CHEMISTRY

BOOKS - FULL MARKS CHEMISTRY (TAMIL ENGLISH)

CHEMICAL KINETICS

Text Book Example Problems

1. The oxidation of nitric oxide (NO) $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$

Series of experiments are conducted by keeping the concentration of one of the reactants constant and the changing the concentration of the others.

Find out the individual overall order of the reaction.

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2. Consider the oxidation of nitric oxide to form NO_2

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2_{(g)}}$

(a) Express the rate of the reaction in terms of changes in the concentration of NO , O_2 and NO_2.

(b) At a particular instant , when $[O_2]$ is decreasing at 0.2 $\text{mol L}^{-1}s^{-1}$ at what rate is $[NO_2]$ increasing at that instant ?

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3. What is the order with respect to each of the reactant and overall order of the following reactions ?

(a) $5Br^-_{(aq)} + BrO^-_{3(aq)} + 6H^+_{(aq)} \rightarrow 3Br_{2_{(l)}} + 3H_2O_{(I)}$

The experimental rate law is

Rate $= k[Br^-][BrO_3^-][H^+]^2$

(b) $CH_3CHO_{(g)} \xrightarrow{\Delta} CH_{4(g)} + CO_{(g)}$

the experimental rate law is

Rate $= k[CH_3CHO]^{3/2}$

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4. The rate of the reaction $x + 2y \rightarrow$ product is $4 \times 10^{-3}\ \text{mol L}^{-1}s^{-1}$, if [x] = [y] =0.2 M and rate constant at 400K is $2 \times 10^{-2}s^{-1}$, what is the overall order of the reaction.

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5. (i) A first order reaction takes 8 hours for 90% completion. Calculate the time required for 80% completion . (log 5 = 0 .6989, log 10 =1)

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6. The half life of a first order reaction $x \rightarrow$ products is 6.932×10^4 s at 500 K . What percentage of x would be decomposed on heating at 500 K for 100 min . $(e^{0.06} = 1.06)$

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7. Show that is case of first order reaction , the time required for 99.9% completion is nearly ten times the time required for half completion of the reaction.

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8. The rate constant of a reaction at 400 and 200 K are 0.04 and $0.02s^{-1}$ respectively. Calculate the value of activation energy .

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9. Rate constant k of a reaction varies with temperature T according to the following Arrhenius 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 is or logk Vs $\frac{1}{T}$ a straight line with a slope of $-400K$ is obtained . Calculate the activation energy .

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Evaluate Yourself

1. Write the rate expression for the following reactions, assuming them as elementary reaction . (i) $3A + 5B_2 \rightarrow 4CD$ (ii) $X_2 + Y_2 \rightarrow 2XY$

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2. Consider the decomposition of $N_2O_{5(g)}$ to form $NO_{2(g)}$ and $O_{2(g)}$. At a particular instant N_2O_5 disappears at a rate of $2.5 \times 10^{-2} \text{mol dm}^{-3} s^{-1}$. At what rates are NO_2 and O_2 formed ? What is the rate of the reaction ?

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3. For a reaction , $X + Y \rightarrow$ Product , quadrupling [x] . Increases the rate by a factor of 8 . Quadrupling both [x] and [y] , increases the rate by a factor of 16. Find the order of the reaction with respect to x and y . What is the overall order of the reaction.

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4. Find the individual and overall order of the following reaction using the given data .

$2NO(g) + Cl_2(g) \rightarrow 2NOCl9g)$

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5. In a first order reaction $A \rightarrow$ products , 60% of the given sample of A decomposes in 40 min . What is the halg life of the reaction .

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6. The rate constant for a first order reaction is $2.3 \times 10^{-4} s^{-1}$. If the initial concentration of the reactant is 0.01M. What concentration will remain after 1 hour?

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7. Hydrolysis of an ester in an aqueous solution was studied by titrating the liberated carboxylic acid against sodium hydroxide solution . The concentration of the ester at different time intervals are given below .

Time (min)	0	30	60	90
Ester concentration $molL^{-1}$	0.85	0.80	0.754	0.71

Show that , the reaction follows first order kinetics.

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8. For a first order reaction the rate constant at $500K$ is $8 \times 10^{-4} s^{-1}$. Calculate the frequency factor , if the energy of activation for the reaction is 190kJ mol^{-1}.

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Textbook Evaluation I Choose The Best Answer

1. For a first order reaction $A \rightarrow B$ the rate constant is $x\min^{-1}$. If the initial concentration of A is 0.01 M, the concentration of A after one hour is given by the expression.

A. $0.01e^{-x}$

B. $1 \times 10^{-2}\left(1 - e^{-60x}\right)$

C. $\left(1 \times 10^{-2}\right)e^{-60x}$

D. none of these

Answer: C

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2. A zeo order reaction $X \rightarrow$ Product, with an initial concentration 0.02 M has a half life of 10 min . If one starts with concentration 0.04 M , then the half life is ....

A. 10 s

B. 5 min

C. 20 min

D. cannot be predicted using the given information

Answer: C

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3. Among the following graphs showing variation of rate constant with temperature (T) for a reaction, the one that exhibits Arrhenius behavior over the entire temperature range is .....

A. 

B. 

C. 

D. both (b) and (c)

Answer: B

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4. For a first order reaction $A \rightarrow$ product with initial concentration $xmolL'^{-1}$ m has a half life period of 2.5 hours. For the same reaction with initial concentration . $\left(\frac{x}{2}\right)$ $\mathrm{mol\ L^{-1}}$ the half life is .....

A. (2.5×2) hours

B. $\left(\frac{2.5}{2}\right)$ hours

C. 2.5 hours

D. Without knowing the rate constant , $t_{1/2}$ cannot be determined from the given data

Answer: D

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5. For the reaction, $2NH_3 \rightarrow N_2 + 3H_2$, if $\frac{-d[NH_3]}{dt} = k_1[NH_3], \frac{d[N_2]}{dt} = k_2[NH_3], \frac{d[H_2]}{dt} = k_3[NH_3]$ then the

relation between k_1, k_2 and k_3 is .....

