CHEMISTRY

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CHEMICAL KINETICS

Evaluate Yourself

1. Write the rate expression for the following reactions, assuming them as elementary reactions.

(i) $3A + 5B_2 \rightarrow 4CD$

(ii) $X_2 + Y_2 \rightarrow 2XY$

A.

B.

C.

D.

Answer:

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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 2.5×10^{-2} mol $\mathrm{dm}^{-3}s^{-1}$. At what rates are NO_2 and O_2 formed? What is the rate of the reaction?

A.

B.

C.

D.

Answer:

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3. (i) 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?

(ii) Find the individual and overall order of the following reaction using the given data.

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

A.

B.

C.

D.

Answer:

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4. In a first order reaction $A \rightarrow$ products 60% of the given sample of A decomposes in 40 min. what is the half life of the reaction?

A.

B.

C.

D.

Answer:

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5. The rate constant for a first order reaction is $2.3 \times 10^{-3} s^{-1}$. If the initial concentration of the reactant is 0.01M. What concentration will remain after 1 hour?

A.

B.

C.

D.

Answer:

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

Show that , the reaction follows first order kinetics .

A.

B.

C.

D.

Answer:

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7. 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 190 kJ mol^{-1}.

A.

B.

C.

D.

Answer:

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Evaluation Textbook Questions Answers I Choose The Correct Answer

1. For a first order reaction A $\rightarrow$ B the rate constant is $x\text{min}^{-1}$. If the initial concentration of A is 0.01M, 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 zero order reaction $X \rightarrow$ Product, with an initial concentration 0.02M has a half life of 10 min. if one starts with concentration 0.04M, 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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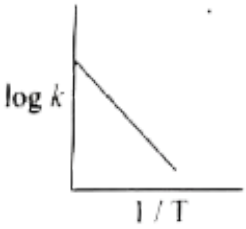
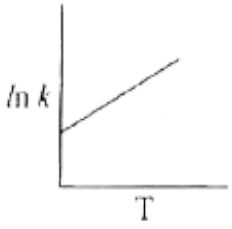
3. Among the following graphs showing variation of rate constant with temperature (T) for a reaction, the one that exhibits Arrhenius behavior over the entire temperature range is :

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 $x \mathrm{mol\ L}^{-1}$, has a half life period of 2.5 hours. For the same reaction with initial concentration `

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 determinded from the given data

Answer: C

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

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 :

A. rate is proportional to the surface coverage

B. rate is inversely proportional to the surface coverage

C. rate is independent of the surface coverage

D. rate of decomposition is slow

Answer: C

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

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

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

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

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

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 $E_a = 0$

(iv) a plot of ln(k) vs T is a straight line.

(v) 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 $-x \quad kJmol^{-1}$ and $y \ \text{kJ} \ \text{mol}^{-1}$. Therefore, the energy of activation in the backward direction is :

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

B. $(x+y)\text{J mol}^{-1}$

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

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

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 200K to 400 K ? $(\mathrm{R} = 8.314 \mathrm{JK}^{-1}\mathrm{mol}^{-1})$

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

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

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

D. $334.65\mathrm{J\ mol}^{-1}\mathrm{K}^{-1}$

Answer: C

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12. For a order reaction , the rate constant is 6.909mon^{-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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13. In a first order reaction $x \rightarrow y$, if k is the rate constant and the initial concentration of the reaction 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. $\left(\frac{ln2}{k}\right)$

D. none of these

Answer: C

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

reaction.

