - p_t}$

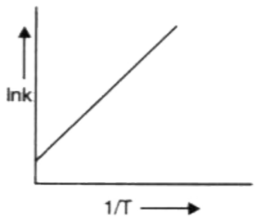
D. $k = \frac{2.303}{t} \log \frac{pi}{pi - x}$

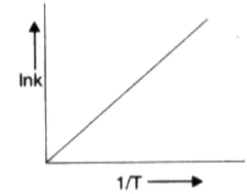
Answer: B

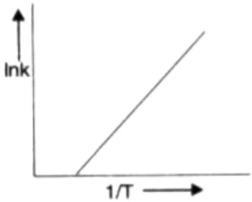
Watch Video Solution

41. According to Arrhenius equation, rate constant k is equal to $Ae^{-E_a/RT}$ Which of the following options represents the graph of In k vs $\frac{1}{T}$?

A. 

B. 

C. 

D. 

Answer: A

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

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

A. Rate constant increases exponentially with increasing activation energy and decreasing temperature

B. Rate constant decreases exponentially with increasing activation energy and increasing temperature

C. Rate constant increases exponentially with decreasing activation energy and decreasing temperature

D. Rate constant increases exponentially with decreasing activation energy and increasing temperature.

Answer: D

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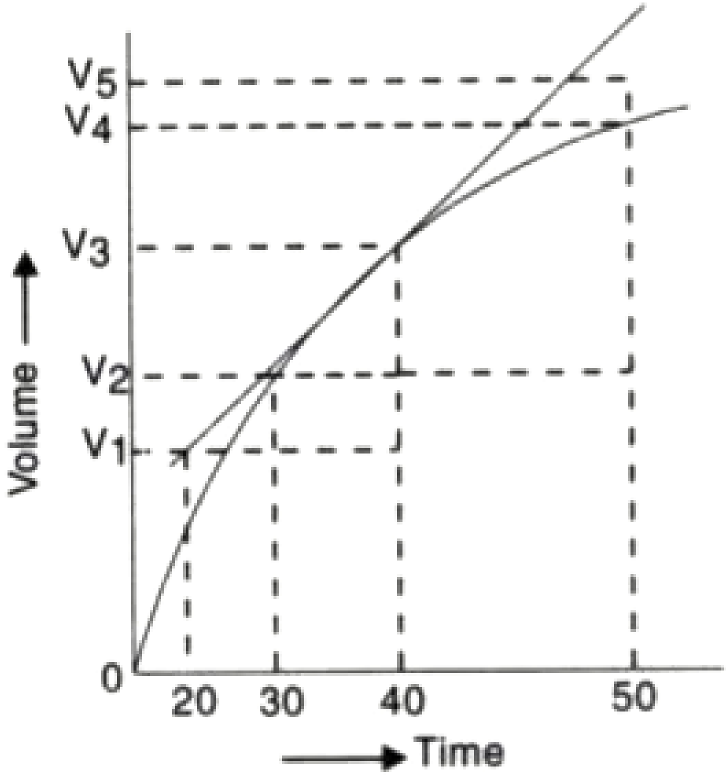
43. A graph of volume of hydrogen released vs time for the reaction between zinc and dil. HCl is given in Fig. On the basis of this mark the correct option.



A. Average rate upto 40 second is $\frac{V_3 - V_2}{40}$

B. Average rate up to 40 seconds is $\frac{V_3 - V_2}{40 - 30}$

C. Average rate upto 40 seconds is $\frac{V_3}{40}$

D. Average rate upto 40 seconds is $\frac{V_3 - V_1}{40 - 20}$

Answer: C

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

A. The order of a reaction can be a fractional number.

B. Order of a reaction is experimentally determined quantity

C. Order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction.

D. The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression.

Answer: C

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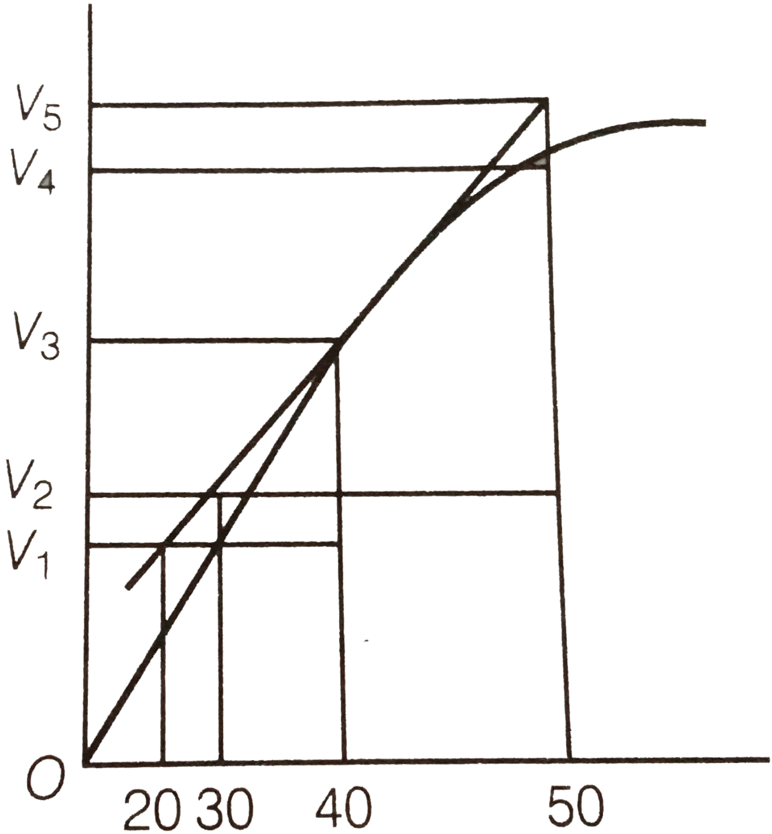
45. Consider the graph given in figure . Which of the following options does not show instantaneous rate of reaction at 40 ?



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

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

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

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

A. $\dfrac{V_5 - V_2}{50 - 30}$

B. $\dfrac{V_4 - V_2}{50 - 30}$

C. $\dfrac{V_3 - V_2}{40 - 30}$

D. $\dfrac{V_3 - V_1}{40 - 20}$

Answer: B

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46. Which of the following statement is correct?

A. The rate of a reaction decreases with passage of time as the concentration of reactants decreases.

B. The rate of a reaction is same at any time during the reaction

C. The rate of a reaction is independent of temperature change

D. The rate of a reaction decreases with increase in concentration of reactant(s)

Answer: A

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

$$5Br^{-}(aq) + BrO_3^{-}(aq) + 6H^{+}(aq) \rightarrow 3Br_2(aq) + 2H_2O(l)$$

A. $\dfrac{\Delta[Br^{-}]}{\Delta t} = 5\dfrac{\Delta[H^{+}]}{\Delta t}$

B. $\dfrac{\Delta[Br^{-}]}{\Delta t} = \dfrac{6}{5}\dfrac{\Delta[H^{+}]}{\Delta t}$

C. $\dfrac{\Delta[Br^{-}]}{\Delta t} = \dfrac{5}{6}\dfrac{\Delta[H^{+}]}{\Delta t}$

D. $\dfrac{\Delta[Br^{-}]}{\Delta t} = 6\dfrac{\Delta[H^{+}]}{\Delta t}$

Answer: C

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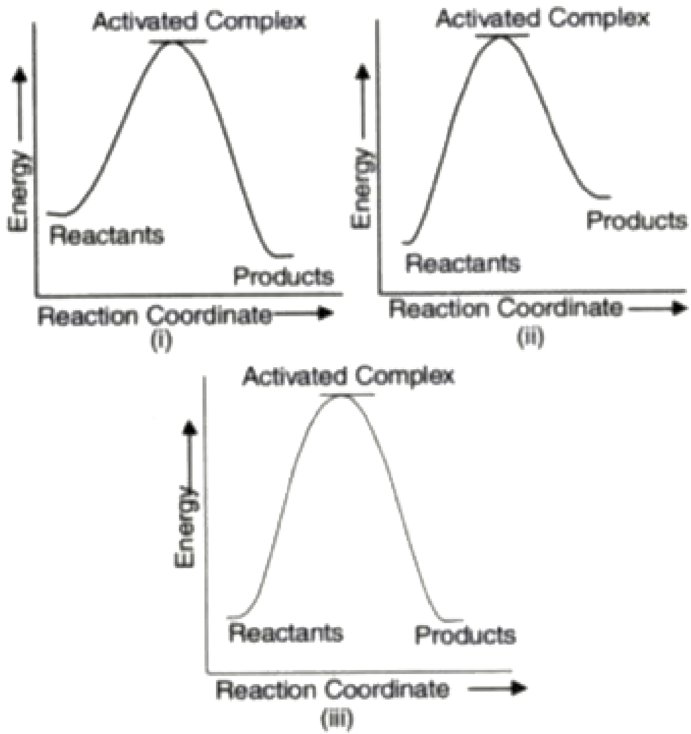
48. Which of the following graphs represents exothermic reaction ?



A. (i) only

B. (ii) only

C. (iii) only

D. (i) and (ii)

Answer: A

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49. Rate law for the reaction $A + 2B \rightarrow C$is found to be Rate =k[A][B] Concentration of reactant 'B' is doubled. Keeping the concentration of 'A' constant, the value of rate constant will be:

A. the same

B. doubled

C. quadrupled

D. halved

Answer: A

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50. Which of the following statements is incorrect about the collison theory of chemical reaction?

A. It considers reacting molecules or atoms to be hard spheres and ignores their structural features.

B. Number of effective collisions determines the rate of reaction.

C. Collision of atoms or molecules possessing sufficient threshold energy results into the product formation.

D. Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective.

Answer: C

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

A. $1.26v \times 10^{15} s$

B. $2.52 \times 10^{14} s$

C. $2.52 \times 10^{28} s$

D. infinite

Answer: D

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

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

Concentration of either 'A' or 'B' were changed Keeping the concentration of one of the reactants constant and rates were measured as a function of initial concentration. Following result were obtained.

Choose the correct option for the rate equations for this reaction.

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

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

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

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

D. Rate =$k[A]^2[B]^\circ$

Answer: B

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53. Which of the following statements is not correct for the catalyst ?

A. It catalyses the forward and backward reactions to the same extent

B. It alters ΔG for the reaction

C. It is a substance that does not change the equilibrium constant of a reaction

D. It provides an alternate mechanism by reducing activation energy between reactants and products.

Answer: B

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54. The value of rate constant of a pseudo first order reaction______

A. depends on the concentration of reactants present in small amount.

B. depends on the concentration of reactants present in excess

C. is independent of the concentration of reactants

D. depends only on temperature.

Answer: B

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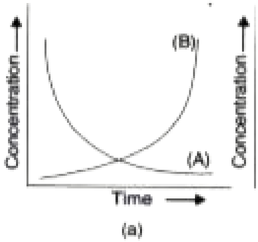
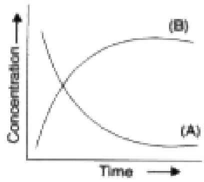
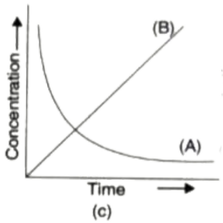
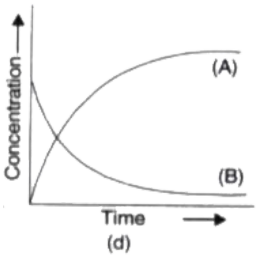
55. Consider the reaction $A \to B$. The concentration of both the reactants and the products varies exponentially with time. Which of the following figure correctly describes the change in concentration of reactants and products with time ?

A. 

B. 

C. 

D. 