A. $k_1 = k_2 = k_3$

B. $k_1 = 3k_2 = 2k_3$

C. $1.5k_1 = 3k_2 = k_3$

D. $2k_1 = k_2 = 3k_3$

Answer: C

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6. The decomposition of phosphine (PH_3) on tungsten at low pressure is a first order reaction . It is because the .....[NEET]

A. rate is proportional to the surface converge

B. rate is inversely proportional to the surface converge

C. rate of decomposition is slow

D. rate is independent of the surface

Answer: C

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7. For a reaction Rate $k = [\text{acetone}]^{3/2}$ then unit of rate constant and rate of reaction respectively is .....

A. $(molL^{-1}s^{-1}), \left(mol^{-1/2}L^{1/2}s^{-1}\right)$

B. $\left(mol^{-1/2}L^{1/2}s^{-1}\right), (molL^{-1}s^{-1})$

C. $(molLs^{-1}), \left(mol^{1/2}L^{1/2}s\right)$

D. $\left(mol^{-1/2}s^{-1}\right), (molL^{-1}s^{-1})$

Answer: B

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8. The addition of a catalyst during a chemical reaction alters which of the following quantities ?

A. Enthalpy

B. Activation energy

C. Entropy

D. Internal energy

Answer: B

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9. Consider the following statements :

(i)increase in concentration of the reactant increases the rate of a zero order reaction.

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

(iii) rate constant k is equal to collision frequency A if $E_a = \circ$

(iv) a plot of ln (k) vs $\left(\frac{1}{T}\right)$ is a straight line with a positive slope.

Correct statements are .....

A. (ii) only

B. (ii) and (iv)

C. (ii) and (v)

D. (i) , (ii) and (v)

Answer: A

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10. In a reversible reaction, the enthalpy change and the activation energy in the forward direction are respectively $-xkJmol$ and $ykJmol^{-1}$. Therefore , the energy of activation in the backward direction is .....

A. $(y-x)\text{kJ mol}^{-1}$

B. $(x+y)Jmol^{-1}$

C. $(x-y)kJmol^{-1}$

D. $(x+y)\times 10^{3}Jmol^{-1}$

Answer: D

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11. What is the activation energy for a reaction if its rate doubles when the temperature is raised from 200 K to 400 K ?

$\left(R = 8.314\text{kJ}mol^{-1}K^{-1}\right)$

A. $234.65\text{kJ mol}^{-1}K^{-1}$

B. $434.65\text{kJ mol}^{-1}K^{-1}$

C. $434.65\text{J mol}^{-1}K^{-1}$

D. $334.65\text{kJ mol}^{-1}K^{-1}$

Answer: C

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12.  , This reaction follows first order kinetic . This rate constant at particular temperature is $2.303 \times 10^{-2}\text{hour}^{-1}$. The initial concentration of cyclopropane is 0.25 M . What will be the concentration of

cyclopropane after 1806 minutes ?

(log 2 = 0.3010)

A. 0.125 M

B. 0.215 M

C. $0.25 \times 2.303M$

D. 0.05 M

Answer: B

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

A. $\left(\frac{3}{2}\right)\log 2$

B. $\left(\frac{2}{3}\right)\log 2$

C. $\left(\frac{3}{2}\right)\log\left(\frac{3}{4}\right)$

D. $\left(\frac{2}{3}\right)\log\left(\frac{4}{3}\right)$

Answer: B

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14. In a first order reaction $x \to y$, if k is the rate constant and the initial concentration of the reactant x is 0.1 M , then , the half life is .....

A. $\left(\frac{\log 2}{k}\right)$

B. $\left(\frac{0.693}{(0.1)k}\right)$

C. $\left(\frac{\ln 2}{k}\right)$

D. none of these

Answer: C

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15. Predict the rate law of the following reaction based on the date given below $2A + B \rightarrow C + 3D$

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

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

C. rate $= [A][B]$

D. rate $= [A]^{1/2}[B]^{3/2}$

Answer: B

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16. Assertion : rate of reaction doubles when the concentration of the reactant is doubles if it is a first order reaction.

A. Both assertion and reason are true and reason is the correct explanation of assertion.

B. Both assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is true but reason is false .

D. Both assertion and reason are false .

Answer: C

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17. The rate constant of a reaction is $5.8 \times 10^{-2} s^{-1}$. The order of the reaction is .....

A. First order

B. zero order

C. second order

D. Third order

Answer: A

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18. For the reaction $N_2O_{5(g)} \rightarrow 2NO_{2_g} + \frac{1}{2}O_{2(g)}$, the value of rate of disappearance of N_2O_5 is given as $6.5 \times 10^{-2})molL^{-1}s^{-1}$. The rate of formation of NO_2 and O_2 is given respectively as .....

A. $\left(3.25 \times 10^{-2}\text{mol L}^{-1}s^{-1}\right)$ and $\left(1.3 \times 10^{-2}\text{molL}^{-1}s^{-1}\right)$

B. $\left(1.3 \times 10^{-2}\text{molL}^{-1}s^{-1}\right.$ and $\left(3.25 \times 10^{-2}\text{mol L}^{-1}s^{-1}\right)$

C. $\left(1.3 \times 10^{-1}\text{molL}^{-1}s^{-1}\right.$ and $\left(3.25 \times 10^{-2}\text{mol L}^{-1}s^{-1}\right)$

D. none of these

Answer: C

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19. During the decomposition of H_2O_2 to given dioxygen , 48 g O_2 is formed per minute at certain point of time . The rate of formation of water at this point is .....

A. 0.76mol min^{-1}

B. 1.5mol min^{-1}

C. 2.25mol min^{-1}

D. 3.0mol min^{-1}

Answer: D

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20. If the initial concentration of the reactant is doubled , the time for half reaction is also doubled . Then the order of reaction is .....