Reason: rate constant also doubles

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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15. 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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16. For the reaction

$$N_2O(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g),$$

the value of rate of disappearance of N_2O_5 is given as

$6.5 \times 10^{-2} \text{mol L}^{-1} s^{-1}$. 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 $\left(1.3 \times 10^{-2} \text{mol} L^{-1} s^{-1}\right)$

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

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

D. None of these

Answer: C

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17. During the decomposition of H_2O_2 to give dioxygen, $48gO_2$ is formed per minute at certain point of time. The rate of formation of water at this point is:

A. 0.75 mol $\min^{-1}$

B. 1.5 mol $\min^{-1}$

C. 2.25 mol $\min^{-1}$

D. 3.0 mol $\min^{-1}$

Answer: D

View Text Solution

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

reaction is:

A. Zero

B. one

C. Fraction

D. none

Answer: A

View Text Solution

19. In a homogeneous reaction

$A \rightarrow B + C + D$, the initial pressure was P_0 and after time t it was P. Expression for 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. $k = \left(\frac{2.303}{t}\right)\log\left(\frac{3P_0 - P}{2P_0}\right)$

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

Answer: A

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20. If 75% of a first order reaction was completed in 60 minutes, 50% 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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21. 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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22. The correct difference between first and second order reactiona is that:

A. A first order reaction can be catalysed , a second order reaction cannot be catalysed.

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

Answer: B

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23. 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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Evaluation Textbook Questions Answers Ii Answer The Following Questions

1. Define average rate and instantaneous rate.

A.

B.

C.

D.

Answer:

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2. Define rate law and rate constant.

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

View Text Solution

4. Define half life of a reaction. Show that for a first order reaction half life is independent of initial concentration.

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

View Text Solution

6. Explain the rate determining step with an example.

A.

B.

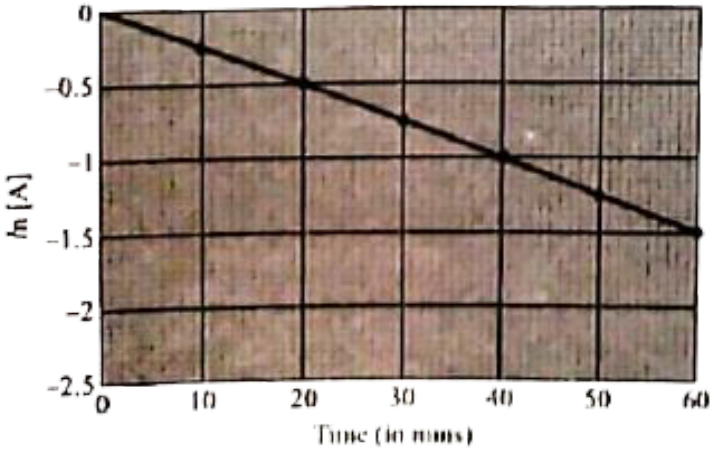
C.

D.

Answer:

View Text Solution

7. Describe the graphical representation of first order reaction.



A plot of ln(A) vs t for a first order reaction, $A \rightarrow$ product with initial concentration of $(A) = 1.00 \ \text{M}$ and $k = 2.5 \times 10^{-10} \text{min}^{-1}$.

A.

B.

C.

D.

Answer:

View Text Solution

8. Write the rate 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.

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

View Text Solution

10. The rate law for a reaction of A, B and L 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 $\left(\frac{1}{3}\right)$ and concentration of [L] is quadrupled.

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

View Text Solution

13. Explain briefly the collision theory of bimolecular reactions.

A.

B.

C.

D.

Answer:

View Text Solution

14. Write Arrhenius equations and explains the terms involved.

A.

B.

C.

D.

Answer:

View Text Solution

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 minute at 500K , the pressure of Cl_2O_7 falls from 0.08 to 0.04 atm. Calculate the rate constant in s^{-1}.

A.

B.

C.

D.

Answer:

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16. Hydrolysis of methyl acetate in aqueous solution has been studied by titrating the liberated acetic acid against sodium hydroxide.

The concentration of an ester at different temperatures is given below.

t (sec)	0	30	60	90
[ester] mol L^{-1}	0.55	0.31	0.17	0.085

(i) Calculate the average rate of reaction between the time interval 30-60 seconds.

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

A.

B.

C.

D.

Answer:

View Text Solution

17. Explain pseudo first order reaction with an example.

A.

B.

C.

D.

Answer:

View Text Solution

18. Identify the order for the following reactions

(i) Rusting of Iron

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

(iii) $2A + 3B \rightarrow$ products, rate $= k[A]^{\frac{1}{2}}[B]^2$

A.