Answer: B

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56. The time of completion of 90% of a first order reaction is approximately

A. 1.1 times that of half-life

B. 2.2 times that of half-life

C. 3.3 times that of half-life

D. 4.4 times that of half-life

Answer: C

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57. The rate law for the reaction $2N_2O_5 \to 4NO_2 + O_2$ is

A. $r - k[N_2O_5]$

B. $r = k[N_2O_5]^2$

C. $r = k[N_2O_5]^0$

D. $r = k[NO_2]^4[O_2]$

Answer: A

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58. At any stage of the reaction 3A $\rightarrow$ 2B, the reaction rate $+\frac{dB}{dt}$ will be equal to

A. $-3\frac{dA}{dt}$

B. $-\frac{dA}{dt}$

C. $\frac{-2}{3}\frac{dA}{dt}$

D. $\frac{-3}{2}\frac{dA}{dt}$

Answer: C

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

A. Diminish to one-fourth of its initial value

B. Diminish to one-eighth of its initial value

C. Increase to eight times of its initial value

D. Increase to four times of its initial value.

Answer: C

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60. In respect of the equation $k = Ae^{-E_a/RT}$ in chemical kinetics, which one of the following statements is correct?

A. k is equilibrium constant

B. A is adsorption factor

C. E_a is energy of activation

D. R is Rydberg constant

Answer: C

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61. The time taken for the completion of 3/4 of a first order reaction is

A. (2.303/k) log 3/4

B. (2.303/k) log 4

C. (2.303/k) log 1/4

D. (2.3033/0.75) log k

Answer: B

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62. For a reaction $A + B \rightarrow C + D$, if concentration of A is doubled without altering that of B, rate doubles. If concentration of B is increased nine times without altering that of A, rate triples. Order of the reaction is

A. 2

B. 1

C. $1\frac{1}{2}$

D. $\frac{1}{3}$

Answer: C

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63. The half-life of a reaction is halved as the initial concentration of the reactant is doubled. The order of the reaction is

A. 0.5

B. 1

C. 2

D. 0

Answer: C

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64. The reaction $X \rightarrow$ Product follows first order kinetics. In 40 minutes the concentration of X changes from 0.1 M to 0.025 M. Then the rate of reaction when concentration of X is 0.01 M will be

A. $1.73 \times 10^{-4} \text{ min }^{-1}$

B. $3.47 \times 10^{-5} M \text{ min }^{-1}$

C. $3.47 \times 10^{-4} M \text{ min }^{-1}$

D. $1.73 \times 10^{-5} M \text{ min }^{-1}$

Answer: C

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65. 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 of to change from 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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66. The rate equation for the reaction $2A + B \rightarrow C$ is found to be : rate = k[A] [B] The correct statement in relation to this reaction is that the

A. unit of k must be s^{-1}

B. $t_{1/2}$ is a constant

C. rate of formation of C is twice the rate of disappearance of A

D. value of k is independent of the initial concentration of A and B.

Answer: D

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67. The rate of first order reaction is 1.5×10^{-2} molL^{-1} $\overset{-1}{\min}$ at 0.5 M concentration of the reactant. The half-life of the reaction is

A. 7.53 min

B. 0.383min

C. 23.1 min

D. 8.73 min

Answer: C

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68. The half-lives of 2 samples are 0.1 and 0.4 seconds. Their initial conc. are 200 and 50 respectively. What is the order of the reaction ?

A. 0

B. 2

C. 1

D. 4

Answer: B

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69. The velocity constant of a reaction at 290 K was found to be $3.2 \times 10^{-3} s^{-1}$. When the temperature is raised to 310 K, it will be about

A. 6.4×10^{-3}

B. 3.2×10^{-4}

C. 9.6×10^{-3}

D. 1.28×10^{-2}

Answer: D

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

A. 30 s

B. 220 s

C. 300s

D. 347s

Answer: D

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71. The role of a catalyst is to change

A. Gibbs energy of reaction

B. enthalpy of reaction

C. activation energy of reaction

D. equilibrium constant.

Answer: C

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

A. increases

B. decreases

C. remains unchanged

D. may increase or decrease.

Answer: C

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

A. determining the rate constant at standard temperature

B. determining the rate constant at two temperatures

C. determining probability of collision

D. using catalyst.

Answer: B

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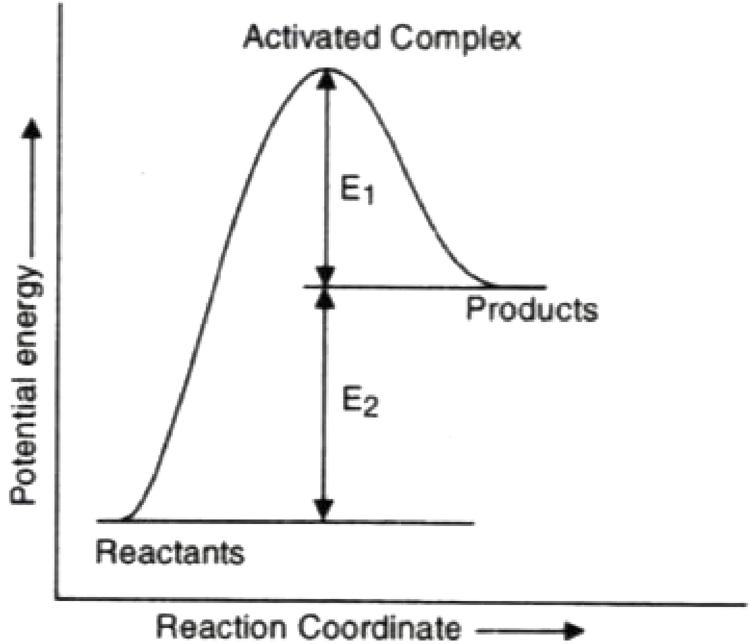
74. Consider the given figure and mark the correct option.



A. Activation energy of forward reaction is $E_1 + E_2$ andproduct is less stable than reactant

B. Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

C. Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

D. Activation energy of backward reaction is E_1 and product is more stable than reactant.

Answer: A

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75. Consider a first order gas phase decomposition reaction given below:

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

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

A. $k = \frac{2.303}{t} \log \frac{pi}{pI - x}$

B. $k = \frac{2.303}{t} \log \frac{2pi}{pI - x}$

C. $k = \frac{2.303}{t} \log \frac{pi}{pI - p_t}$

D. $k = \frac{2.303}{t} \log \frac{pi}{pi - x}$

Answer: B

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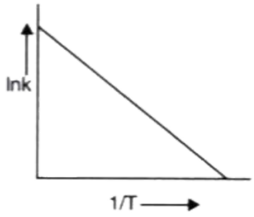
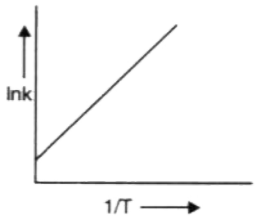
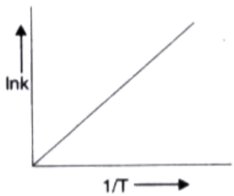
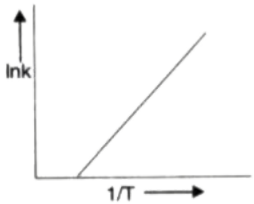
76. According to Arrhenius equation, rate constant k is equal to $Ae^{-E_a/RT}$ Which of the following options represents the graph of In k vs $\frac{1}{T}$?

A. 

B. 

C. 

D. 

Answer: A

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

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

A. Rate constant increases exponentially with increasing activation energy and decreasing temperature

B. Rate constant decreases exponentially with increasing activation energy and increasing temperature

C. Rate constant increases exponentially with decreasing activation energy and decreasing temperature

D. Rate constant increases exponentially with decreasing activation energy and increasing temperature.

Answer: D

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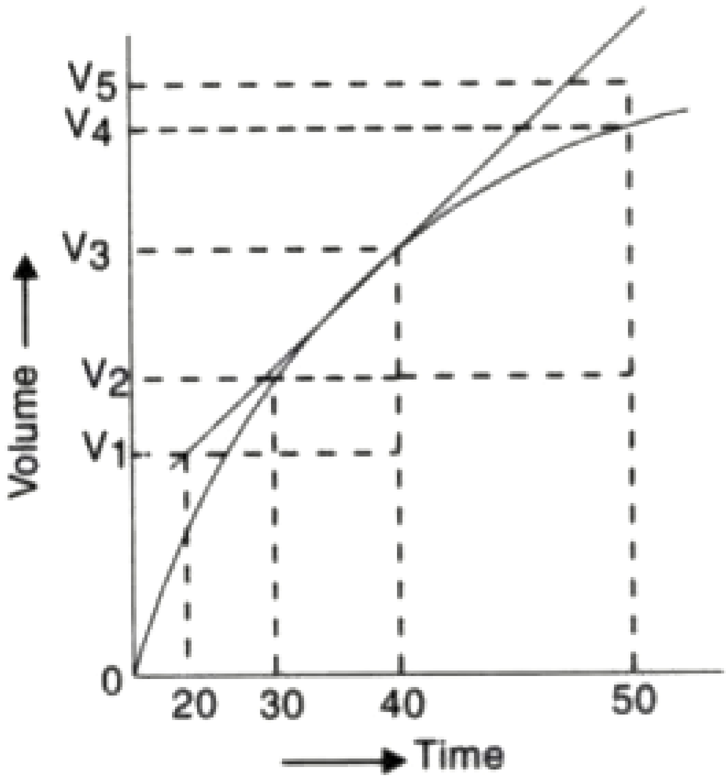
78. A graph of volume of hydrogen released vs time for the reaction between zinc and dil. HCl is given in Fig. On the basis of this mark the correct option.



A. Average rate upto 40 second is $\frac{V_3 - V_2}{40}$

B. Average rate up to 40 seconds is $\frac{V_3 - V_2}{40 - 30}$

C. Average rate upto 40 seconds is $\frac{V_3}{40}$

D. Average rate upto 40 seconds is $\frac{V_3 - V_1}{40 - 20}$

Answer: C

Watch Video Solution

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

A. The order of a reaction can be a fractional number.

B. Order of a reaction is experimentally determined quantity

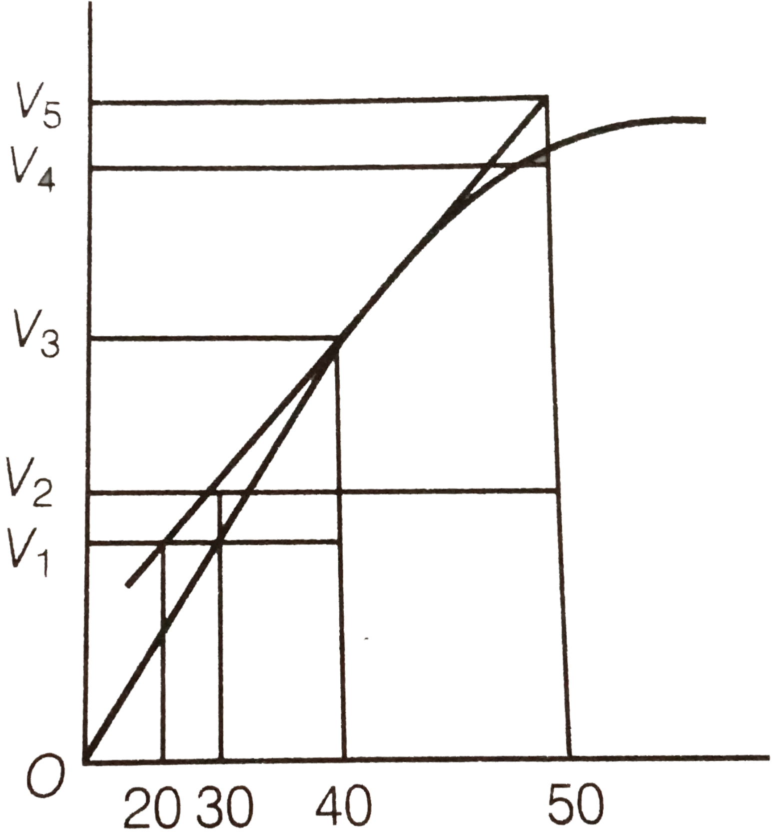
C. Order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction.