A. zero

B. one

C. Fraction

D. none

Answer: A

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21. In a homogeneous reaction $A \rightarrow B + C + D$, the initial pressure was P_0 and after time t is was P. Expression of rate constant in terms of P_0 , P and t will be

A. $k = \left(\frac{2.303}{t}\right)\log\left(\frac{2P_0}{3P_0 - P}\right)$

B. $k = \left(\frac{2.303}{t}\right)\log\left(\frac{2P_0}{P_0 - P}\right)$

C. $k = \left(\frac{2.303}{t}\right)\log\left(\frac{2P_0}{3P_0 - 2P}\right)$

D. $k = \left(\frac{2.303}{t}\right)\log\left(\frac{2P_0}{3P_0 - P}\right)$

Answer: A

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22. If 7% of a first order reaction was completed in 60% of the same reaction under the same conditions would be completed in.....

A. 20 minutes

B. 30 minutes

C. 35 minutes

D. 75 minutes

Answer: B

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23. The half life period of a radioactive element is 140 days . After 560 days , 1 g of element will be reduced to .....

A. $\left(\frac{1}{2}\right)g$

B. $\left(\frac{1}{4}\right)g$

C. $\left(\frac{1}{8}\right)g$

D. $\left(\frac{1}{16}\right)g$

Answer: D

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24. The correct difference between first and second order reactions is that .....

A. A first order reaction can be cataylsed , a second order reaction cannot b cataysed .

B. The half life of a first order reaction does not depend on $[A_0]$, the half life of a second order reaction odes depend on $[A_0]$.

C. The rate of a first order reaction does not depend on reactant concentrations , the rate of a second order reaction does depend on reactant concentrations.

D. The rate of a first reaction does depend on reactant concentration , the rate of a second order reaction does not depend on reactant concentrations.

Answer: B

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25. After 2 hours , a radioactive substance becomes $\left(\frac{1}{16}\right)^{th}$ of original amount . Then the half life (in min) is .....

A. 60 minutes

B. 120 minutes

C. 30 minutes

D. 15 minutes

Answer: C

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Textbook Evaluation Ii Answer The Following Questions

1. Define average rate and instantaneous rate.

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2. Defined rate law and constant.

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3. Derive integrated rate law for a zero order reaction $A \rightarrow$ Product .

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4. Define half life of reaction . Shows that the first order reaction half life is independent of Intel concentration.

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5. What is an elementary reaction ? Given the differences between order and molecularity of a reaction .

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6. Explain the rate determining step with an example .

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7. Describe the graphical representation of first order reaction.

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8. Write the law for the following reactions .

(a) A reaction that is 3/2 order in x and zero order in y .

(b) A reaction that is second order in NO and first order in Br_2 .

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9. Explain the effect of catalyst on reaction rate with an example.

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10. The rate law for a reaction of A,B and C has been found to be rate = $k[A]^2[B][L]^{3/2}$

How would the rate of reaction Change when

(i) Concentration of [L] is quadrupled

(ii) Concentration of both [A] and [B] are doubled

(iii) Concentration of [A] is halved

(iv) Concentration of [A] is reduced to $(1/3)$ and consideration of [L] is quadrupled .

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11. The rate of formation of a dimer in a second order reaction $7.5 \times 10^{-3} \text{mol L}^{-1} s^{-1}$ at 0.05mol L^{--1} monomer concentration. Calculate the rate constant.

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12. For reaction $x + y + z \rightarrow$ products the rate law is given by rate $= k[x]^{3/2}[y]^{1/2}$ what is the overall order of the reaction and what is the order of reaction with respect to Z.

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13. Explain briefly the collision theory of bimolecular reactions.

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14. Write Arrhenius equation and explains the terms involved.

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15. The decomposition of Cl_2O_7 at 500K in the gas phase to Cl_2 and O_2 is a first order reaction . After 1 minutes at 500 K , the pressure of Cl_2O_7 falls from 0.08 to 0.04 atm. Calculate the reate constant in s^{-1}.

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16. Given the example for a zero order reaction.

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17. Explain pseudo first order reaction with an example.

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18. Identify the order for the following reactions

(i) Rusting of Iron

(ii) Radioactive disintegration of $._{92}U^{238}$.

(iii) $2A + B \rightarrow$ products , rate $= k[A]^{1/2}[B]^2$

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19. A gas phase reaction has energy of activation $200 \mathrm{kJ\ mol^{-1}}$. If the frequency factor of the reaction is $1.6 \times 10^{13} s^{-1}$. Calculate the rate constant at 600 K . $\left(e^{-40.09} = 3.8 \times 10^{-18}\right)$.

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20. For the reaction $2x + y \rightarrow L$ find the rate law from the following data.

$[x](\ \mathrm{min}\ )$	$[y](\ \mathrm{min}\ )$	$Rate\left(Ms^{-1}\right)$
0.2	0.02	0.15
0.4	0.02	0.30
0.4	0.08	1.20

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21. How do concentration of the influence the rate of reaction ?

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22. How do nature of the reactant influence rate of reaction? Nature and state of the reactant:

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23. The rate constant for first order reaction is $1.54 \times 10^{-3} s^{-1}$. Calculate its half life time .

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24. The half life of the homogeneous gaseous reaction $SO_2Cl_2 \rightarrow SO_2 + Cl_2$ which obeys first order kinetics is 8.0 minutes. How long will it take for the concentration of SO_2Cl_2 to the reduced to 1% of the initial value ?

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25. The time for half change in a first order decomposition of a substance A is 60 seconds. Calculate the rate constant . How much of A will be left after 180 seconds?

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26. A zero order reaction is 20% complete in 20 minutes . Calculate the value of the rate constant . In what time will the reaction be 80% complete ?

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27. The activation energy of a reaction is 225 k $calmol^{-1}$ and the value of rate constant at $40^{\circ}C$is $1.8 \times 10^{-5}s^{-1}$. Calculate the frequency factor , a , .

