CHEMISTRY

JEE MAIN AND ADVANCED

CHEMICAL KINETICS

Example

1. For a reaction , $2A + D \to 3C$, the rate of appearance of C at time t is $1.2 \times 10^{-4} \text{mol L}^{-1} s^{-1}$. Find the rate of reaction.

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2. The decomposition of NH_3 on platinum surface is a zero order reaction. What would be the rate of production of N_2 and H_2 if $k = 2.5 \times 10^{-4} \text{mol L}^{-1} s^{-1}$?

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3. The form of rate law for a reaction is expressed as, rate = k$[Cl_2][NO]^2$

Find out the order of the reaction with respect to Cl_2, with respect to NO and also the overall order of the reaction.

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4. From the expression of the following reactions, determine order of reaction and the dimensions of the rate constant.

(i) $3NO(g) \rightarrow N_2O(g) + NO_2(g) \qquad \text{Rate} = k[NO]^2$

(ii)

$H_2O_2(aq) + 3l^-(aq) + 2H^+ \rightarrow 2H_2O(l) + l_3^- \qquad \text{Rate} = k[H_2O_2][l]$

(iii)

$CH_3CHO(g) \rightarrow CH_4(g) + CO(g) + CO(g) \qquad \text{Rate} = k[CH_3CHO]$

(iv) $C_2H_5Cl(g) \rightarrow C_2H_4(g) + HCl(g) \qquad \text{Rate} = k[C_2H_5Cl]$

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5. The half life period of a first order reaction is 60 min. What percentage will be left after 240 min.

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6. A first order reaction has specific reaction rate of $10^{-3}s^{-1}$. How much time will it takes for 10 gm of the reactant to reduce to 2.5 gm ?

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7. A first order reaction is found to have a rate constant $k = 7.39 \times 10^{-5}s^{-1}$. Find the half life of this reaction.

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8. Half life for a first order reaction is 20 minutes . What is its rate constant ?

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9. Half life time for first order reaction is 25 minutes . What time will be required for 99% completion of reaction ?

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10. A first order reaction has a specific rate constant of $2 \times 10^{-3} s^{-1}$. How much time it will take for20 gm to reduce to 5 g ?

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11. The rate constant k for the order gas phase decomposition of ethyl iodide, $C_2H_5l \rightarrow C_2H_4 + Hl$ is $1.60 \times 10^{-5} s^{-1}$ ar 600 K and $6.36 \times 10^{-3} s^{-1}$ at 700 K. Calculate the energy of activation for this reaction.

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12. What would be the energy of activation for a reaction when a change of temperature from $20^\circ C$ to $30^\circ C$ exactly triples the reaction rate constant ?

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13. The rate constant of a reaction is $1.5 \times 10^7 s^{-1}$ at 50°C and $4.5 \times 10^7 s^{-1}$ at 100°C. Calculate the value of activation energy for the reaction $\left(R = 8.314 JK^{-1} mol^{-1}\right)$

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14. Calculate the activation energy of a reaction whose reaction rate at 310 K gets doubled for 320 K rise in temperature.

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15. Half life of a first order chemical reaction is 69 hr at 300 K. Also , rate of this reaction is doubled as temperature is increased from 300 K to 310 K. Determine activation energy and pre - exponential factor for this reaction.

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16. If the rate of a reaction gets doubled as the temperature is increased from $27^\circ \text{ to } 37^\circ C$. Find the activation energy of reaction?

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17. Why reactions having molecularity are less observed ?

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18. Rate constant k of a reaction varies with temperature according to the equation

logk = constant $-\frac{E_a}{2.303R}\left(\frac{1}{T}\right)$

where E_a is the energy of activation 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 the energy of activation for this reaction

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19. Why do reaction rates depend on temperature ? Explain.

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20. What is the effect of catalyst on activation energy ?

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Try Yourself

1. The rate of formation of nitric oxide (NO) in the following reaction is $3.6 \times 10^{-3} \text{mol L}^{-1} s^{-1}$.

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

Find the rate of disappearance of oxygen.

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2. For the reaction $R \rightarrow P$, the concentration of reactant changes from 0.03 M to 0.02 M in 25 minutes. Calculate the average rate of reaction rate of reaction using units of time both in minutes and seconds.

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3. For the reaction $A + B \rightarrow C + D$, doubling the concentration of both the reactants increases the reaction rate by 8 times and doubling the concentration of only B simply doubles the reaction rate. Find the rate law for the above equation.