D. The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression.

Answer: C

Watch Video Solution

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



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

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

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

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

A. $\frac{V_5 - V_2}{50 - 30}$

B. $\frac{V_4 - V_2}{50 - 30}$

C. $\frac{V_3 - V_2}{40 - 30}$

D. $\frac{V_3 - V_1}{40 - 20}$

Answer: B

Watch Video Solution

81. Which of the following statement is correct?

A. The rate of a reaction decreases with passage of time as the concentration of reactants decreases.

B. The rate of a reaction is same at any time during the reaction

C. The rate of a reaction is independent of temperature change

D. The rate of a reaction decreases with increase in concentration of reactant(s)

Answer: A

Watch Video Solution

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

$$5Br^{-}(aq) + BrO_3^{-}(aq) + 6H^{+}(aq) \rightarrow 3Br_2(aq) + 2H_2O(l)$$

A. $\frac{\Delta[Br^{-}]}{\Delta t} = 5\frac{\Delta[H^{+}]}{\Delta t}$

B. $\frac{\Delta[Br^{-}]}{\Delta t} = \frac{6}{5}\frac{\Delta[H^{+}]}{\Delta t}$

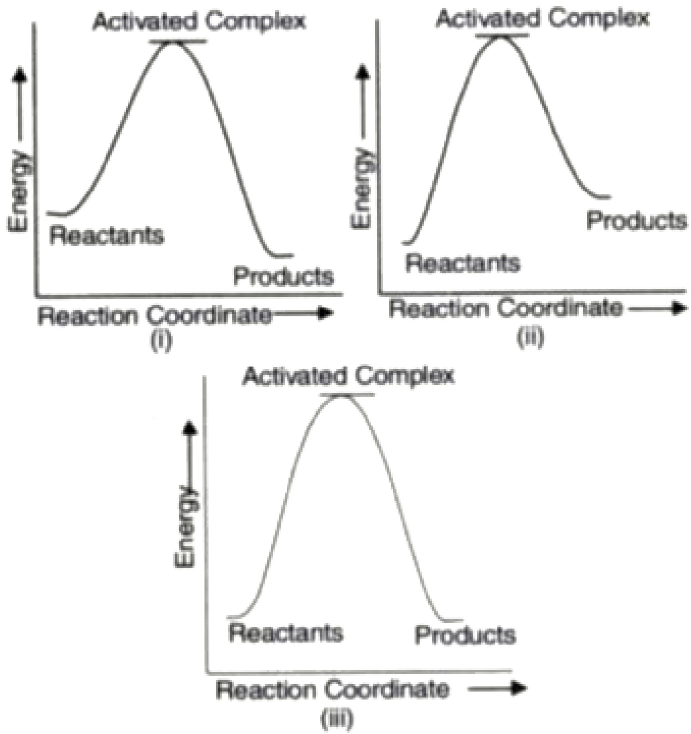
C. $\frac{\Delta[Br^{-}]}{\Delta t} = \frac{5}{6}\frac{\Delta[H^{+}]}{\Delta t}$

D. $\frac{\Delta[Br^{-}]}{\Delta t} = 6\frac{\Delta[H^{+}]}{\Delta t}$

Answer: C

Watch Video Solution

83. Which of the following graphs represents exothermic reaction ?



A. (i) only

B. (ii) only

C. (iii) only

D. (i) and (ii)

Answer: A

Watch Video Solution

84. Rate law for the reaction $A + 2B \rightarrow C$ is found to be Rate =k[A][B] Concentration of reactant 'B' is doubled. Keeping the concentration of 'A' constant, the value of rate constant will be:

A. the same

B. doubled

C. quadrupled

D. halved

Answer: A

Watch Video Solution

85. Which of the following statements is incorrect about the collison theory of chemical reaction?

A. It considers reacting molecules or atoms to be hard spheres and ignores their structural features.

B. Number of effective collisions determines the rate of reaction.

C. Collision of atoms or molecules possessing sufficient threshold energy results into the product formation.

D. Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective.

Answer: C

Watch Video Solution

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

A. $1.26v \times 10^{15} s$

B. $2.52 \times 10^{14} s$

C. $2.52 \times 10^{28} s$

D. infinite

Answer: D

Watch Video Solution

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

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

Concentration of either 'A' or 'B' were changed Keeping the concentration of one of the reactants constant and rates were measured as a function of initial concentration. Following result were obtained.

Choose the correct option for the rate equations for this reaction.

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

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

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

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

D. Rate =$k[A]^2[B]^\circ$

Answer: B

Watch Video Solution

88. Which of the following statements is not correct for the catalyst ?

A. It catalyses the forward and backward reactions to the same extent

B. It alters ΔG for the reaction

C. It is a substance that does not change the equilibrium constant of a reaction

D. It provides an alternate mechanism by reducing activation energy between reactants and products.

Answer: B

Watch Video Solution

89. The value of rate constant of a pseudo first order reaction______

A. depends on the concentration of reactants present in small amount.

B. depends on the concentration of reactants present in excess

C. is independent of the concentration of reactants

D. depends only on temperature.

Answer: B

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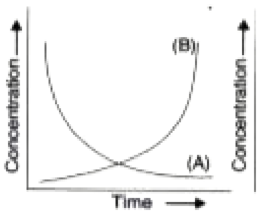
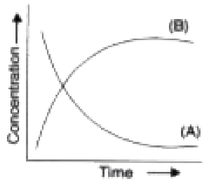
90. Consider the reaction $A \rightarrow B$. The concentration of both the reactants and the products varies exponentially with time. Which of the following figure correctly describes the change in concentration of reactants and products with time ?

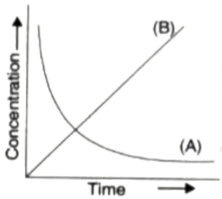


(a)

A.

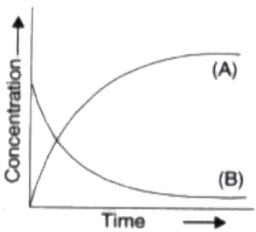


B.



(c)

C.



(d)

D.

Answer: B

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91. The time of completion of 90% of a first order reaction is approximately

A. 1.1 times that of half-life

B. 2.2 times that of half-life

C. 3.3 times that of half-life

D. 4.4 times that of half-life

Answer: C

Watch Video Solution

92. The rate law for the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ is

A. $r - k[N_2O_5]$

B. $r = k[N_2O_5]^2$

C. $r = k[N_2O_5]^0$

D. $r = k[NO_2]^4[O_2]$

Answer: A

Watch Video Solution

93. At any stage of the reaction 3A $\rightarrow$ 2B, the reaction rate $+\dfrac{dB}{dt}$ will be equal to

A. $-3\dfrac{dA}{dt}$

B. $-\dfrac{dA}{dt}$

C. $\dfrac{-2}{3}\dfrac{dA}{dt}$

D. $\dfrac{-3}{2}\dfrac{dA}{dt}$

Answer: C

Watch Video Solution

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

A. Diminish to one-fourth of its initial value

B. Diminish to one-eighth of its initial value

C. Increase to eight times of its initial value

D. Increase to four times of its initial value.

Answer: C

Watch Video Solution

95. In respect of the equation $k = Ae^{-E_a/RT}$ in chemical kinetics, which one of the following statements is correct?

A. k is equilibrium constant

B. A is adsorption factor

C. E_a is energy of activation

D. R is Rydberg constant

Answer: C

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96. The time taken for the completion of 3/4 of a first order reaction is

A. (2.303/k) log 3/4

B. (2.303/k) log 4

C. (2.303/k) log 1/4

D. (2.3033/0.75) log k

Answer: B

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97. For a reaction $A + B \to C + D$, if concentration of A is doubled without altering that of B, rate doubles. If concentration of B is increased nine times without altering that of A, rate triples. Order of the reaction is

A. 2

B. 1

C. $1\frac{1}{2}$

D. $\frac{1}{3}$

Answer: C

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98. The half-life of a reaction is halved as the initial concentration of the reactant is doubled. The order of the reaction is

A. 0.5

B. 1

C. 2

D. 0

Answer: C

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99. The reaction $X \rightarrow$ Product follows first order kinetics. In 40 minutes the concentration of X changes from 0.1 M to 0.025 M. Then the rate of reaction when concentration of X is 0.01 M will be

A. $1.73 \times 10^{-4} \text{ min }^{-1}$

B. $3.47 \times 10^{-5} M \text{ min }^{-1}$

C. $3.47 \times 10^{-4} M \text{ min }^{-1}$

D. $1.73 \times 10^{-5} M \text{ min }^{-1}$

Answer: C

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100. 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 of to change from 0.1 M to 0.025 M is

A. 30 min

B. 15 min

C. 7.5 min

D. 60 min

Answer: A

Watch Video Solution

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

A. unit of k must be s^{-1}

B. $t_{1/2}$ is a constant

C. rate of formation of C is twice the rate of disappearance of A

D. value of k is independent of the initial concentration of A and B.

Answer: D

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102. The rate of first order reaction is 1.5×10^{-2} mol$L^{-1}\min^{-1}$ at 0.5 M concentration of the reactant. The half-life of the reaction is

A. 7.53 min

B. 0.383min

C. 23.1 min

D. 8.73 min

Answer: C

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103. The half-lives of 2 samples are 0.1 and 0.4 seconds. Their initial conc. are 200 and 50 respectively. What is the order of the reaction ?

A. 0

B. 2

C. 1

D. 4

Answer: B

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104. The velocity constant of a reaction at 290 K was found to be $3.2 \times 10^{-3} s^{-1}$. When the temperature is raised to 310 K, it will be about

A. 6.4×10^{-3}

B. 3.2×10^{-4}

C. 9.6×10^{-3}

D. 1.28×10^{-2}

Answer: D

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

A. 30 s

B. 220 s

C. 300s

D. 347s

Answer: D

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EXERCISE (PART- I (OBJECTIVE QUESRTIONS) C. CORRECT THE FOLLOWING STATEMENTS BY CHANGING THE UNDERLINED PART OF THE STATEMENT (DO NOT CHANGE THE WHOLE SENTENCE .))

1. The rate of a reaction $\underline{\text{can be determined }}$ by dividing the total change in concentration by total time taken.

Watch Video Solution

2. Greater the concentration of reactants, $\underline{\text{slower the rate of reaction}}$.

Watch Video Solution

3. A small rise in temperature $\underline{\text{decreases }}$ the rate of reaction.

Watch Video Solution

4. Correct the following statements by changing the underlined part of the sentence (Do not change the whole sentence)

Catalyst increases the rate of forward reaction $\underline{\text{and decreases the rate of backward reaction}}$ in a reversible process.

Watch Video Solution

5. $\underline{\text{Catalyst is a substance which alters}}$ the equilibrium constant of reaction

Watch Video Solution

6. Temperature coefficient of a reaction is the ratio of the rate constants at $\underline{\text{temperatures separated by } 20^{\circ}}$.

Watch Video Solution

7. Order of a rection $\underline{\text{ cannot be fractional}}$

Watch Video Solution

8. Photochemical combination of hydrogen and chlorine is a $\underline{\text{first order reaction}}$.

Watch Video Solution

9. $\underline{\text{Fastest step }}$ in a reaction is the rate determining step.