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28. Benzene diazonium chloride in aqueous solution decomposes according to the equation $C_6H_5N_2Cl \rightarrow C_6H_5Cl + N_2$. Starting with an initial concentration of 10g L^{-1}, the volume of N_2 gas obtained at $50^\circ C$ at different intervals of time was found to be as under :

$t(\text{ min }):$	6	12	18	24	30	∞
Vol. of $N_2(ml):$	19.3	32.6	41.3	46.5	50.4	58.3

Show that the above reaction follows the first order kinetics. What is the value of the rate constant ?

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

$t(\text{ min })$	0	10	20
$V(ml)$	46.1	29.8	19.3

where t is the time in minutes and V is the volume of standard $KMnO_4$ solution required for titrating the same volume of the reaction mixture.

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30. A first order reaction is 40% complete in 50 minutes . Calculate the value of the rate constant. In wha time the reaction be 80% complete ?

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Additional Questions I Choose The Correct Answer

1. Which onr of thr following is a slow reaction ?

A. Rusing of iron

B. Combustion of carbon

C. Reaction between $BaCl_2 \text{and dil } H_2SO_4$.

D. Reaction between acidified $K_2Cr_2O_7$ with NaCl.

Answer: A

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2. Which one of the following is the unit of rate of reaction ?

A. s^{-1}

B. mol s^{-1}

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

D. $mo^{-1}lL^{-1}s^{-1}$

Answer: C

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3. For a gas phase reaction , the unit of reaction rat is .....

A. s^{-1}

B. $\text{atm}\ \ s^{-1}$

C. $molL^{-1}s^{-1}$

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

Answer: B

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4. For the reaction $A \rightarrow 2B$, the rate of the reaction rate is .....

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

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

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

D. Rate = $2\frac{d[B]}{dt}$

Answer: A

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5. Consider the following statement .

(i) In ionisation of cyclopropane, if the concentration of cyclopropane is reduced is reduced half , the rate increases twice.

(ii) The rate of the reaction depends upon the concentration of the reactant.

(iii) Order values must be determined experimentally .

Which of the above statement (s) is / are not correct ?

A. (i) only

B. (ii) and (iii)

C. (iii) only

D. (ii) only

Answer: A

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6. In the reaction $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$, the order of the reaction with respect to NO is .....

A. First order

B. second order

C. third order

D. zero order

Answer: B

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7. In the reaction $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$, the order of the reaction with respect to O_2 is .....

A. zero order

B. first order

C. second order

D. Third order

Answer: B

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8. The overall order of the reaction $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ is .....

A. 2

B. 1

C. 3

D. 0

Answer: C

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9. Consider the following statements .

(i) Rate of the reaction does not depend on the initial concentration of the reactants.

(ii) Rate constant of the reaction depends on the initial concentration of reactants.

(iii) Rate constant of the reaction is equal to the rate of the reaction,

when the concentration of each of the reactants is unity.

Which of the above statement (s) is/are not correct ?

A. (i) only

B. (ii) only

C. (i) and (ii)

D. (iii) only

Answer: D

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10. The overall molecularity of the reaction $2H_2O_{2(aq)} \xrightarrow{I^-} 2H_2Ol_{(l)} + O_{2(g)}$ is .....

A. unimolecular

B. bimolecular

C. termolceular

D. pentamolecular

Answer: B

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11. Which of the following is the order decompostion of hydrogen peroxide catalysed by I^- ?

A. First order

B. second order

C. Zero order

D. Third order

Answer: A

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12. Consider the following statements .

(i) order cannot be zero .

(ii) Molecularity can be zero (or) fractional (or) integer.

(iii) order can be determined only by experiment.

Which of the above statement (s) is/are not correct?

A. (i) only

B. (ii) only

C. (iii) only

D. (i) and (ii)

Answer: C

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13. The overall order of the reaction $5Br^- + BrO_3^- + 6H^+$ is .....

A. 4

B. $3/2$

C. 12

D. 1

Answer: A

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14. Which one of the following reaction is a fractional order reaction ?

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

B. $CH_3CHO_{(g)} \rightarrow CH_{4_{(g)}} + CO^{(g)}$

C. $2H_2O_{2(aq)} \rightarrow 2H_2O_{(l)} + O_{2_g}$

D. $H_2 + Br_2 \rightarrow 2HBr$

Answer: B

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15. The order of decomposition of acetaldehyde is .....

A. 1

B. 1.5

C. 2

D. $5/2$

Answer: B

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16. Which one of the following is the unit rate constant for a first order reaction ?

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

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

C. s^{-1}

D. mol L S

Answer: C

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17. Which one of the following is an example for first order reaction ?

A. $2NO_{(g)} + O_{2_{(g)}} \rightarrow 2NO_{2(g)}$

B. $CH_3CHO_{(g)} \rightarrow CH_{4(g)} + CO_{(g)}$

C. $SO_2Cl_{2(l)} \rightarrow SO_{2(g)} + Cl_{2(g)}$

D. $2HBr \rightarrow H_2 + Br_2$

Answer: C

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18. Which one of the following is not an example for first order reaction ?

A. $N_2O_{5(g)} \rightarrow 2NO_{2_{(g)}} \frac{1}{2}O_{2(g)}$

B. $SO_2Cl_{2(l)} \rightarrow SO_{2(g)} + Cl_{2(g)}$

C. $H_2O_{2(aq)} \rightarrow H_2O_{(l)} \frac{1}{2} O_{2(g)}$

D. $CH_3CHO_{(g)} \rightarrow CH_{4_g} + CO_{(g)}$

Answer: D

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19. What is the order of isomerisation of cyclopropane to propene ?

A. 1.5

B. $3/2$

C. $5/2$

D. 1

Answer: D

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20. Which is the order of isomerisation of cycloprapane ot propene ?