B.

C.

D.

Answer:

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19. A gas phase reaction has energy of activation 200 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. $\left(e^{-}40.09 = 3.8 \times 10^{-18}\right)$

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

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21. How do concentrations of the reactant influence the rate of reaction ?

A.

B.

C.

D.

Answer:

View Text Solution

22. How do nature of the reactant influence rate of reaction.

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

View Text Solution

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 be reduced to 1% of the initial value?

A.

B.

C.

D.

Answer:

View Text Solution

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 ?

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

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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 (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?

A.

B.

C.

D.

Answer:

View Text Solution

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

t (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.

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

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Other Important Questions Answers I Choose The Correct Answer

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

A. The order of a reaction can be fractional.

B. Order of reaction is an experimental quantity.

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

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

expression.

Answer: C

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2. Which of the following statements is correct?

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

B. The rate of reaction is the same at anytime during the reaction.

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

D. The rate of reaction decreases with increases in concentration of reactants.

Answer: A

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3. Which of the following expression is correct for the rate of reaction given below:

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

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

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

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

View Text Solution

4. Time required for 100 percent completion of a zero order reaction is :

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

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

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

D. ak

Answer: C

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5. For the reaction $aA + bB \rightarrow cC$, if $-3\frac{d[A]}{dt} = -\frac{d[B]}{dt} = +1.5\frac{d[C]}{dt}$, then a, b and c respectively are:

A. $3, 1, 2$

B. $2, 1, 3$

C. $1, 3, 2$

D. $6, 2, 3$

Answer: C

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6. The rate of a gaseous reaction is given by the expression $k[A][B]$. If the volume of the reaction vessel is suddenly

reduced to $1/4^{th}$ of the initial volume, the reaction rate relating to original rate will be:

A. $1/10$

B. $1/8$

C. 8

D. 16

Answer: D

View Text Solution

7. In a reaction $A \rightarrow B$, the rate of reaction increases two times on increasing the concentration of the reactant four times, then order of reaction is :

A. 0

B. 2

C. $1/2$

D. 4

Answer: C

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8. The rate of the reaction $2NO + Cl_2 \rightarrow 2NOCl$ is given by the rate equation:

rate $= k[NO]^2[Cl_2]$. The value of the rate constant can be increased by:

A. increasing the temperature

B. increasing the concentration of NO

C. increasing the concentration of Cl_2

D. doing all of these

Answer: A

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9. The unit of rate constant for a zero order reaction is:

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

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

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

D. s^{-1}

Answer: A

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10. Rate constant of a reaction (k) is 175 $\text{litre}^2\text{mol}^{-2}\text{sec}^{-1}$.

What is the order of reaction?

A. first

B. second

C. third

D. zero

Answer: C

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

A. 1 hour

B. 0.5 hour

C. 0.25 hour

D. 2 hours

Answer: A

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12. 75% of the first order reaction was completed in 32 min. 50% of the reaction was completed in:

A. 24 min

B. 8 min

C. 16 min

D. 4 min

Answer: C

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13. $1/[A]$ vs time is a straight line. The order of the reaction is:

A. 1

B. 2

C. 3

D. 0

Answer: B

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14. If a graph is plotted between in k and $1/T$ for the first order reaction, the slope of the straight line so obtained is given by:

A. $-\frac{E_a}{R}$

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

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

D. $-\frac{E_a}{2.303}$

Answer: A

View Text Solution

15. 10g of a radioactive isotope is reduced to 1.25 g in 12 years. Therefore, half-life period of the isotope is:

A. 24 years

B. 4 years

C. 3 years

D. 8 years

Answer: B

View Text Solution

16. The half-life period of a radioactive element is 20 days. What will be the remaining mass of 100 g of it after 60 days?