Watch Video Solution

10. Activation energy is the $\underline{\text{sum }}$ of threshold energy and energy of reactants.

Watch Video Solution

11. The order of a reaction $\underline{\text{can be}}$ calculated from law of mass action.

Watch Video Solution

12. Collision theory is $\underline{\text{not satisfactory}}$ for bimolecular reactions.

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13. The order of reaction is determined by $\underline{\text{stoichiometry}}$ of the reaction

Watch Video Solution

14. The rate of a reaction $\underline{\text{can be determined}}$ by dividing the total change in concentration by total time taken.

Watch Video Solution

15. Greater the concentration of reactants, <u>slower the rate of reaction</u>.

Watch Video Solution

16. A small rise in temperature <u>decreases</u> the rate of reaction.

Watch Video Solution

17. Correct the following statements by changing the underlined part of the sentence (Do not change the whole sentence)

Catalyst increases the rate of forward reaction <u>and decreases the rate of backward reaction</u> in a reversible process.

Watch Video Solution

18. <u>Catalyst is a substance which alters</u> the equilibrium constant of reaction

Watch Video Solution

19. Temperature coefficient of a reaction is the ratio of the rate constants at $\underline{\text{ temperatures separated by } 20^\circ}$.

Watch Video Solution

20. Order of a reaction $\underline{\text{ cannot be fractional}}$

Watch Video Solution

21. Photochemical combination of hydrogen and chlorine is a $\underline{\text{first order reaction}}$.

Watch Video Solution

22. $\underline{\text{Fastest step }}$ in a reaction is the rate determining step.

Watch Video Solution

23. Activation energy is the $\underline{\text{sum}\quad}$ of threshold energy and energy of reactants.

Watch Video Solution

24. The order of a reaction $\underline{\text{can be}}$ calculated from law of mass action.

Watch Video Solution

25. Collision theory is $\underline{\text{not satisfactory}\quad}$ for bimolecular reactions.

Watch Video Solution

26. The order of reaction is determined by $\underline{\text{stoichiometry}\quad}$ of the reaction

Watch Video Solution

27. The rate of a reaction $\underline{\text{can be determined}}$ by dividing the total change in concentration by total time taken.

Watch Video Solution

28. Greater the concentration of reactants, $\underline{\text{slower the rate of reaction}}$.

Watch Video Solution

29. A small rise in temperature $\underline{\text{decreases}}$ the rate of reaction.

Watch Video Solution

30. Correct the following statements by changing the underlined part of the sentence (Do not change the whole sentence)

Catalyst increases the rate of forward reaction $\underline{\text{and decreases the rate of backward reaction}}$ in a reversible process.

Watch Video Solution

31. $\underline{\text{Catalyst is a substance which alters}}$ the equilibrium constant of reaction

Watch Video Solution

32. Temperature coefficient of a reaction is the ratio of the rate constants at $\underline{\text{ temperatures separated by } 20^\circ}$.

Watch Video Solution

33. Order of a reaction $\underline{\text{ cannot be fractional}}$

Watch Video Solution

34. Photochemical combination of hydrogen and chlorine is a $\underline{\text{first order reaction}}$.

Watch Video Solution

35. $\underline{\text{Fastest step }}$ in a reaction is the rate determining step.

Watch Video Solution

36. Activation energy is the $\underline{\text{sum }}$ of threshold energy and energy of reactants.

Watch Video Solution

37. The order of a reaction $\underline{\text{can be}}$ calculated from law of mass action.

Watch Video Solution

38. Collision theory is $\underline{\text{not satisfactory}}$ for bimolecular reactions.

Watch Video Solution

39. The order of reaction is determined by $\underline{\text{stoichiometry}}$ of the reaction

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EXERCISE (PART- I (OBJECTIVE QUESRTIONS) D. MATCH THE FOLLOWING)

1. Match the following columns

(i) First order rate constant	(a) $K = Ae^{-Ea/RT}$
(ii) Rate determining step	(b) Arrhenius equation
(iii) Arrhenius equation	(c) Slowest step
(iv) Rate of reaction	(d) sec^{-1}
(v) Activation energy	(e) mole L^{-1} s^{-1}
(vi) Provides alternative path requiring lower activation energy	(f) Temperature coefficient
(vii) Half-life period of first order reaction	(g) $a/2k$
(viii) Ratio of rate constants at two different temperatures differing by 10°C.	(h) Independent of initial concentration
(ix) Half-life of a zero order reaction	(i) Catalyst

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2. Match the following columns

(*i*) First order rate constant	(*a*) $K = Ae^{-Ea/RT}$
(*ii*) Rate determining step	(*b*) Arrhenius equation
(*iii*) Arrhenius equation	(*c*) Slowest step
(*iv*) Rate of reaction	(*d*) sec^{-1}
(*v*) Activation energy	(*e*) mole L^{-1} s^{-1}
(*vi*) Provides alternative path requiring lower activation energy	(*f*) Temperature coefficient
(*vii*) Half-life period of first order reaction	(*g*) $a/2k$
(*viii*) Ratio of rate constants at two different temperatures differing by 10°C.	(*h*) Independent of initial concentration
(*ix*) Half-life of a zero order reaction	(*i*) Catalyst

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3. Match the following columns

(i) First order rate constant	(a) $K = Ae^{-Ea/RT}$
(ii) Rate determining step	(b) Arrhenius equation
(iii) Arrhenius equation	(c) Slowest step
(iv) Rate of reaction	(d) sec^{-1}
(v) Activation energy	(e) mole L^{-1} s^{-1}
(vi) Provides alternative path requiring lower activation energy	(f) Temperature coefficient
(vii) Half-life period of first order reaction	(g) $a/2k$
(viii) Ratio of rate constants at two different temperatures differing by 10°C.	(h) Independent of initial concentration
(ix) Half-life of a zero order reaction	(i) Catalyst

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EXERCISE (PART- II (DESCRIPTIVE QUESRTIONS) A. VERY SHORT ANSWER QUESTIONS (WITH ANSWERS))

1. State the rate law of chemical reactions.

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2. What is an elementary reaction?

Watch Video Solution

3. Define order of a reaction.

Watch Video Solution

4. What is meant by molecularity of a reaction ?

Watch Video Solution

5. For the reaction $2X \rightarrow X_2$, the rate of reaction becomes three times when the concentration of X is increased 27 times. What is the order of the reaction?

Watch Video Solution

6. Why hydrolysis of ethyl acetate with NaOH follows second order kinetics while acidic hydrolysis of ethyl acetate is a first order reaction.

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7. Identify the reaction order from each of the following rate :

$k = 2.3 \times 10^5 Lmol^{-1} s^{-1}$

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8. Identify the reaction order from each of the following rate :

$k = 3.1 \times 10^{-4} s^{-1}$

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9. Give one example of reaction in which order and molecularity are equal.

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10. For which order of the reaction, the units of the rate constant are independent of the concentration ?

Watch Video Solution

11. What is the order of a photochemical reaction ?

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12. Does a zero order reaction has molecularity equal to zero?

Watch Video Solution

13. Give an example of pseudo first order reaction.

Watch Video Solution

14. How does the value of rate constant vary with reactant concentration?

Watch Video Solution

15. A substance with initial concentration a follows zero order kinetics with rate constant k = mol $L^{-1}s^{-1}$. In how much time will the reaction go to completion ?

Watch Video Solution

16. The reaction A+B $\rightarrow$ C has zero order. What is the rate equation?

Watch Video Solution

17. For the reaction, Ester $+H^{+} \rightarrow$ Acid + Alcohol, rate = k[Ester] $\left[H^{+}\right]^{0}$. What is the order of the reaction ?

Watch Video Solution

18. For a reaction $A + 2B \rightarrow C$, rate =k$[A]^x[B]^y$. What is the order of reaction ?

Watch Video Solution

19. For a reaction $A \rightarrow B$, the rate of reaction becomes twenty seven times when the concentration of A is increased three times. What is the order of the reaction?

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20. For the reaction $Cl_2(g) + 2NO(g) \rightarrow 2NOCI_{(g)}$ the rate law is expressed as: rate=$k[Cl_2][NO]^2$ What is the overall order of this reaction ?

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21. Is there any reaction for which reaction rate does not decrease with time?

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22. A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of the reaction ?

Watch Video Solution

23. The rate of reaction $X \rightarrow Y$ becomes 8 times when the concentration of the reactant X is doubled. Write the rate law of the reaction.

Watch Video Solution

24. A first order reaction is 50% complete in 20 minutes. What is its rate constant ?

Watch Video Solution

25. What is the order of a reaction whose rate constant has the same units as the rate of reaction ?

Watch Video Solution

26. How is half-life period of a reaction is inversely proportional to initial concentration for a second order reaction?

Watch Video Solution

27. In some cases, it is found that large number of colliding molecules have energy more than threshold energy, yet the reaction is slow. Why ?

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28. In the reaction $A \rightarrow B$, if the concentration of A is plotted against time, the curves obtained will be as shown in Fig. 1 and 2. Predict the order of the reactions.

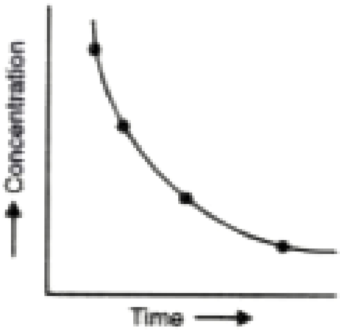

Fig. 1.

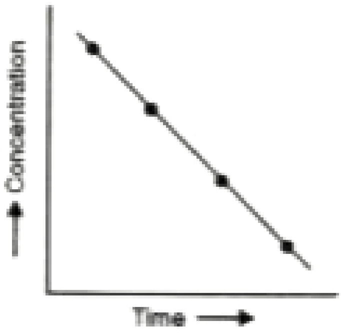

Fig. 2.

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29. What is the rate determining step of a reaction?

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30. The kinetics for the reaction, $2NO + 2H_2 \rightarrow N_2 + 2H_2O$ is explained by the following two steps:

$(i) 2NO + H_2 \rightarrow N_2 + H_2O + O$ (slow)

$(ii) O + H_2 \rightarrow H_2O$ (fast)

What is the predicted rate law?

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31. Write the rate law and order for the following reaction:

$AB_2 + C_2 \rightarrow AB_2C + C$ (slow)

$AB_2 + C \rightarrow AB_2C$(fast)

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32. Define Elementary step in a reaction

Watch Video Solution

33. What is the temperature coefficient?

Watch Video Solution

34. What are effective collisions ?

Watch Video Solution

35. Define threshold energy.

Watch Video Solution

36. What is the effect of catalyst on the rate of reaction ?

Watch Video Solution

37. Define activation energy of a reaction.

Watch Video Solution

38. How is activation energy of a reaction affected?

by using a catalyst

Watch Video Solution

39. How is activation energy of a reaction affected

by increasing the temperature ?

Watch Video Solution

40. In some cases, it is found that large number of colliding molecules have energy more than threshold energy, yet the reaction is slow. Why ?

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41. The reaction $2H_2(g) + O_2(aq) \rightarrow 2H_2O(l)$is thermodynamically feasible. How is that a mixture of hydrogen and oxygen kept at room temperature shows no tendency to form water?

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42. The activation energy of a reaction is zero. Will the rate constant of the reaction depend upon temperature ?

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43. Is there any participation of the catalyst in the chemical process?

Watch Video Solution

44. How does a catalyst work?

Watch Video Solution

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Watch Video Solution

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52. Identify the reaction order from each of the following rate :

$k = 3.1 \times 10^{-4} s^{-1}$

Watch Video Solution

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70. How is half-life period of a reaction is inversely proportional to initial concentration for a second order reaction?

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71. In some cases, it is found that large number of colliding molecules have energy more than threshold energy, yet the reaction is slow. Why ?