A. $CH_3CHO_{(g)} \rightarrow CH_{4(g)} + CO_{(g)}$

B. $2H_2O_{2_{(aq)}} \rightarrow H_2O_{(l)} + O_{2(g)}$

C.

$$CH_3COOHCH_{3(aq)} + H_2O(l) \xrightarrow{H^+} CH_3COOH_{(aq)} + CH_3OH_{(aq)}$$

D. Isomerisation of cyclo propane to propene

Answer: C

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21. Which one of the following is called pseudo firs order reaction ?

A. Decomposition of acetaldehyde

B. Acid hydrolysis of an ester

C. Isomerisation of cycloprapane to propne

D. Decomposition of hydrogen peroxide

Answer: B

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22. Which of the following is an example of zero order reaction ?

A. Iodination of acetone in acid medium

B. Hydrolysis of an ester in acid medium

C. Decomposition of acetaldehyde

D. Isomerisation of cyclo propane to propene

Answer: A

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23. Which one of the follow is not zero order reaction ?

A. $H_{2(g)} + Cl_{2(g)} \xrightarrow{h\nu} 2HCl_{(g)}$

B. $N_2O(g) \Leftrightarrow N_{2(g)} + \frac{1}{2}O_{2(g)}$

C. $CH_3COHO_{(g)} \rightarrow CH_{4(g)} + CO((g))$

D. $CH_3COCH_3 + I_2 \xrightarrow{H^+} ICH_2COCH_3 + HI$

Answer: C

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24. Consider the following statements.

(i) For a first order reaction, half life period is independent of initial of concentration.

(ii) Photo chemical reaction between H_2 and Cl_2 is azero order reaction.

(iii) Acid hydrolysis of an ester is a second order reaction

Which of the above statement is/ are correct ?

A. (i) only

B. (iii) only

C. (i) & (ii)

D. (ii) & (iii)

Answer: C

View Text Solution

25. The formula of half life for an n^{th} order reaction involving A and $n \neq 1$ is .....

A. $t_{1/2} = \frac{2^{n-1} - 1}{(n-1)k(A_0)^{n-1}}$

B. $t_{1/2} = \frac{k_1}{0.693}$

C. $t_{1/2} = \frac{2^n}{(n-1)k(A)^{n+1}}$

D. $t_{1/2} = \frac{2^{n-1} - 1}{(n-1)k(A_g)^{n+1}}$

Answer: A

View Text Solution

26. The half life period of first order reaction is 10 seconds. What is the time required for 99.9% completion of that reaction ?

A. 20 seconds

B. 1000 seconds

C. 100 seconds

D. 99 seconds

Answer: C

View Text Solution

27. Which one of the following is known as arrhenius equation ?

A. $k = Ae^{-\left(\frac{E_a}{RT}\right)}$

B. $k = Ae^{\left(\frac{E_a}{RT}\right)}$

C. $k = Ae^{-\left(\frac{RT}{E_a}\right)}$

D. $k = Ae^{-\left(\frac{RT}{E_a}\right)}$

Answer: A

View Text Solution

28. Which one of the following is known as arrhenisus equation ?

A. Nature of the reactant

B. Concentration of the reactants

C. Surface area and temperature

D. pressure

Answer: D

View Text Solution

29. Consider the following statements.

(i) Higher the concentration , slower is the possibility for collision and rate also slower

(ii) Increase in surface are a of reactant leads to more collisions per second

(iii) Gas phase reactions are slower as compared to solid or liquid reactants

Which of the above statement is/ are not correct ?

A. (ii)

B. (i) & (iii)

C. (ii) & (iii)

D. (i) & (ii)

Answer: B

View Text Solution

30. Which of the following reaction take place at a faster rate

A. $2Na_{(s)} + I_{2(s)} \rightarrow 2NaI_{(s)}$

B. $2Na_{(s)} + I_{2(g)} \rightarrow 2NaI_{(s)}$

C. $PbNO_3(s) + KI_{(s)} \rightarrow PbI_{(s)} + KNO_3$

D. $\underset{\text{Marble}}{CaCO_3} + \overset{dil}{HCl} \rightarrow CaCl_2 + H_2O + CO_2 \uparrow$

Answer: B

View Text Solution

31. Which one of the following graph is not correct

A. 

B. 

C. 

D. 

Answer: D

View Text Solution

32. The half life of paracetamol with in the body is ....

A. 2 hours

B. 2.5 hours

C. 6 hours

D. 10 hours

Answer: B

View Text Solution

33. What is the order of radioactive decay ?

A. first order

B. zero order

C. second order

D. Third order

Answer: A

View Text Solution

34. $t_{1/2}$ of the reaction increases with increases in initial concentration of the reaction means the order of reaction will be .....

A. first order

B. zero order

C. second order

D. third order

Answer: B

View Text Solution

35. The reaction rate the does not decrease with time is

A. pseudo first order reaction

B. first order reaction

C. zero order reaction

D. second order reaction

Answer: C

View Text Solution

36. The rate of the reaction $X \rightarrow Y$ becomes 8 times when the concentration of the reactant 'X' is doubled . The rate law of the reaction is .....

A. $-\frac{d[x]}{dt} = k[X]^2$

B. $-\frac{d[x]}{dt} = k[X]^3$

C. $-\frac{d[x]}{dt} = k[X]^4$

D. $-\frac{d[x]}{dt} = k[X]^8$

Answer: B

View Text Solution

37. The decomposition of ammonia gas on platinum surface has a rate constant $k = 2.5 \times 10^{-4} \text{mol L}^{-1} s^{-1}$. What is the order of the reaction ?