A. 25 g

B. 50 g

C. 12.5 g

D. 20 g

Answer: C

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17. Activation energy of a chemical reaction can be determined by:

A. determining the rate constant at standard temperature.

B. determining the rate constants at two temperatures.

C. determining probability of collision.

D. using catalyst.

Answer: B

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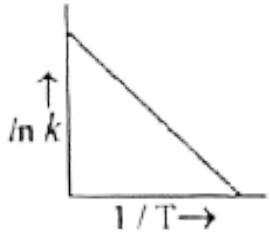
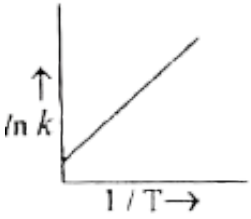
18. According to Arrhenius equation, rate constant k is equal to $Ae^{-E_a/RT}$. Which of the following options represents

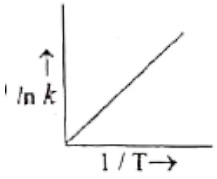
the graph of In k vs $\frac{l}{T}$?



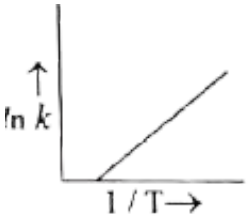
A.



B.



C.



D.

Answer: A

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19. Which of the following statement 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

View Text Solution

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

A. 1.26×1015 s

B. 2.52×1014s

C. 2.52×1028 s

D. infinite

Answer: A

View Text Solution

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

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

Concentration of either 'A' or 'B' were changed keeping the concentrations of one of the reactants constant and rates were measured as a function of initial concentration.

Following results were obtained. Choose the correct option for the rate equations for this reaction.

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

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

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

D. Rate $= k[A]^2[B]^0$

Answer: B

View Text Solution

22. The rate constant of the reaction $A \rightarrow B$ is 0.6×10^3 mole per litre per second. If the concentration of A is 5 M, then concentration of B after 20 minutes is:

A. 0.36 M

B. 0.72 M

C. 1.08 M

D. 3.60 M

Answer: B

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23. The half-life of a substance in a certain enzyme catalysed reaction is 138 s. The time required for the concentration of the substance to fall from 1.28 mg L^{-1} to $0.04\mathrm{mg}\,\mathrm{L}^{-1}$, is:

A. 414 s

B. 552 s

C. 690 s

D. 276 s

Answer: C

View Text Solution

24. $t_{1/4}$ can be taken as the time taken for the concentration of a reactant of drop to $\frac{3}{4}$ of its initial value. If the rate constant for a first order reaction is k, then $t_{1/4}$ can be written as :

A. $0.10/k$

B. $0.29/k$

C. $0.69/k$

D. $0.75/k$

Answer: B

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25. The activation energy of a reaction can be determined from the slope of which of the following graph ?

A. ln k vs $\frac{1}{t}$

B. $\frac{t}{\ln k}$ vs $\frac{1}{t}$

C. ln k vs t

D. $\frac{\ln k}{t}$ vs t

Answer: A

View Text Solution

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

A. 60.5 kJ mol^{-1}

B. 53.6 kJ mol^{-1}

C. 48.6 kJ mol^{-1}

D. 58.5 kJ mol^{-1}

Answer: B

View Text Solution

27. In the presence of a catalyst, the activation energy of a reaction is lowered by 2 kcal at $27^{\circ}C$. The rate of reaction will increase by:

A. 2 times

B. 14 times

C. 28 times

D. 20 times

Answer: C

View Text Solution

28. Which one of the following is not correct?

A. Every bimolecular collision does not result into a chemical reaction.

B. Collision theory is not applicable to unimolecular reaction.

C. According to collision frequency, $k = PZ_{AB}e^{-E/RT}$ where Z_{AB} is collision frequency and P is steric factor.

D. Collision theory assumes molecules to be hard spheres.

Answer: B

View Text Solution

Other Important Questions Answers Ii Answer The Following Questions

1. Express the rate of the following reaction interms of disappearance of the reactant and appearance of formation of the product: $A \rightarrow B$.

A.

B.

C.

D.

Answer:

View Text Solution

2. Mention the unit of rate of reaction.

A.

B.

C.

D.