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4. For the 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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5. The rate of constant for first reaction is 0.0005 min^{-1} . Calculate its half life.

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6. 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 3 g ?

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7. The half life time , $t_{1/2}$ for the first order decomposition of NH_4NO_2 is 123 minutes at $15^\circ C$.

(a) What is the value of k ?

(b) How long will it take for 2 g of NH_4NO_2 to decompose until 0.2 remains ?

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8. The rate of a reaction triples when temperature change from $20^\circ C$ to $50^\circ C$. Calculate the energy of activation.

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

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10. The activation energy of a reaction is $94.14 \mathrm{kJ\ mol}^{-1}$ and the value of rate constant at 313 K is $1.8 \times 10^{-5} s^{-1}$. Calculate the frequency factor A

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Exercise

1. In a reaction,

$aA + bB \rightarrow cC + dD$

rate $= -\frac{1}{a}\frac{d[A]}{dt}$, the - ve sign in it represents

A. The rate of reaction increases with time

B. The rate is negative for the reaction

C. The concentration of the reactant 'A' decreases during the reaction

D. The concentration of reactant 'A' increases in the reaction

Answer: C

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2. Unit of rate of a reaction is

A. mol/Ls

B. Same for instantaneous rate and average rate

C. Same for all reactions and not depend upon the nature of reaction

D. All of these

Answer: D

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3. For the reaction,

$2N_2O_5 \rightarrow 4NO_2 + O_2$

Select the correct statement

A. Rate of formation of O_2 is same as rate of formation of NO_2

B. Rate of disappearance of N_2O_5 is two times the rate of formation of NO_2

C. Rate of formation of O_2 is 0.5 time rate disappearance of N_2O_5

D. Rate of formation of NO_2 is equal to rate of disappearance of N_2O_5

Answer: C

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4. What is the unit of rate constant of n^{th} order of the reaction ?

A. $(mol/L)^n s^{-1}$

B. $(mol/Ls^{-1})^{n-1}$

C. $\left(\frac{L}{mol}s^{-1}\right)^{n-1}$

D. $(L/mol)^{n-1}s^{-1}$

Answer: D

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5. $\frac{dx}{dt} = K[A]^{0.5}[B]^{0.5}[C]^{0.5}$. What will be the order of the reaction ?

A. 1

B. 1.5

C. Zero

D. 2

Answer: B

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6. $H_2 + l_2 \rightarrow$ 2HI (An elementary reaction) of second order

If the volume of the container containing the gaseous mixture is increased to two time, then final rate of the reaction.

A. Become four times

B. Become $\frac{1}{4}$ th of the original rate

C. Become 2 times

D. Become $\frac{1}{2}$ of the original rate

Answer: B

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7. In a certain reaction shown below,

$4A + 2B \rightarrow 3C$

If rate of formation of C is 9.6×10^{-2} mol/Ls . What will be rate of reaction ?

A. 9.6×10^{-2} mol/Ls

B. 3.2×10^{-2} mol/Ls

C. 2.4×10^{-2} mol/Ls

D. 4.8×10^{-2} mol/Ls

Answer: B

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8. The rate of reaction is always equal to the rate constant. The order of the reaction. Will be

A. First order

B. Second order

C. Half order

D. Zero order

Answer: D

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9. For the reaction,

$$H_2O_2 + 2H^+ + 3l^- \rightarrow l_3^- + 2H_2O$$

select the correct statement

A. Rate of disappearance of H_2O_2 will be three times the rate of disappearance of l^-

B. Rate of disappearance of H_2O_2 is $\frac{1}{3}$ of rate of formation of l_3^-

C. Rate of disappearance of l^- ions will be three times the rate of formation l_3^- ions

D. Rate of formation of H_2O is $\frac{1}{2}$ of rate formation of l_3^-

Answer: C

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10. The value rate constant depends upon

A. Temperature

B. Concentration

C. Catalyst

D. Both (1) & (3)

Answer: D

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11. $2A \rightarrow C + D$

In this reaction, if we double the concentration of A, reaction rate become , two time .. What is the order of this reaction ?

A. 1

B. 3

C. 2

D. 1.5

Answer: A

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12. In a zero order reaction , 20% of the reaction complete in 10 s. How much time it will take to complete 50% of the reaction ?

A. 20 s

B. 25 s

C. 30 s

D. 40 s

Answer: B

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13. If the half - life of the first order reaction is 50 s, what be the value of its rate constant ?