Watch Video Solution

72. In the reaction $A \rightarrow B$, if the concentration of A is plotted against time, the curves obtained will be as shown in Fig. 1 and 2. Predict the order of the reactions.

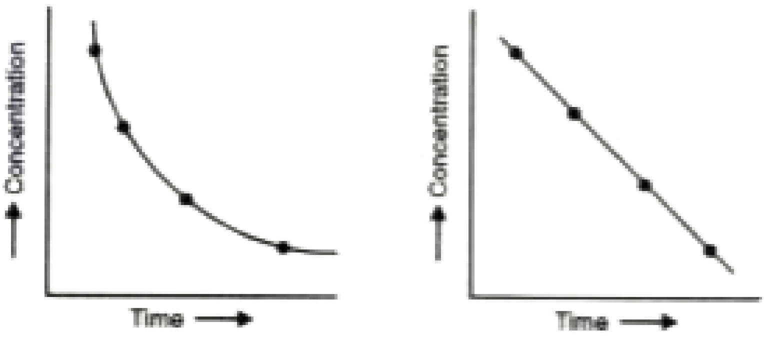

Fig. 1. Fig. 2.

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73. What is the rate determining step of a reaction?

Watch Video Solution

74. The kinetics for the reaction, $2NO + 2H_2 \rightarrow N_2 + 2H_2$O is explained by the following two steps:

$(i) 2NO + H_2 \rightarrow N_2 + H_2O + O$ (slow)

$(ii) O + H_2 \rightarrow H_2O$ (fast)

What is the predicted rate law?

Watch Video Solution

75. Write the rate law and order for the following reaction:

$AB_2 + C_2 \rightarrow AB_2C + C$ (slow)

$AB_2 + C \rightarrow AB_2C$(fast)

Watch Video Solution

76. Define Elementary step in a reaction

Watch Video Solution

77. What is the temperature coefficient?

Watch Video Solution

78. What are effective collisions ?

Watch Video Solution

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Watch Video Solution

80. What is the effect of catalyst on the rate of reaction ?

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81. Define activation energy of a reaction.

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82. How is activation energy of a reaction affected?

by using a catalyst

Watch Video Solution

83. How is activation energy of a reaction affected

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86. The activation energy of a reaction is zero. Will the rate constant of the reaction depend upon temperature ?

Watch Video Solution

87. Is there any participation of the catalyst in the chemical process?

Watch Video Solution

88. How does a catalyst work?

Watch Video Solution

89. State the rate law of chemical reactions.

Watch Video Solution

90. What is an elementary reaction?

Watch Video Solution

91. Define order of a reaction.

Watch Video Solution

92. What is meant by molecularity of a reaction ?

Watch Video Solution

93. For the reaction $2X \rightarrow X_2$, the rate of reaction becomes three times when the concentration of X is increased 27 times. What is the order of the reaction?

Watch Video Solution

94. Why hydrolysis of ethyl acetate with NaOH follows second order kinetics while acidic hydrolysis of ethyl acetate is a first order reaction.

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95. Identify the reaction order from each of the following rate :

$k = 2.3 \times 10^5 Lmol^{-1}s^{-1}$

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96. Identify the reaction order from each of the following rate :

$k = 3.1 \times 10^{-4} s^{-1}$

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97. Give one example of reaction in which order and molecularity are equal.

Watch Video Solution

98. For which order of the reaction, the units of the rate constant are independent of the concentration ?

Watch Video Solution

99. What is the order of a photochemical reaction ?

Watch Video Solution

100. Does a zero order reaction has molecularity equal to zero?

Watch Video Solution

101. Give an example of pseudo first order reaction.

Watch Video Solution

102. How does the value of rate constant vary with reactant concentration?

Watch Video Solution

103. A substance with initial concentration a follows zero order kinetics with rate constant k = mol $L^{-1}s^{-1}$. In how much time will the reaction go to completion ?

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104. The reaction $A + B \rightarrow C$ has zero order. What is the rate equation?

Watch Video Solution

105. For the reaction, Ester $+H^{+} \rightarrow$ Acid + Alcohol, rate = k[Ester] $\left[H^{+}\right]^{0}$. What is the order of the reaction ?

Watch Video Solution

106. For a reaction $A + 2B \rightarrow C$, rate =k$[A]^{x}[B]^{y}$. What is the order of reaction ?

Watch Video Solution

107. For a reaction $A \rightarrow B$, the rate of reaction becomes twenty seven times when the concentration of A is increased three times. What is the order of the reaction?

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108. For the reaction $Cl_2(g) + 2NO(g) \rightarrow 2NOCI_{(g)}$ the rate law is expressed as: rate=$k[Cl_2][NO]^2$ What is the overall order of this reaction ?

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109. Is there any reaction for which reaction rate does not decrease with time?

Watch Video Solution

110. A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of the reaction ?

Watch Video Solution

111. The rate of reaction $X \to Y$ becomes 8 times when the concentration of the reactant X is doubled. Write the rate law of the reaction.

Watch Video Solution

112. A first order reaction is 50% complete in 20 minutes. What is its rate constant ?

Watch Video Solution

113. What is the order of a reaction whose rate constant has the same units as the rate of reaction ?

Watch Video Solution

114. How is half-life period of a reaction is inversely proportional to initial concentration for a second order reaction?

Watch Video Solution

115. In some cases, it is found that large number of colliding molecules have energy more than threshold energy, yet the reaction is slow. Why ?

Watch Video Solution

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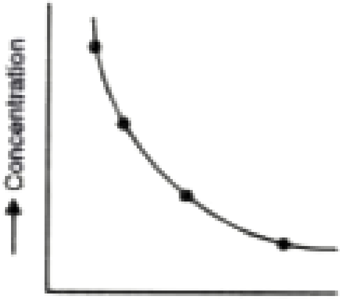

Fig. 1.

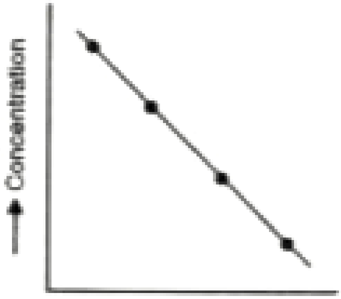

Fig. 2.

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Watch Video Solution

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$(ii) O + H_2 \rightarrow H_2O$ (fast)

What is the predicted rate law?

Watch Video Solution

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Watch Video Solution

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Watch Video Solution

Watch Video Solution

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Watch Video Solution

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Watch Video Solution

125. Define activation energy of a reaction.

Watch Video Solution

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Watch Video Solution

127. How is activation energy of a reaction affected

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130. The activation energy of a reaction is zero. Will the rate constant of the reaction depend upon temperature ?

Watch Video Solution

131. Is there any participation of the catalyst in the chemical process?

Watch Video Solution

132. How does a catalyst work?

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EXERCISE (PART- II (DESCRIPTIVE QUESRTIONS) B. SHORT ANSWER QUESTIONS)

1. Define the terms:

Instantaneous rate of a reaction

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2. Define the terms:

Average rate of reaction

Watch Video Solution

3. Define the terms:

Half-life period and reaction life time.

Watch Video Solution

4. What is meant by rate of reaction ? Show that the rate of reaction cannot be determined by dividing the total change in concentration by total time taken.

Watch Video Solution

5. How is the rate of reaction expressed ? Write the factors which affect the rate of reaction.

Watch Video Solution

6. Explain the terms rate equation and specific reaction rate.

Watch Video Solution

7. What is meant by molecularity of a reaction ? Why the molecularity of a reaction rarely exceeds three?

Watch Video Solution

8. What is the difference between rate law and law of mass action?

Watch Video Solution

9. What is meant by order of a reaction ?

Watch Video Solution

10. Differentiate between order and molecularity of a reaction.

Watch Video Solution

11. Derive the integrated rate equation for first order reactions.

Watch Video Solution

12. Write the name of any two methods to determine the order of a reaction. Describe any one of them.

Watch Video Solution

13. How the order of a reaction can be determined by integral equation method ?

Watch Video Solution

14. The kinetics of a reaction, $A + B \rightarrow C + D$obey the rate equation : rate $= k[A]^x[B]^y$ For it find out

order of reaction

Watch Video Solution

15. The kinetics of a reaction, $A + 2B \to C + D$obey the rate equation :

rate $= k[A]^x[B]^y$ For it find out

apparent molecularity of reaction

Watch Video Solution

16. The kinetics of a reaction, $A + 2B \to C + D$obey the rate equation :

rate $= k[A]^x[B]^y$ For it find out

order of a reaction when B is present in large excess.

Watch Video Solution

17. Explain why the molecularity and order of the following reaction are different?

$CH_3COOC_2H_5 + H_2O \to CH_3COOH + C_2H_5OH$

Watch Video Solution

18. What is half-life period ? Show that the half-life period of a first order reaction is independent of initial concentration.

Watch Video Solution

19. Comment on the statement that the rate of a chemical reaction is very likely to be most rapid at the beginning of the reaction?

Watch Video Solution

20. What are the two necessary conditions for the colliding molecules to yield the products ?

Watch Video Solution

21. What are simple reactions and what are complex reactions in chemical kinetics?

Watch Video Solution

22. How do we know that not all collisions between reactant molecules lead to chemical change? What determines whether a particular collision will be effective ?

Watch Video Solution

23. A reaction proceeds through several fast and slow steps. Which of the step will determine its order and molecularity ?

Watch Video Solution

24. Consider the following reaction between NO_2 and F_2, $2NO_2 + F_2 \rightarrow 2NO_2F$

It follows a second order rate law

$$-\frac{1}{2}\frac{d[NO_2]}{2} = k[NO_2][F_2]$$

What could be the most likely mechanism for this reaction?

Watch Video Solution

25. From the following mechanism of a complex reaction, find out the order of a reaction, molecularity and rate law :

$A + B \rightarrow M$

$M + B \rightarrow N + L(\text{Slow})$

$N + L + B \rightarrow C$

$A + 3B \rightarrow C$

Watch Video Solution

26. Nitric oxide reacts with hydrogen to give nitrogen and water:

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

The kinetics of this reaction is explained by the following steps:

$(i) 2NO + H_2 \rightarrow N_2 + H_2O_2$(slow)

$(ii) H_2O_2 + H_2 \rightarrow 2H_2O$ (fast)

What is the predicted rate law ?

Watch Video Solution

27. Nitric oxide NO reacts with oxygen to produce nitrogen dioxide:

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

The rate law for this reaction is rate $= k[NO]^2[O_2]$

Propose a mechanism for the above reaction.

Watch Video Solution

28. Define the threshold energy and activation energy. How are they interrelated ?

Watch Video Solution

29. Draw a representative reaction curve for an exothermic reaction and (i) label the activation energies for the forward and reverse reaction (ii) enthalpy for the forward and reverse reactions. How will the curve change with the addition of a catalyst ?

Watch Video Solution

30. Equal amount of a reactant were taken in two closed flasks of same capacity but even then the rate of reaction in one flask was found to be higher than the other. Under what conditions it is possible?

Watch Video Solution

31. An increase in temperature of 10 K rarely doubles the kinetic energy of the particles and hence the number of collisions is not doubled. Yet, this temperature increase may be enough to double the rate of a slow reaction. How can be this explained?

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32. On the basis of heat of combustion values, graphite is more stable than diamond. However, diamond does not change into graphite for years together.

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Watch Video Solution

33. What is the effect of light radiations on reaction rates?

Watch Video Solution

34. Comment on the following statements.

Endothermic reactions have higher activation energies than exothermic reactions.

Watch Video Solution

35. Comment on the following statements.

A reaction with a higher activation energy will proceed at faster rate.

Watch Video Solution

36. Comment on the following statements.

CH_4 does not react with oxygen at room temperture but burns when a lighted match stick is applied to the mixture.