Answer:

View Text Solution

3. Explain how will you determine experimentally determine (i) average rate of reaction (ii) instantaneous rate of reaction and (iii) initial rate of reaction.

A.

B.

C.

D.

Answer:

View Text Solution

4. In the 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 period.

A.

B.

C.

D.

Answer:

View Text Solution

5. The concentration of a reactant changes from 0.03 M to 0.02 M in 25 minutes. Calculates the average rate using of

time both in minutes and in seconds.

A.

B.

C.

D.

Answer:

View Text Solution

6. Decomposition of N_2D_5 is expressed by the equation.

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

If during a certain internal of time the rate of decomposition of N_2O_5 is 1.8×10^{-3} mol $\text{litre}^{-1}\text{min}^{-1}$, what will be

the rates of formation of NO_2 and O_2 during the same interval.

A.

B.

C.

D.

Answer:

View Text Solution

7. For each of the following reactions, express the given rate of changes of concentration of the product or reactant interms of rate of change of concentration of other reactants or products in that reaction.

(a) $H_2O_2 + 2H^+ + 3I^- \rightarrow I_3^- + 2H_2O$

$16H^+ + 2MnO_4^- + 10I^-$

$\frac{-d[I^-]}{dt} = ? \frac{-d[H^+]}{dt} = ?$

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

(c) $4NH_3 + 5O_2 \rightarrow 4NO_2 + 6H_2O,$

A.

B.

C.

D.

Answer:

View Text Solution

8. From the concentration of R at different times given below, calculate the average rate of the reaction.

$R \rightarrow P$ during different intervals of time

A.

B.

C.

D.

Answer:

View Text Solution

9. The decomposition of N_2O_5 is CCl_4 solution at 318K has been studied by monitering the concentration of the N_2O_5 in the solution.

Initially the concentration of N_2O_5 in the solution is 2.33 M and after 184 minutes it is reduced to 2.08M. The reaction takes place according to the equation $2N_2O_5 \rightarrow 4NO_2 + O_2$.

Calculate the average rate of the reaction in terms of hours, minutes and second. What is the rates of production during this period?

A.

B.

C.

D.

Answer:

View Text Solution

10. In hydrogenation reaction at $25^{\circ}C$ it is observed that hydrogen gas pressure falls from 2 atm to 1.2 atm in 50 min. Calculate the rate of reaction in molarity per sec.

R = 0.0821 lit $\mathrm{mol}^{-1}\mathrm{deg}^{-1}$.

A.

B.

C.

D.

Answer:

View Text Solution

11. Explain why average rate cannot be used to product the rate of reaction at any instant.

A.

B.

C.

D.

Answer:

View Text Solution

12. Bringout the difference between rate and rate constant of a reaction ?

A.

B.

C.

D.

Answer:

View Text Solution

13. The decomposition of dimethyl ether leads to the formation of CH_4, H_2 and Co and the reaction rate in given by

rate $= R[CH_3OCH_3]^{\frac{3}{2}}$

The rate is followed by increase in pressure in a closed vessel, so that the rate is expressed in terms of partial pressure of dimethyl ether.

rate $= R[P_{CH_3OCH_3}]^{\frac{1}{2}}$

If the pressure is measured in bar and the time in seconds than what are the units of rate and rate constant?

A.

B.

C.

D.

Answer:

View Text Solution

14. State the order with respect to each reactant, overall reaction and the units of rate constant in each of the following reactions.

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

rate $= k[NO]^2[Br_2]$

(b) $CH_3CHO(g) \rightarrow CH_4(g) + CO(g)$

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

(c) $2H_2(g) + 2NO(g) \rightarrow 2H_2O(g) + N_2(g)$

rate $= k[H_2][NO]^2$

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

rate $= k[CO] \wedge (2)[Cl]^{1/2}$

(e) $H_2O_2 + 3I^- + 2H^+ \rightarrow 2H_2O + I_3^-$

rate $= k\left[H_2O_2\left[I^-\right]\right.$

A.

B.

C.

D.