A. first order

B. second order

C. third order

D. zero order

Answer: D

View Text Solution

38. A reaction is 50% completed in 2 hours and 75% completed in 4 hours. Then the order of the reaction is .....

A. first order

B. zero order

C. second order

D. third order

Answer: A

View Text Solution

39. What is the rate equation for the reaction $A + B \rightarrow C$ has zero order ?

A. Rate = k

B. Rate = k [A]

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

D. Rate k. $\frac{1}{[c]}$

Answer: C

View Text Solution

40. How does the value of rate constant vary with reactant concentration ?

A. $k \propto \frac{c^{n-1}}{n+1}$

B. $k \propto \frac{1}{c^{n-1}}$

C. $k \propto \frac{1}{c^{n+1}}$

D. $k \propto \frac{1}{C}$

Answer: B

View Text Solution

41. Identify the reaction order if the unit of rate constant is s^{-1}.

A. zero order reaction

B. second order reaction

C. first order reaction

D. third order reaction

Answer: C

View Text Solution

42. What is unit of zero order reaction ?

A. s^{-1}

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

C. $molL^{-1}s^{-1}$

D. $molLs^{-1}$

Answer: C

View Text Solution

43. Which of the following factor affect th rate of the reaction

A. volume

B. pressure

C. conc

D. all the above

Answer: C

View Text Solution

44. Acid hydrolysis of an ester is an example of .....

A. zero order reaction

B. Pseudo first order reaction

C. second order reaction

D. first order reaction

Answer: B

View Text Solution

45. Polymerisation reactions follows .....order kinetics.

A. fractional

B. first

C. zero

D. Pseudo first

Answer: A

View Text Solution

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

A. changing concentration of the reactants

B. Evaluating rate constants at standard temperature

C. Evaluating rate constants at two different temperature

D. Evaluating rate constants at two different temperature

Answer: C

View Text Solution

47. Which of the following is the fastest reaction ?

A. $\dot{u}\dot{u}\frac{1}{2}2 \xrightarrow{250^\circ C}$

B. $\dot{u}\dot{u}\frac{1}{2}2 \xrightarrow{500^\circ C}$

C. $\dot{u}\dot{u}\frac{1}{2}2 \xrightarrow{750^\circ C}$

D. $\dot{u}\dot{u}\frac{1}{2}2 \xrightarrow{1000^\circ C}$

Answer: D

View Text Solution

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

A. 2

B. 5

C. 3

D. 4

Answer: D

View Text Solution

49. A large increase in the rate of a reactant for a rise in temperature is due to .....

A. the decrease in the number of collisions

B. increases in the number of activated molecules

C. the shortening of mean free path

D. the lowering of activation energy

Answer: B

View Text Solution

50. The minimum energy of a molecule would posses in order to enter into a fruitful collision is known as .....

A. Reaction energy

B. collision energy

C. Activation energy

D. Threshold energy

Answer: D

View Text Solution

Additional Questions Ii Fill In The Blanks

1. The unit of the a reaction is .....

View Text Solution

2. For a..... reaction the unit of the reaction rate is atm s^{-1}

View Text Solution

3. An elementary step is characterised by its .....

View Text Solution

4. The total number of reactant spices involved in an elementary step is called is .....

View Text Solution

5. The overall order of decomposition of acetaldehyde to methane and carbon monoxide rate law is called.....

View Text Solution

6. A second order reaction can be altered to a first order reaction by taking one of the reactant in large excess, it is called... .....

View Text Solution

7. A reaction in which rate is independent of the the concentration of the reactant over a wide range of concentration is called.....

View Text Solution

8. All radioactive disintegration reactions follow..... kinetics.

View Text Solution

9. For a first order reaction, half life does not depend on.....

View Text Solution

10. Half life period of zero order reaction is ..... proportional to initial concentration of the reactant.

View Text Solution

11. Half life period ..... reaction is directly proportional to initial concentration of the reactant .

View Text Solution

12. ..... was proposed by Max Trautz and wilinam lewis.

View Text Solution

13. Collision theory was proposed by.....in 1916 and .....in 1918.

View Text Solution

14. For a gas at room temperature (289 K) and 1 atm, each molecules undergoes approximately ..... Per second.

View Text Solution

15. In order the react, the colliding molecules must process a minimum energy called.....

View Text Solution

View Text Solution

16. The number of collisions of reactant molecules per second is known as.....

View Text Solution

17. ..... reactions are faster as compared to reaction involving solid or liquid reactants.

View Text Solution

18. The rate of reaction .....with the increase is the concentration of the reactants.

View Text Solution

19. Higher the concentration of reactions greater is the possibility of .....and hence the .....

View Text Solution

20. In the presence of catalyst the energy of activation is .....and hence greater number of molecules change over to products there by increasing the rate of the reaction.

View Text Solution

21. Bio availability of drugs within the body and this branch of study is called.....

View Text Solution

22. ..... has a half life 2.5 hours within the body.

View Text Solution

23. Increase in surface are of reactant leads to more collisions per litre per second and hence the rate of the reaction.....

View Text Solution

24. Acid hydrolysis of an ester is an example of .....

View Text Solution

Additional Questions Iii Match The Following

1. Match the list I and II using the code given below the list .

List -I	List - II
A. Acid hydrolysis of an ester	1. Fractional orde
B. Decomposition of H_2O_2	2. second order rea
C. Decomposition of CH_3CHO	3. Pseudo first ord
D. Substitution of methyl bromide with aqueous KOH	4. First order reac

Code

A. $\begin{matrix} A & B & C & D \\ 3 & 4 & 1 & 2 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 4 & 2 & 3 & 1 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 1 & 3 & 2 & 4 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 2 & 1 & 4 & 3 \end{matrix}$

Answer: a

View Text Solution

2. Match the list I and II using the code given below the list .

	List -I		List - II
$A.$	$2NO + O_2 \rightarrow 2NO_2$	1.	First order
$B.$	$CH_3COOCH_3 + H_2O \xrightarrow{H^+} CH_3COOH + CH_3OH$	2.	Zero order
$C.$	$_{92}U\dot{u}\dot{u}\dot{u} \rightarrow_{90} Th +_2 He$	3.	Pseudo firs
$D.$	$CH_3COCH_3 + I_2 \rightarrow ICH_2COCH_3 + HI$	4.	Third orde

code

A. $\begin{matrix} A & B & C & D \\ 3 & 2 & 4 & 1 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 4 & 3 & 1 & 2 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 2 & 1 & 3 & 4 \end{matrix}$

D.