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37. Discuss the effect of catalyst on the activation energy.

Watch Video Solution

38. What is activation energy? How is the rate constant of a reaction related to its activation energy ?

Watch Video Solution

39. What is an activated complex ? Explain with the help of a suitable example.

Watch Video Solution

40. Define the terms:

Instantaneous rate of a reaction

Watch Video Solution

41. Define the terms:

Average rate of reaction

Watch Video Solution

42. Define the terms:

Half-life period and reaction life time.

Watch Video Solution

43. What is meant by rate of reaction ? Show that the rate of reaction cannot be determined by dividing the total change in concentration by total time taken.

Watch Video Solution

44. How is the rate of reaction expressed ? Write the factors which affect the rate of reaction.

Watch Video Solution

45. Explain the terms rate equation and specific reaction rate.

Watch Video Solution

46. What is meant by molecularity of a reaction ? Why the molecularity of a reaction rarely exceeds three?

Watch Video Solution

47. What is the difference between rate law and law of mass action?

Watch Video Solution

48. What is meant by order of a reaction ?

Watch Video Solution

49. Differentiate between order and molecularity of a reaction.

Watch Video Solution

50. Derive the integrated rate equation for first order reactions.

Watch Video Solution

51. Write the name of any two methods to determine the order of a reaction. Describe any one of them.

Watch Video Solution

52. How the order of a reaction can be determined by integral equation method ?

Watch Video Solution

53. The kinetics of a reaction, $A+2B \rightarrow C+D$obey the rate equation : rate $=k[A]^{x}[B]^{y}$ For it find out

order of a reaction when B is present in large excess.

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54. The kinetics of a reaction, $A+2B \rightarrow C+D$obey the rate equation : rate $=k[A]^{x}[B]^{y}$ For it find out apparent molecularity of reaction

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Watch Video Solution

56. Explain why the molecularity and order of the following reaction are different?

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Watch Video Solution

57. What is half-life period ? Show that the half-life period of a first order reaction is independent of initial concentration.

Watch Video Solution

58. Comment on the statement that the rate of a chemical reaction is very likely to be most rapid at the beginning of the reaction?

Watch Video Solution

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Watch Video Solution

60. What are simple reactions and what are complex reactions in chemical kinetics?

Watch Video Solution

61. How do we know that not all collisions between reactant molecules lead to chemical change? What determines whether a particular collision will be effective ?

Watch Video Solution

62. A reaction proceeds through several fast and slow steps. Which of the step will determine its order and molecularity ?

Watch Video Solution

63. Describe the important aspects of bimolecular collision theory of reaction rates.

Watch Video Solution

64. Consider the following reaction between NO_2 and $F_2, 2NO_2 + F_2 \rightarrow 2NO_2F$

It follows a second order rate law

$$-\frac{1}{2}\frac{d[NO_2]}{2} = k[NO_2][F_2]$$

What could be the most likely mechanism for this reaction?

Watch Video Solution

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$$A + B \rightarrow M$$

$$M + B \rightarrow N + L(\text{Slow})$$

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66. Nitric oxide reacts with hydrogen to give nitrogen and water:

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

The kinetics of this reaction is explained by the following steps:

$(i) 2NO + H_2 \rightarrow N_2 + H_2O_2$(slow)

$(ii) H_2O_2 + H_2 \rightarrow 2H_2O$ (fast)

What is the predicted rate law ?

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67. Nitric oxide NO reacts with oxygen to produce nitrogen dioxide:

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

The rate law for this reaction is rate $= k[NO]^2[O_2]$

Propose a mechanism for the above reaction.

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68. Assume that Earth is in circular orbit around the Sun with kinetic energy K and potential energy U, taken to be zero for infinite separation.

Then, the relationship between K and U:

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69. Draw a representative reaction curve for an exothermic reaction and (i) label the activation energies for the forward and reverse reaction (ii) enthalpy for the forward and reverse reactions. How will the curve change with the addition of a catalyst ?

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Watch Video Solution

103. Which among the following is the most appropriate statement about collision theory of reaction rates?

Watch Video Solution

104. Consider the following reaction between NO_2 and F_2, $2NO_2 + F_2 \rightarrow 2NO_2F$

It follows a second order rate law

$$-\frac{1}{2}\frac{d[NO_2]}{2} = k[NO_2][F_2]$$

What could be the most likely mechanism for this reaction?

Watch Video Solution

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$(ii) H_2O_2 + H_2 \rightarrow 2H_2O$ (fast)

What is the predicted rate law ?

Watch Video Solution

107. Nitric oxide reacts with oxygen to produce nitrogen dioxide.

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

What is the predicted rate law and order if the mechanism is:

$(i) NO + O_2 \overset{K}{\Longleftrightarrow} NO_3$ (fast)

$(ii) NO_3 + NO \overset{K_1}{\Longleftrightarrow} NO_2 + NO_2$ (slow)

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108. Define the terms threshold energy and activation energy. Using the concept of activation energy, explain the role of a cataylst on the rate of reaction.

Watch Video Solution

109. Draw a representative reaction curve for an exothermic reaction and (i) label the activation energies for the forward and reverse reaction (ii) enthalpy for the forward and reverse reactions. How will the curve change with the addition of a catalyst ?

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EXERCISE (PART- II (DESCRIPTIVE QUESRTIONS) C.LONG ANSWER QUESTIONS)

1. What do you understand by rate of a reaction and specific reaction rate ? How the rate of a reaction can be determined ?

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2. What do you understand by order and molecularity of a reaction ? Give the important distinguishing features between the two.

Watch Video Solution

3. Discuss the effect of concentration and temperature on reaction rates.

Watch Video Solution

4. Define the terms threshold energy and activation energy. Using the concept of activation energy, explain the role of a cataylst on the rate of reaction.

Watch Video Solution

5. Starting with the differential rate law equation for a first order reaction, derive the integerated rate law equation for a first order reaction. How is it related to the rate constant ?

Watch Video Solution

6. How does temperature affect the rate of a reaction ? Is there a corresponding equal increase in number of collisions among molecules of a gaseous reaction ? How is this effect explained by the concept of activation energy and activated molecules?

Watch Video Solution

7. State and explain Arrhenius equation. How can we determine the activation energy of a reaction using this equation?

Watch Video Solution

8. Explain the terms:

Activation energy

Watch Video Solution

9. Explain the terms:

Threshold energy

Watch Video Solution

10. Explain the terms:

Law of mass action

Watch Video Solution

11. Write the rate law for a first order reaction and justify the statement that half-life of such a reaction is independent of the initial concentration of the reactants.

Watch Video Solution

12. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

threshold energy

Watch Video Solution

13. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activation energy of forward reaction

Watch Video Solution

14. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activation energy of backward reaction

Watch Video Solution

15. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activated complex

Watch Video Solution

16. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

overall energy change for the reaction

Watch Video Solution

17. How do temperature and the presence of a catalyst bring about an increase in the rate of a reaction ?

Watch Video Solution

18. The Arrhenius equation is given as $k = Ae^{-E_a/RT}$. What do k, A and E stand for? What are their units for a first order reaction? What is the physical significance of A and E?

Watch Video Solution

19. What do you understand by rate of a reaction and specific reaction rate ? How the rate of a reaction can be determined ?

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20. What do you understand by order and molecularity of a reaction ? Give the important distinguishing features between the two.

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Watch Video Solution

23. Starting with the differential rate law equation for a first order reaction, derive the integerated rate law equation for a first order reaction. How is it related to the rate constant ?

Watch Video Solution

24. How does temperature affect the rate of a reaction ? Is there a corresponding equal increase in number of collisions among molecules of a gaseous reaction ? How is this effect explained by the concept of activation energy and activated molecules?

Watch Video Solution

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Watch Video Solution

26. Explain the terms:

Activation energy

Watch Video Solution

27. Explain the terms:

Threshold energy

Watch Video Solution

28. Explain the terms:

Law of mass action

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30. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

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Watch Video Solution

31. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activation energy of forward reaction

Watch Video Solution

32. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activation energy of backward reaction

Watch Video Solution

33. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activated complex

Watch Video Solution

34. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

overall energy change for the reaction

Watch Video Solution

35. How do temperature and the presence of a catalyst bring about an increase in the rate of a reaction ?

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36. The Arrhenius equation is given as $k = Ae^{-E_a/RT}$. What do k, A and E stand for? What are their units for a first order reaction? What is the physical significance of A and E?

Watch Video Solution

37. What do you understand by rate of a reaction and specific reaction rate ? How the rate of a reaction can be determined ?

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38. What do you understand by order and molecularity of a reaction ? Give the important distinguishing features between the two.

Watch Video Solution

39. Discuss the effect of concentration and temperature on reaction rates.

Watch Video Solution

40. Define the terms threshold energy and activation energy. Using the concept of activation energy, explain the role of a cataylst on the rate of reaction.

Watch Video Solution

41. Starting with the differential rate law equation for a first order reaction, derive the integerated rate law equation for a first order reaction. How is it related to the rate constant ?

Watch Video Solution

42. How does temperature affect the rate of a reaction ? Is there a corresponding equal increase in number of collisions among molecules of a gaseous reaction ? How is this effect explained by the concept of activation energy and activated molecules?

Watch Video Solution

43. State and explain Arrhenius equation. How can we determine the activation energy of a reaction using this equation?

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44. Explain the terms:

Activation energy

Watch Video Solution

45. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

threshold energy

Watch Video Solution

46. Explain the terms:

Law of mass action

Watch Video Solution

47. Write the rate law for a first order reaction and justify the statement that half-life of such a reaction is independent of the initial concentration of the reactants.

Watch Video Solution

48. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

threshold energy

Watch Video Solution

49. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activation energy of forward reaction

Watch Video Solution

50. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activation energy of backward reaction

Watch Video Solution

51. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

activated complex

Watch Video Solution

52. Draw the potential energy diagram for an exothermic reaction. Explain the terms:

overall energy change for the reaction

Watch Video Solution

53. How do temperature and the presence of a catalyst bring about an increase in the rate of a reaction ?

Watch Video Solution

54. The Arrhenius equation is given as $k = Ae^{-E_a / RT}$. What do k, A and E stand for? What are their units for a first order reaction? What is the physical significance of A and E?

Watch Video Solution

ISC EXAMINATION QUESTIONS (PART-I (OBJECTIVE QUESTIONS) A.FILL IN THE BLANKS)

1. The half-life period of a .... order reaction is ..... initial concentration.

Watch Video Solution

2. For a first order reaction, the unit of rate is .... and that of rate constant is ....

Watch Video Solution

3. Half-life period of a .... order reaction is .... of the concentration of the reactant.

Watch Video Solution

4. When the concentration of a reactant of first order reaction is doubled, the rate becomes .... times, but for .... order reaction, the rate remains same.

Watch Video Solution

5. The half-life period of a .... order reaction is ..... initial concentration.

Watch Video Solution

6. For a first order reaction, the unit of rate is .... and that of rate constant is ....

Watch Video Solution

7. Half-life period of a .... order reaction is .... of the concentration of the reactant.

Watch Video Solution

8. When the concentration of a reactant of first order reaction is doubled, the rate becomes .... times, but for .... order reaction, the rate remains same.

Watch Video Solution

9. The half-life period of a .... order reaction is ..... initial concentration.

Watch Video Solution

10. For a first order reaction, the unit of rate is .... and that of rate constant is ....

Watch Video Solution

11. Half-life period of a .... order reaction is .... of the concentration of the reactant.

Watch Video Solution

12. When the concentration of a reactant of first order reaction is doubled, the rate becomes .... times, but for .... order reaction, the rate remains same.