Answer:

View Text Solution

15. Identify the reaction order from the following rate constants.

(a) $k = 3.1 \times 10 - 4\text{sec}^{-1}$

(b) $k = 1.12 \times 10^{-2}\text{atm}^{-1}s^{-1}$

(c) $k = 1.35 \times 10^{-2}\text{mol}^{-2}\text{let}^{2}s^{-1}$

(d) $k = 3.4 \times 10^{-3}\text{mol}^{-1}\text{let}s^{-1}$

A.

B.

C.

D.

Answer:

View Text Solution

16. Derive an expression for the rate constant for the first order reaction.

A.

B.

C.

D.

Answer:

View Text Solution

17. How will you determine the first order rate constant graphically?

A.

B.

C.

D.

Answer:

View Text Solution

18. Give example for first order reaction.

A.

B.

C.

D.

Answer:

View Text Solution

19. Show that acid hydrolysis of an ester is a pseudo first order reaction.

A.

B.

C.

D.

Answer:

View Text Solution

20. Give examples of zero order reaction.

A.

B.

C.

D.

Answer:

View Text Solution

21. Give the general rate equation for n^{th} order reaction involving one reactant A.

A.

B.

C.

D.

Answer:

View Text Solution

22. Derive an expression to calculate $t_{1/2}$ for a zero order reaction.

A.

B.

C.

D.

Answer:

View Text Solution

23. Give the general expression for $t_{1/2}$ of the n^{th} order $(n \neq 1)$ reaction.

A.

B.

C.

D.

Answer:

View Text Solution

24. Give the characteristics of first order reaction.

A.

B.

C.

D.

Answer:

View Text Solution

25. Calculate the half life of a first order reaction from their rate constant given below:

(a) 200sec^{-1} $(b)2\text{min}^{-1}$ $(c)4\text{year}^{-1}$

A.

B.

C.

D.

Answer:

View Text Solution

26. The rate constant for a first order reaction is 60sec^{-1}. How much time will it take to reduce the initial concentration to its $\frac{1}{16^{th}}$ value?

A.

B.

C.

D.

Answer:

View Text Solution

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

A.

B.

C.

D.

Answer:

View Text Solution

28. Sucrose decomposes in acid solution into glucose and fructose according to first order rate law. With $t_{1/2} = 3.00$ hrs. What fraction of sucrose remains after 8 hours?

A.

B.

C.

D.

Answer:

View Text Solution

29. Explain pressure change method in determining a first order reaction.

A.

B.

C.

D.

Answer:

View Text Solution

30. The decomposition of Cl_2O_7 at 400K in the gas phase to Cl_2 and O_2 is a first order reaction.

(i) After 55 seconds at 400K, the pressure of Cl_2O_7 falls from 0.062 to 0.044 atm.

Calculate the rate constant.

(ii) Calculate the pressure of Cl_2O_7 after 100 seconds of decomposition at this temperature.

A.

B.

C.

D.

Answer:

View Text Solution

31. For the decomposition of azo isopropane to hexane and nitrogen at 543K, the following data are obtained.

t (sec)	p (mm of Hr)
0	35.0
360	54.0
720	63.0

Calculate the rate constant for the reaction.

A.

B.

C.

D.

Answer:

View Text Solution

32. Explain Oswald dilution method for determining the order of the reaction.

A.

B.

C.

D.

Answer:

View Text Solution

33. Show that if the concentration of a reactant is doubled, the rate of the reaction is also doubled for a first order reaction, increases four times for a second order reaction,

increases by eight times for a third order reaction. i.e., $A \rightarrow$ product .

A.

B.

C.

D.

Answer:

View Text Solution

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

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

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 results were obtained. Find the order with respect to A and B and write the rate law for the reaction.

Exp	Initial concen -tration of A mol L^{-1}	Initial concen -tration of B in mol L^{-1}	Initial rate of formation of C mol L^{-1} sec^{-1}
1	0.30	0.30	0.10
2	0.30	0.60	0.40
3	0.60	0.30	0.20

A.

B.

C.

D.