A. $1.38 \times 10^{-2} s^{-1}$

B. $25 s^{-1}$

C. $34.66 s^{-1}$

D. $1.38 \times 10^{-4} s^{-1}$

Answer: A

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14. In a first order reaction , on plotting a graph between $t_{1/2}$ and concentration of reactant

A. A curve is obtained

B. A straight line is obtained having slope 45°

C. A straight line is parallel to time axis

D. A straight line is parallel to the concentration axis

Answer: D

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15. In data given below.

	$[A]$	$[B]$	rate
	mol/L	mol/L	$molL^{-1}s^{-1}$
$a.$	0.02	1.2	3.0×10^{-3}
$b.$	0.04	2.4	6.0×10^{-3}

The reaction may be

A. First order

B. Second order

C. Pseudo second order

D. Second order w.r.t. A

Answer: A

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16. For certain first order reaction, 75% of the reaction complete in 30 min. How much time it require to complete 99.9% of the reaction ?

A. 150 min

B. 100 min

C. 90 min

D. 300 min

Answer: A

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17. For zero order reaction , $t_{1/2}$ will be (A_0 is the initial concentration , K is rate constant)

A. 0.693/K

B. 2.303/K

C. $\frac{A_0}{2K}$

D. $\frac{\text{In} A_0}{2}$

Answer: C

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18. In pseudo - order reactions

A. The actual order of reaction is different from that expected using rate law expression

B. The concentration of at least one reactant is taken in large excess

C. The concentration of reactant taken in excess may be taken as constant

D. All of these

Answer: D

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19. The depletion of ozone involves the following steps :

Step 1 : $O_3 \underset{K_1}{\overset{K_2}{\Longleftrightarrow}} O_2 + O$ (fast)

Step 2 : $O_3 + O \underset{K}{\longrightarrow} 2O_2$ (slow)

The predicted order of the reaction will be

A. First

B. 1.5

C. -1.5

D. Zero

Answer: A

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20. The half life for the zero order reaction will be

A. $t_{1/2} \propto (conc.)^0$

B. $t_{1/2} \propto (conc.)^1$

C. $t_{1/2} \propto (conc.)^{-1}$

D. $t_{1/2} \propto (conc.)^2$

Answer: B

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21. A catalyst cannot change

A. Rate constant of the reaction

B. Equilibrium constant of the reaction

C. Activation energy of reaction

D. All of these

Answer: B

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22. Select the incorrect statement

A. The minimum amount of energy required by reactant molecules to give product is threshold energy

B. Activation energy is the sum of threshold energy and average kinetic energy

C. Threshold energy is the sum of initial potential energy of reactants and activation energy

D. Lower is the activation energy faster is the reaction

Answer: B

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23. If the rate of reaction increases by two times with every $10^{\circ}C$ rise in temperature, then if we raise the temperature by $40^{\circ}C$, the new rate of the reaction will be :-

A. 4 times

B. 8 times

C. 16 times

D. 32 times

Answer: C

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24. According to collision theory, rate of the reaction increases , because

A. Number of collision decreases

B. Number of molecules crossing energy barrier increases

C. Kinetic energy of molecules increases

D. Value of rate constant increases

Answer: B

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25. $A + B \rightarrow C, \Delta H = +60$ kJ/mol

E_{a_f} is 150 kJ. What is the activation energy for the backward reaction ?

A. 210 kJ

B. 105 kJ

C. 90 kJ

D. 145 kJ

Answer: C

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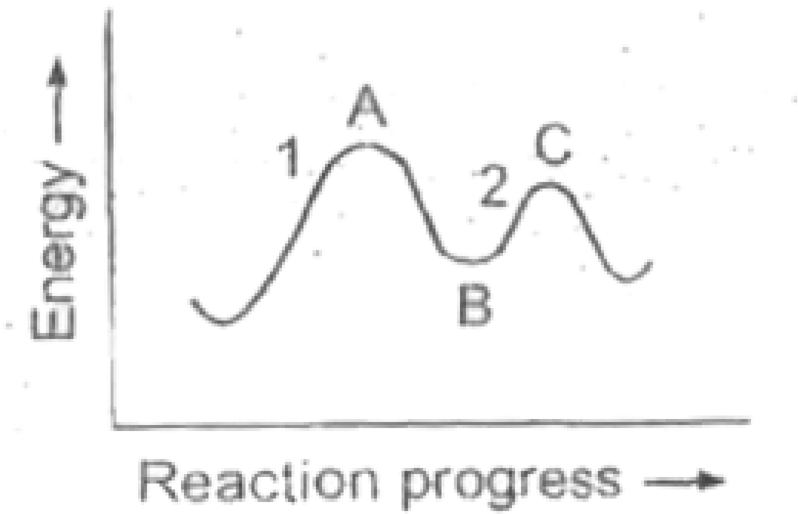

26.