Watch Video Solution

ISC EXAMINATION QUESTIONS (PART-I (OBJECTIVE QUESTIONS) B .COMPLETE THE FOLLOWING STATEMENTS BY SELECTING THE CORRECT ALTERNATIVE FROM THE CHOICES GIVEN :)

1. The rate constant of a reaction varies :

A. with temperature

B. with concentration of reaction

C. with both temperature and concentration of the reactants

D. with neither temperature nor concentration of the reactants.

Answer: A

Watch Video Solution

2. A quantitative relationship between the temperature and rate constant is given by :

A. Nernst equation

B. Arrhenius equation

C. van't Hoff equation

D. Henderson equation

Answer: B

Watch Video Solution

3. The reaction between X and Y is first order with respect to X and second order with respect to Y. If the concentration of X is halved and the concentration of Y is doubled, the rate of reaction will be

A. the same as the initial value

B. three times the initial value

C. double the initial value

D. half the initial value.

Answer: C

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4. 75% of a first order reaction was completed in 32 minutes. When was 50% of the reaction completed ?

A. 24 minutes

B. 16 minutes

C. 8 minutes

D. 4 minutes

Answer: B

Watch Video Solution

5. In a plot of log k vs 1/T, the slope is

A. $-E_a/2.303$

B. $E_a/2.303R$

C. $E_a/2.303$

D. $-E_a/2.303R$

Answer: D

Watch Video Solution

6. For reaction $2N_2O_5 = 2NO_2 + O_2$, the rate and rate constants are 1.02×10^{-4} mole litre^{-1} $\sec^{-1}$ and $3.4 \times 10^{-5} \sec^{-1}$ respectively. The concentration of N_2O_5 at that time will be

A. $1.732 mol lit^{-1}$

B. $3 mol L^{-1}$

C. $1.02 \times 10^{-4} mol Lit^{-1}$

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

Answer: B

Watch Video Solution

7. For a first order reaction, the rate constant for decomposition of N_2O_5 is $6 \times 10^{-4} \sec^{-1}$. The half-life period for the decomposition in seconds is :

A. 11.55

B. 115.5

C. 1155

D. 1.155

Answer: D

Watch Video Solution

8. The rate constant of a reaction varies :

A. with temperature

B. with concentration of reaction

C. with both temperature and concentration of the reactants

D. with neither temperature nor concentration of the reactants.

Answer: A

Watch Video Solution

9. A quantitative relationship between the temperature and rate constant is given by :

A. Nernst equation

B. Arrhenius equation

C. van't Hoff equation

D. Henderson equation

Answer: B

Watch Video Solution

10. The reaction between X and Y is first order with respect to X and second order with respect to Y. If the concentration of X is halved and the concentration of Y is doubled, the rate of reaction will be

A. the same as the initial value

B. three times the initial value

C. double the initial value

D. half the initial value.

Answer: C

Watch Video Solution

11. 75% of a first order reaction was completed in 32 minutes. When was 50% of the reaction completed ?

A. 24 minutes

B. 16 minutes

C. 8 minutes

D. 4 minutes

Answer: B

Watch Video Solution

12. In a plot of log k vs 1/T, the slope is

A. $-E_a/2.303$

B. $E_a/2.303R$

C. $E_a/2.303$

D. $-E_a/2.303R$

Answer: D

Watch Video Solution

13. For reaction $2N_2O_5 = 2NO_2 + O_2$, the rate and rate constants are 1.02×10^{-4} mole litre^{-1} $\sec^{-1}$ and $3.4 \times 10^{-5} \sec^{-1}$ respectively. The concentration of N_2O_5 at that time will be

A. $1.732 mollit^{-1}$

B. $3 molL^{-1}$

C. $1.02 \times 10^{-4} molLit^{-1}$

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

Answer: B

Watch Video Solution

14. For a first order reaction, the rate constant for decomposition of N_2O_5 is $6 \times 10^{-4} \sec^{-1}$. The half-life period for the decomposition in seconds is :

A. 11.55

B. 115.5

C. 1155

D. 1.155

Answer: D

Watch Video Solution

15. The rate constant of a reaction varies :

A. with temperature

B. with concentration of reaction

C. with both temperature and concentration of the reactants

D. with neither temperature nor concentration of the reactants.

Answer: A

Watch Video Solution

16. A quantitative relationship between the temperature and rate constant is given by :

A. Nernst equation

B. Arrhenius equation

C. van't Hoff equation

D. Henderson equation

Answer: B

Watch Video Solution

17. The reaction between X and Y is first order with respect to X and second order with respect to Y. If the concentration of X is halved and the concentration of Y is doubled, the rate of reaction will be

A. the same as the initial value

B. three times the initial value

C. double the initial value

D. half the initial value.

Answer: C

Watch Video Solution

18. 75% of a first order reaction was completed in 32 minutes. When was 50% of the reaction completed ?

A. 24 minutes

B. 16 minutes

C. 8 minutes

D. 4 minutes

Answer: B

Watch Video Solution

19. In a plot of log k vs 1/T, the slope is

A. $-E_a/2.303$

B. $E_a/2.303R$

C. $E_a/2.303$

D. $-E_a/2.303R$

Answer: D

Watch Video Solution

20. For reaction $2N_2O_5 = 2NO_2 + O_2$, the rate and rate constants are 1.02×10^{-4} mole litre^{-1} $\sec^{-1}$ and $3.4 \times 10^{-5} \sec^{-1}$ respectively. The concentration of N_2O_5 at that time will be

A. $1.732 mollit^{-1}$

B. $3 mol L^{-1}$

C. $1.02 \times 10^{-4} mol Lit^{-1}$

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

Answer: B

Watch Video Solution

21. For a first order reaction, the rate constant for decomposition of N_2O_5 is $6 \times 10^{-4} \sec^{-1}$. The half-life period for the decomposition in seconds is :

A. 11.55

B. 115.5

C. 1155

D. 1.155

Answer: D

Watch Video Solution

ISC EXAMINATION QUESTIONS (PART-I (OBJECTIVE QUESTIONS) C .CORRECT THE FOLLOWING STATEMENTS)

1. Order of reaction cannot be fractional.

Watch Video Solution

2. The rate constant of a reaction increases linearly with increase in temperature.

Watch Video Solution

3. The rate constant of any reaction is proportional to the concentration of the reactants.

Watch Video Solution

4. The rate constant of a first order reaction is proportional to the concentration of the reactant.

Watch Video Solution

5. Order of reaction cannot be fractional.

Watch Video Solution

6. The rate constant of a reaction increases linearly with increase in temperature.

Watch Video Solution

7. The rate constant of any reaction is proportional to the concentration of the reactants.

Watch Video Solution

8. The rate constant of a first order reaction is proportional to the concentration of the reactant.

Watch Video Solution

9. Order of reaction cannot be fractional.

Watch Video Solution

10. The rate constant of a reaction increases linearly with increase in temperature.

Watch Video Solution

11. The rate constant of any reaction is proportional to the concentration of the reactants.

Watch Video Solution

12. The rate constant of a first order reaction is proportional to the concentration of the reactant.

Watch Video Solution

ISC EXAMINATION QUESTIONS (PART-I (OBJECTIVE QUESTIONS) D. MATCH THE FOLLOWING)

1. Match the following columns

(*i*) Activation energy (I.S.C. 2013)	(*a*) mol L^{-1} sec^{-1}
(*ii*) Rate of reaction (I.S.C. 2014)	(*b*) Arrhenius equation

Watch Video Solution

2. Match the following columns

(*i*) Activation energy (I.S.C. 2013)	(*a*) mol L^{-1} sec^{-1}
(*ii*) Rate of reaction (I.S.C. 2014)	(*b*) Arrhenius equation

Watch Video Solution

3. Match the following columns

(i) Activation energy (I.S.C. 2013)	(a) mol L^{-1} sec^{-1}
(ii) Rate of reaction (I.S.C. 2014)	(b) Arrhenius equation

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ISC EXAMINATION QUESTIONS (PART-II (DESCRIPTIVE QUESTIONS))

1. Write the Arrhenius equation. Indicate how this equation can be used to calculate the quantities involved in it.

Watch Video Solution

2. Draw a graph which can be used to calculate the activation energy of a reaction.

Watch Video Solution

3. List any two factors that influence the rate of chemical reaction. Indicate whether the rate constant of the reaction is dependent or independent on these factors.

Watch Video Solution

4. Write the Arrhenius equation.

Watch Video Solution

5. Give the mechanism for the reaction of t-butyl bromide with aqueous potassium hydroxide.

Watch Video Solution

6. Draw a graph which is used to calculate the activation energy of a reaction. Give the appropriate expressions used to calculate the activation energy graphically.

Watch Video Solution

7. Give one example each of homogeneous and heterogeneous catalysis.

Watch Video Solution

8. What is the difference between the order of a reaction and its molecularity ?

Watch Video Solution

9. An alkyl bromide undergoes reaction in the alkaline medium to form the corresponding alcohol. When the concentration of the alkyl bromide is doubled keeping the concentration of the alkali constant, the rate of the reaction is doubled. When the concentration of the alkali is doubled keeping the concentration of the alkyl bromide constant, the rate of

reaction remains the same. Write the mechanistic steps for the reaction and state the type of the reaction and the nature of the reagent.

Watch Video Solution

10. Explain graphically how the rate of a reaction changes with every $10^\circ C$ rise in temperature.

Watch Video Solution

11. How is the activation energy of a reaction related to its rate constant ?

Watch Video Solution

12. Write the mathematical expression relating the variation of rate constant of a reaction with temperature.

Watch Video Solution

13. How can you graphically find the activation energy of the reaction from the above expression?

Watch Video Solution

14. Explain graphically how the rate of a reaction changes with every $10^\circ C$ rise in temperature.

Watch Video Solution

15. Give one example of zero order reaction.

Watch Video Solution

16. What is the difference between the order of a reaction and its molecularity ?

Watch Video Solution

17. What is the order of the reaction whose rate constant has the same unit as the rate of reaction ?

Watch Video Solution

18. Write the Arrhenius equation. Indicate how this equation can be used to calculate the quantities involved in it.

Watch Video Solution

19. Draw a graph which can be used to calculate the activation energy of a reaction.

Watch Video Solution

20. List any two factors that influence the rate of chemical reaction. Indicate whether the rate constant of the reaction is dependent or independent on these factors.

Watch Video Solution

21. Write the Arrhenius equation.

Watch Video Solution

22. Give the mechanism for the reaction of t-butyl bromide with aqueous potassium hydroxide.

Watch Video Solution

23. Draw a graph which is used to calculate the activation energy of a reaction. Give the appropriate expressions used to calculate the activation energy graphically.

Watch Video Solution

24. Give one example each of homogeneous and heterogeneous catalysis.

Watch Video Solution

25. What is the difference between the order of a reaction and its molecularity ?

Watch Video Solution

26. An alkyl bromide undergoes reaction in the alkaline medium to form the corresponding alcohol. When the concentration of the alkyl bromide is doubled keeping the concentration of the alkali constant, the rate of the reaction is doubled. When the concentration of the alkali is doubled keeping the concentration of the alkyl bromide constant, the rate of reaction remains the same. Write the mechanistic steps for the reaction and state the type of the reaction and the nature of the reagent.

Watch Video Solution

27. Explain graphically how the rate of a reaction changes with every $10^{\circ} C$ rise in temperature.

Watch Video Solution

28. How is the activation energy of a reaction related to its rate constant ?

Watch Video Solution

29. Write the mathematical expression relating the variation of rate constant of a reaction with temperature.

Watch Video Solution

30. How can you graphically find the activation energy of the reaction from the above expression?

Watch Video Solution

31. Explain graphically how the rate of a reaction changes with every $10^\circ C$ rise in temperature.

Watch Video Solution

32. Give one example of zero order reaction.

Watch Video Solution

33. What is the difference between the order of a reaction and its molecularity ?

Watch Video Solution

34. What is the order of the reaction whose rate constant has the same unit as the rate of reaction ?

Watch Video Solution

35. Write the Arrhenius equation. Indicate how this equation can be used to calculate the quantities involved in it.

Watch Video Solution

36. Draw a graph which can be used to calculate the activation energy of a reaction.

Watch Video Solution

37. List any two factors that influence the rate of chemical reaction. Indicate whether the rate constant of the reaction is dependent or independent on these factors.