Answer:

View Text Solution

35. The initial rate of reactions $3A + 2B + C \rightarrow$ products at different initial concentrations are give below.

Initial rate ms^{-1}	$[A_0]$ M	$[B_0]$ M	$[C_0]$ M
1) 5.0×10^{-3}	0.010	0.005	0.010
2) 5.0×10^{-3}	0.010	0.005	0.015
3) 1.0×10^{-2}	0.010	0.010	0.010
4) 1.25×10^{-3}	0.005	0.005	0.010

A.

B.

C.

D.

Answer:

View Text Solution

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

(i) Write the differential rate equation.

(ii) How is rate affected by increasing the concentration of B, three times, keeping the concentration of A constant ?

(iii) How is the rate affected by when concentration of both A and B are doubled ?

A.

B.

C.

D.

Answer:

View Text Solution

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

$2A + B \rightarrow C + D.$

What is the order with respect to each reactant and overall order of the reaction? Write the rate law. Also calculate the rate constant for the reaction and the units of rate constant.

A.

B.

C.

D.

Answer:

View Text Solution

38. In a reaction between A and B, the initial rate of reaction was measured at different initial concentration of A and B as given below.

A mol L^{-1}	0.20	0.20	0.40
B mol L^{-1}	0.30	0.10	0.05
r_0 (mol L^{-1} s^{-1})	5.07×10^{-5}	5.07×10^{-5}	7.16×10^{-5}

What is the order with respect to A and B?

A.

B.

C.

D.

Answer:

View Text Solution

39. The decomposition of ammonium nitrate in aqueous solution was studied by placing the apparatus in a thermostate maintained at a particular temperature. The volume of nitrogen gas collected at different intervals of time was as follows:

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

A.

B.

C.

D.

Answer:

View Text Solution

40. What dp understand by fraction of effective collisions? Mention its signi ficances.

A.

B.

C.

D.

Answer:

View Text Solution

41. Explain the importance of proper orientation of molecules in the collision theory.

A.

B.

C.

D.

Answer:

View Text Solution

42. Define activation energy of a reaction.

A.

B.

C.

D.

Answer:

View Text Solution

43. Arrhenius equation is given by $k = Ae^{-E_a/RT}$. Based on this equation answer the following questions.

(i) Can reactions have zero activation energy?

(ii) Can a reaction have negative activation energy ?

A.

B.

C.

D.

Answer:

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

A.

B.

C.

D.

Answer:

View Text Solution

45. Write Arrhenius equation and explain the terms? What is the significance of frequency factor A in the equation.

A.

B.

C.

D.

Answer:

View Text Solution

46. Explain how the energy of activation for a reaction is determined.

A.

B.

C.

D.

Answer:

View Text Solution

47. Describe how the energy of activation of a reaction is determined graphically.

A.

B.

C.

D.

Answer:

View Text Solution

48. The rate constant for a reaction is $1.2 \times 10^{-3} \text{sec}^{-1}$ at $30^{\circ} C$ and $2.1 \times 10^{-3} \text{sec}^{-1}$ at $40^{\circ} C$. Calculate the energy of activation .

A.

B.

C.

D.

Answer:

View Text Solution

49. The rate of particular reaction doubles when temperature changes from $27^{\circ}C$ to $37^{\circ}C$. Calculate the energy of activation.

A.

B.

C.

D.

Answer:

View Text Solution

50. The activation energy of a reaction 94.14kJ mol^{-1} and the value of the rate constant at 313K is $1.8 \times 10^{-1}\text{sec}^{-1}$. Calculate the frequency factor (A).

A.

B.

C.

D.

Answer:

View Text Solution

51. 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 600K is $1.60 \times 10^{-5} s^{-1}$. Its energy of activation is 209 kJ/mol. Calculate the rate constant of the reaction at 700K.

A.

B.

C.

D.

Answer:

View Text Solution

52. Rate constant 'k' of a reaction varies with temperature according to the equation log $k = \text{constant}, -\frac{E_a}{2.303R} \times \frac{1}{T}$.

A.

B.

C.

D.

Answer:

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