A	B	C	D
1	4	2	3

Answer: b

View Text Solution

3. Match the list I and II using the code given below the list .

	List -I		List - II
$A.$	$N_2O(g) \Leftrightarrow N_2(g) + 1/2O_2(g)$	1.	$Order =$
$B.$	$SO_2Cl(g) \rightarrow SO_2(g) + cl_2(g)$	2.	$Order =$
$C.$	$CH_3CHO(g) \rightarrow CH_4(g) + CO(g)$	3.	$Order =$
$D.$	$5Br^-_{(aq)} + BrO^-_{3(aq)} + 6H^+ \rightarrow 3Br_{2(l)} + 3H_2O(l)$	4.	$Order =$

code

A.

A	B	C	D
3	1	4	2

B.

A	B	C	D
4	2	3	1

C.

A	B	C	D
2	4	1	3

D.

A	B	C	D
1	3	2	4

Answer: a

View Text Solution

View Text Solution

4. Match the list I and II using the code given below the list .

	List -I		List - II
$A.$	$t_{1/2}$ of first order reaction	1.	$k = \frac{2.303}{t}\log.\left[\frac{(A_0)}{(A)}\right]$
$B.$	$t_{1/2}$of n^{th}order	2.	$f = e^{-\frac{Ea}{RT}}$
$C.$	Fraction of effective collision	3.	$\frac{0.6932}{k}$
$D.$	Rate constant of first order reaciton	4.	$\frac{2^{n-1}-1}{(n-1)\,k\,(A_0)^{n-1}}$

code

A. $\begin{matrix} A & B & C & D \\ 3 & 4 & 1 & 2 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 4 & 2 & 3 & 1 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 1 & 3 & 2 & 4 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 2 & 1 & 4 & 3 \end{matrix}$

Answer: a

View Text Solution

Additional Questions Iv Assertion And Reason

1. Assertion (A) : Decomposition of hydrogen first order reaction .

Reaction (R) : The above reaction take place in two steps, step I involved both H_2O_2 and I^- and so it is bimolecular but order is determined experimentally as 1 .

A. Both A and R are correct and R is the correct explanation of A

B. Both A and R are correct but R is not the correct explanation of A

C. A is correct but R is wrong

D. A is wrong but R is correct

Answer: a

View Text Solution

2. Assertion (A) : $5Br^-_{(aq)} + BrO^-_{3_{(aq)}} + 6H^+ \rightarrow 3BR_{2(l)} + 3H_2O_{(l)}$

The overall order of the reaction is equal to 4 .

Reason (R) : The experimental rate law is , Rate =

$K[Br^-][BRO_3^-][H^+]^2$.

So 1 + +1 + 2 = 4 order value is 4.

A. Both A and R are correct and R is the correct explanation of A

B. Both A and R are correct but R is not the correct explanation of A

C. A is correct but R is wrong

D. A is wrong but R is correct

Answer: a

View Text Solution

3. Assertion (A) : The rate of a reaction increases with the increase in the concentration of the reactants .

Reason (R) : The rate of the reaction depends upon the number of Collisions between the reacting molecules. Higher the concentration , greater is the possibility for collision and hence the rate .

A. Both A and R are correct and R is the correct explanation of A

B. Both A and R are correct but R is not the correct explanation of A

C. A is correct but R is wrong

D. A is wrong but R is correct

Answer: a

View Text Solution

4. Assertion (A): Powered calcium carbonate reacts much faster with dilute HCI then with the same mass of $CaCO_3$ as marble.

Reason : For a given mass of a reactant , when the particle size decrease, surface area increases Increase in surface area of the reaction leads to more Collisions per litre per second and hence the rate of the reaction also increase

A. Both A and R are correct and R is the correct explanation of A

B. Both A and R are correct but R is not the correct explanation of A

C. A is correct but R is wrong

D. A is wrong but R is correct

Answer: a

View Text Solution

5. Assertion (A) : Catalyst presence increase the rate the reaction

Reason (R) : in the presence of a catalyst , energy of activation is lowered and hence greater number of molecules can across the energy barrier and change over to products thereby increasing the rate of the reaction.

A. Both A and R are correct and R is the correct explanation of A

B. Both A and R are correct but R is not the correct explanation of A

C. A is correct but R is wrong

D. A is wrong but R is correct

Answer: b

View Text Solution

6. Assertion (A) : Doctors adviced to take paracetamol once in 6 hours during fever and body pain

Reason (R) : Paracetamol has a half-life of 2.5 hours within the body . After 10 hours (4 half lives) only 6.25% of drug remains. Based on this , doctors adviced to take it once in 6 hours.

A. Both A and R are correct and R is the correct explanation of A

B. Both A and R are correct but R is not the correct explanation of A

C. A is correct but R is wrong

D. A is wrong but R is correct

Answer: a

View Text Solution

7. Assertion (A) : Order of the reaction can be zero or fractional

Reason (R) : We cannot determine order from balanced chemical equation

A. Both A and R are correct and R is the correct explanation of A

B. Both A and R are correct but R is not the correct explanation of A

C. A is correct but R is wrong

D. A is wrong but R is correct

Answer: a

View Text Solution

8. Assertion (A) : If the activation energy of a reaction is zero , temperature will have no effect on the rate constant

Reason (R) : Lower the activation energy , faster is the reaction .