Watch Video Solution

38. Write the Arrhenius equation.

Watch Video Solution

39. Give the mechanism for the reaction of t-butyl bromide with aqueous potassium hydroxide.

Watch Video Solution

40. Draw a graph which is used to calculate the activation energy of a reaction. Give the appropriate expressions used to calculate the activation energy graphically.

Watch Video Solution

41. Give one example each of homogeneous and heterogeneous catalysis.

Watch Video Solution

42. What is the difference between the order of a reaction and its molecularity ?

Watch Video Solution

43. An alkyl bromide undergoes reaction in the alkaline medium to form the corresponding alcohol. When the concentration of the alkyl bromide is doubled keeping the concentration of the alkali constant, the rate of the reaction is doubled. When the concentration of the alkali is doubled keeping the concentration of the alkyl bromide constant, the rate of reaction remains the same. Write the mechanistic steps for the reaction and state the type of the reaction and the nature of the reagent.

Watch Video Solution

44. Explain graphically how the rate of a reaction changes with every $10^{\circ} C$ rise in temperature.

Watch Video Solution

45. How is the activation energy of a reaction related to its rate constant ?

Watch Video Solution

46. Write the mathematical expression relating the variation of rate constant of a reaction with temperature.

Watch Video Solution

47. How can you graphically find the activation energy of the reaction from the above expression?

Watch Video Solution

48. Explain graphically how the rate of a reaction changes with every $10^{\circ} C$ rise in temperature.

Watch Video Solution

49. Give one example of zero order reaction.

Watch Video Solution

50. Write two differences between 'order of reaction' and 'molecularity of reaction'.

Watch Video Solution

51. What is the order of the reaction whose rate constant has the same unit as the rate of reaction ?

Watch Video Solution

ISC EXAMINATION QUESTIONS (NUMERICAL PROBLEMS)

1. A first order reaction is 50% complete in 30 minutes at 27° C. Calculate the rate constant of the reaction at 27° C.

Watch Video Solution

2. The initial rate of a reaction $A + B \rightarrow$ Products is doubled when the concentration of A is doubled and increases eight fold when the initial concentration of both A and B are doubled. State the order of the reaction with respect to A and with respect to B. Write the rate equation.

Watch Video Solution

3. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

What are the orders with respect to A and B ?

Watch Video Solution

4. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

What is the overall order ?

Watch Video Solution

5. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Write the rate law equation.

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Watch Video Solution

6. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Calculate the rate constant.

Watch Video Solution

7. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Suggest a possible mechanism.

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8. The rate constant of a first order reaction is $4.5 \times 10^{-2} \sec^{-1}$ What will be the time required for the initial concentration of 0.4 M of the reactant to be reduced to 0.2 M ?

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9. 1g of strontium - 90 was reduced to 0.953 g after two years. Calculate the half-life period of strontium - 90.

Watch Video Solution

10. Show that the time required for the completion of 75% of a reaction of first order is twice the time required for the completion of 50% of the reaction.

Watch Video Solution

11. A study of chemical kinetics of the reaction, $A+B \rightarrow$ Products, gave the following data at $25^{\circ} C$.

Experiment	[A]	[B]	α [Products/dt]
1.	1.0	0.15	4.20×10^{-6}
2.	2.0	0.15	8.40×10^{-6}
3.	1.0	0.20	5.60×10^{-6}

find : The order of reaction with respect to A.

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12. A study of chemical kinetics of the reaction, $A+B \rightarrow$ Products, gave the following data at $25^{\circ} C$.

Experiment	[A]	[B]	α [Products/dt]
1.	1.0	0.15	4.20×10^{-6}
2.	2.0	0.15	8.40×10^{-6}
3.	1.0	0.20	5.60×10^{-6}

find : The order of reaction with respect to B

Watch Video Solution

13. A study of chemical kinetics of the reaction, $A + B \rightarrow$ Products, gave the following data at $25^{\circ} C$.

Experiment	[A]	[B]	α [Products/dt]
1.	1.0	0.15	4.20×10^{-6}
2.	2.0	0.15	8.40×10^{-6}
3.	1.0	0.20	5.60×10^{-6}

find :The rate law.

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14. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The half-life of the reaction.

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15. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The time required for completing 17% of the reaction.

Watch Video Solution

16. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The time required for completing 87.5% of the reaction.

Watch Video Solution

17. If the half-life period for a first order reaction is 69.3 seconds, what is the value of its rate constant ?

Watch Video Solution

18. The slope of the line in the graph of log k (k = rate constant) versus $\frac{1}{T}$ is - 5841. Calculate the activation energy of the reaction.

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19. A substance decomposes by following first order kinetics. If 50% of the compound is decomposed in 120 minutes, how long will it take for 90% of the compound to decompose ?

Watch Video Solution

20. A first order reaction is 50% complete in 30 minutes at 27°C. Calculate the rate constant of the reaction at 27°C.

Watch Video Solution

21. The initial rate of a reaction $A + B \rightarrow$ Products is doubled when the concentration of A is doubled and increases eight fold when the initial concentration of both A and B are doubled. State the order of the reaction with respect to A and with respect to B. Write the rate equation.

Watch Video Solution

22. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

What are the orders with respect to A and B ?

Watch Video Solution

23. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

What is the overall order ?

Watch Video Solution

24. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Write the rate law equation.

Watch Video Solution

25. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Calculate the rate constant.

Watch Video Solution

Watch Video Solution

26. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration $(\mathrm{Mol\ L^{-1}})$		Initial rate $(\mathrm{Mol\ L^{-1}\ s^{-1}})$
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Suggest a possible mechanism.

Watch Video Solution

27. The rate constant of a first order reaction is $4.5 \times 10^{-2}\,\mathrm{sec}^{-1}$ What will be the time required for the initial concentration of 0.4 M of the reactant to be reduced to 0.2 M ?

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29. Show that the time required for the completion of 75% of a reaction of first order is twice the time required for the completion of 50% of the reaction.

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30. A study of chemical kinetics of the reaction, $A + B \rightarrow$ Products, gave the following data at $25^{\circ} C$.

Experiment	[A]	[B]	α [Products/dt]
1.	1.0	0.15	4.20×10^{-6}
2.	2.0	0.15	8.40×10^{-6}
3.	1.0	0.20	5.60×10^{-6}

find : The order of reaction with respect to A.

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31. A study of chemical kinetics of the reaction, $A + B \rightarrow$ Products, gave the following data at $25^\circ C$.

Experiment	[A]	[B]	α [Products/dt]
1.	1.0	0.15	4.20×10^{-6}
2.	2.0	0.15	8.40×10^{-6}
3.	1.0	0.20	5.60×10^{-6}

find : The order of reaction with respect to B

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32. A study of chemical kinetics of the reaction, $A + B \rightarrow$ Products, gave the following data at $25^\circ C$.

Experiment	[A]	[B]	α [Products/dt]
1.	1.0	0.15	4.20×10^{-6}
2.	2.0	0.15	8.40×10^{-6}
3.	1.0	0.20	5.60×10^{-6}

find :The rate law.

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33. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The half-life of the reaction.

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34. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The time required for completing 17% of the reaction.

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35. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The time required for completing 87.5% of the reaction.

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36. If the half-life period for a first order reaction is 69.3 seconds, what is the value of its rate constant ?

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37. The slope of the line in the graph of log k (k = rate constant) versus $\frac{1}{T}$ is - 5841. Calculate the activation energy of the reaction.

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38. A substance decomposes by following first order kinetics. If 50% of the compound is decomposed in 120 minutes, how long will it take for 90% of the compound to decompose ?

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39. A first order reaction is 50% complete in 30 minutes at 27°C. Calculate the rate constant of the reaction at 27°C.

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40. The initial rate of a reaction $A + B \rightarrow$ Products is doubled when the concentration of A is doubled and increases eight fold when the initial concentration of both A and B are doubled. State the order of the reaction with respect to A and with respect to B. Write the rate equation.

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41. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Calculate the rate constant.

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42. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

What is the overall order ?

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43. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Write the rate law equation.

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44. Consider the reaction, $A + B \rightarrow C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Calculate the rate constant.

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45. Consider the reaction, $A + B \to C + D$.

The initial rate for different initial concentrations of the reactants are given below :

S.No.	Initial Concentration (Mol L^{-1})		Initial rate (Mol L^{-1} s^{-1})
	A	B	
(i)	1.0	1.0	2.0×10^{-3}
(ii)	2.0	1.0	4×10^{-3}
(iii)	4.0	1.0	8×10^{-3}
(iv)	1.0	2.0	2×10^{-3}
(v)	1.0	4.0	2×10^{-3}

Suggest a possible mechanism.

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46. The rate constant of a first order reaction is $4.5 \times 10^{-2} \sec^{-1}$ What will be the time required for the initial concentration of 0.4 M of the reactant to be reduced to 0.2 M ?

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47. 1g of strontium - 90 was reduced to 0.953 g after two years. Calculate the half-life period of strontium - 90.

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48. Show that the time required for the completion of 75% of a reaction of first order is twice the time required for the completion of 50% of the reaction.

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49. A study of chemical kinetics of the reaction $A + B \rightarrow$ products, gave the following data at $25^\circ C$:

Experiment	[A]	[B]	$\frac{d[Products]}{dt}$
1	1·0	0·15	$4{\cdot}20 \times 10^{-6}$
2	2·0	0·15	$8{\cdot}40 \times 10^{-6}$
3	1·0	0·20	$5{\cdot}60 \times 10^{-6}$

Find : (1) The order of reaction with respect to A. (2) The order of reaction with respect to B. (3) The rate law.

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50. A study of chemical kinetics of the reaction $A + B \rightarrow$ products, gave the following data at $25^\circ C$:

Experiment	[A]	[B]	$\frac{d[Products]}{dt}$
1	1·0	0·15	$4{\cdot}20 \times 10^{-6}$
2	2·0	0·15	$8{\cdot}40 \times 10^{-6}$
3	1·0	0·20	$5{\cdot}60 \times 10^{-6}$

Find : (1) The order of reaction with respect to A. (2) The order of reaction with respect to B. (3) The rate law.

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51. A study of chemical kinetics of the reaction $A + B \rightarrow$ products, gave the following data at $25^{\circ}C$:

Experiment	*[A]*	*[B]*	$\frac{d[Products]}{dt}$
1	1·0	0·15	$4 \cdot 20 \times 10^{-6}$
2	2·0	0·15	$8 \cdot 40 \times 10^{-6}$
3	1·0	0·20	$5 \cdot 60 \times 10^{-6}$

Find : (1) The order of reaction with respect to A. (2) The order of reaction with respect to B. (3) The rate law.

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52. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The half-life of the reaction.

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53. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The time required for completing 17% of the reaction.

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54. In a first order reaction, 10% of the reactant is consumed in 25 minutes. Calculate :

The time required for completing 87.5% of the reaction.

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55. If the half-life period for a first order reaction is 69.3 seconds, what is the value of its rate constant ?

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56. The slope of the line in the graph of log k (k = rate constant) versus $\frac{1}{T}$ is - 5841. Calculate the activation energy of the reaction.

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57. A substance decomposes by following first order kinetics. If 50% of the compound is decomposed in 120 minutes, how long will it take for 90% of the compound to decompose ?

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