A. Both A and R are correct and R is the correct explanation of A

B. Both A and R are correct but R is not the correct explanation of A

C. A is correct but R is wrong

D. A is wrong but R is correct

Answer: b

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Additional Questions V Find The Odd One Out

1. Find the odd one out

A. $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + 1/2O_{2(g)}$

B. $SO_2Cl_{2(g)} \rightarrow SO_{2(g)} + Cl_{2(g)}$

C. $CH_3CHO_{(g)} \xrightarrow{\Delta} CH_{4(g)} + CO_{(g)}$

D. $H_2O_{2((aq))} \rightarrow H_2O_{(l)} + 1/2O_{2_{(g)}}$

Answer: c

View Text Solution

2. Find the odd one out

A. $H_{2(g)} + Cl_{2(g)} \xrightarrow{h\nu} 2HCl_{(g)}$

B. $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + 1/2O_{2(g)}$

C. $N_2O_{(g)} \Leftrightarrow N_{2_{(g)}} + \frac{1}{2}O_{2(g)}$

D. $CH_3COCH_3 + I_2 \xrightarrow{H^+} ICH_2COCH_3 + HI$

Answer: b

View Text Solution

3. Find the odd one out

A. Decomposition of dinitrogen pentoxide

B. Iodination of acetone in acid medium

C. Decomposition of N_2O on hot Pt surface

D. photochemical reaction between H_2 and Cl_2

Answer: a

View Text Solution

Additional Questions 2 Mark Questions

1. Defined rate of the reaction give the unit of rate

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2. Defined molecularity of a reaction.

View Text Solution

3. Define order of chemical reaction.

View Text Solution

4. Define half life period.

View Text Solution

5. Mention the factors affecting the reaction rate .

View Text Solution

6. How is surface area of the reactant affect the the rate of the reaction?

View Text Solution

7. Paracetamol is prescribed to take once in 6 hours, justify this statement.

View Text Solution

8. For a reactions , $A + B \rightarrow$ product , the rate law is given by $r = k[A]^{1/2}[B]^2$. What is the order of the reaction ?

View Text Solution

9. The conversion of molecules X to Y follows second order kinetics . If concentration of X is increased to three times how will it affect the rate of formation of Y ?

View Text Solution

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.

View Text Solution

11. What will be the effect of temperature on rate constant ?

View Text Solution

12. A reaction is first order in A and second order in B.

View Text Solution

13. Define zero order reaction . Given the unit for its content (k).

View Text Solution

14. Write units of rate constant k for zero order , first order , second order and n^{th} order reaction.

View Text Solution

15. What is the effect of catalyst on the activation energy ? Why ?

View Text Solution

16. Give the differences between zero order and first order reaction .

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Additional Questions 3 Mark Questions

1. Write the differences between the rate and rate constant of the reaction.

View Text Solution

2. Whate are the examples of first order reaction ?

View Text Solution

3. For the reaction $R \rightarrow P$, the concentration of a reactant changes from 0.03 M to 0.02 M in 25 minutes . Calculate te average rate of reaction

using units of time both in minutes and seconds .

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

View Text Solution

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

View Text Solution

6. 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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7. A reaction is second order with respect to a reactant . How is the rate of reaction affected if the concentration of the reactant is : (i) doubled (ii) reduced to half.

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8. The rate constant for a first order reaction is $60s^{-1}$. How much time will it take to reduce the initial concentration of the reactant to its $1/16^{th}$ value?

View Text Solution

9. For a first reaction , show that time required for 99% completion is twice the time required for the completion of 90% of reaction.

View Text Solution

10. Calculate the half life of a first order reaction whose rate constant is $200s^{-1}$

View Text Solution

11. The decomposition of dinitrogen pontoxide (N_2O_5) follows the first order rate law . Calculare the rate constant from the given data :

View Text Solution

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

View Text Solution

13. A first order reaction is 20% completed in 10 minutes . Calculate the time taken for the reaction to go to 80% completion.

View Text Solution

14. For a reaction : $2NH_3(g) \xrightarrow{Pt} N_2(g) + 3H_2(g)$ Rate = K

(i) Write the order and molecularity of this reaction.

Write the unit of K.

View Text Solution

Additional Questions 5 Mark Questions

1. How would you calculate the order of the reaction $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ by an experiment ? (or) prove that $2NO + O_2 \rightarrow 2NO_2$ is a third order reaction.

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2. Derive the integrated rate law for a first order reaction ?

View Text Solution

3. Explain the effect of temperature on reaction rate based on Arrhenius theory.

View Text Solution

4. Explain about the factors that affecting the reaction rate . The rate of a reaction is affected by the following factors .

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5. The decomposition of A into product has value of k as as $4.5 \times 10^3 s^{-1}$ at $10^\circ C$ and energy of activation 60kJ mol^{-1}. At what temperature would k be $1.5 \times 10^4 s^{-1}$?

View Text Solution

6. For a decomposition reaction the value of rate constant k at two different temperature are given below :

$k_1 = 2.15 \times 10^{-8}$ $\mathrm{L\,mol^{-1}}s^{-1}$ at $650K$ $k_2 = 2.39 \times 10^{-7}\mathrm{l\,mol^{-1}}$

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

View Text Solution

7. For a certain chemical reaction variation in concentration In [R] Vs time (s) plot is given below :

For this reaction write /draw

(i) What is the order of the reaction ?

(ii) What is the units of rate constant (k) ?

(iii) Give the relationship between k and $t_{1/2}$ (half - life period).

(iv) What does the slope of above line indicate ?

(v) Draw the plot of log $[R_0]/[R]$ vs time (s)

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8. A substance reacts according to the according to the first roder rate law and the specific reaction rate for the reaction is $1 \times 10^{-2} s^{-1}$. If the initial concentration is 1.0 M.

(a) What is the initial rate ?

(b) What is the reaction rate after 1 minutes ?

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9. A first order reaction in 50% completed in 30 minutes at $27^{\circ} C$ and in 10 minutes at $47^{\circ} C$. Calculate the reaction rate constant at $27^{\circ} C$ and the energy of activation of eh reaction in kJ mol^{-1}

View Text Solution

10. In Arrhenius equation for a a certain reaction , the values of A and E_a (activation energy) are $4 \times 10^{13} \mathrm{sec}^{-1}$ and $98.6 \mathrm{kJ\ mol}^{-1}$ respectively. If the reaction is of order , at what temperature will its half life period be 10 minutes ?

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