Reaction progress $\rightarrow$

A. It is a 2 steps reaction , step 1 is slower than step 2

B. It is a 2 steps reaction , step 2 is slower than step 1

C. Single step reaction where B is a activated complex

D. Single step reaction where B is a reaction intermediate

Answer: A

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27. Rate of reaction depends upon

A. Nature of reactants

B. Physical state of the reactants

C. Temperature

D. All of these

Answer: D

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28. The correct expression for Arrhenius equation is (where K is rate constant)

A. $K = e^{-\Delta H / RT} A$

B. In $K = \frac{\Delta E_a}{RT} + InA$

C. In $K = \text{In A} + \frac{E_a}{RT}$

D. In $\left(\frac{A}{K}\right) = \frac{E_a}{RT}$

Answer: D

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29. The temperature coefficient of a certain reaction is found to be 3. If temperature changes from $25^\circ \text{ to } 55^\circ$, the new rate of reaction will be

A. 8 times

B. 9 times

C. 16 times

D. 27 times

Answer: D

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30. In Arrhenius equation , $K = Ae^{-E_a/RT}$. The A is

A. Activation energy

B. Enthalpy of reaction

C. Free energy of reaction

D. Rate constant of the reaction at infinite temperature

Answer: D

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Assignment Section A Objective Type Questions

1. The unit of rate constant and rate of a reaction are same for

A. First order

B. Zero order

C. Second order

D. Third order

Answer: B

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2. For a reaction of type

$aA + bB \rightarrow \text{products}, \dfrac{-d[A]}{dt}$ is equal to

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

B. $-\dfrac{b}{d}\dfrac{d[B]}{dt}$

C. $-\dfrac{a}{b} \times \dfrac{d[B]}{dt}$

D. $-\dfrac{b}{a} \times \dfrac{d[B]}{dt}$

Answer: C

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3. For a gaseous reaction, the rate of reaction may be expressed in the units

A. atm

B. atm s

C. atm/s

D. atm / s^2

Answer: C

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4. In gaseous state reaction, $A_2(g) \rightarrow B(g) + \left(\frac{1}{2}\right)C(g)$. The increase in pressure from 100 mm to 120 mm is noticed in 5 minutes. The rate of disappearance of $A_2 \text{in mm min}^{-1}$ is :

A. 4min min^{-1}

B. 8min min^{-1}

C. 16min min^{-1}

D. 2min min^{-1}

Answer: B

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5. Which of the following will react at the highest rate ?

A. 1 mol of A and 1 mol of B in a 1 L vessel

B. 2 mol of A and 2 mol of B in a 2 L vessel

C. 3 mol of A and 3 mol of B in a 3 L vessel

D. All would react at the same rate

Answer: D

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6. Which of the following does not affect the rate of reaction?

A. Amount of the reactant taken

B. Physical state of the reactant

C. ΔH of reaction

D. Size of vessel

Answer: C

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7. In a reaction, $2X + Y \rightarrow X_2Y$, the X disappears at

A. Half the rate as that of disappearance of Y

B. The same rate as that of disappearance of Y

C. The same rate as that of appearance of X_2Y

D. Twice the rate as that of appearance of X_2Y

Answer: D

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8. During the course of a chemical reaction , the rate constant ___.

A. Remains constant throughout

B. Increases as the reaction proceeds

C. Decreases as the reaction proceeds

D. First increases followed by a decreases

Answer: C

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9. A reaction involving two different reactants can never be:

A. Second order reaction

B. Bimolecular reaction

C. Unimolecular reaction

D. First order reaction

Answer: C

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10. For the hypothetical reaction $2A \rightarrow 3C$, the reaction rate r in terms of the rate of change of the concentration is given by

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

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

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

D. $r = \frac{d[A]}{dt}$

Answer: B

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11. In the reaction $A + 2B \rightarrow C + 2O$ the initial rate $\frac{-d[A]}{dt}$ at $t = 0$ was found to the $2.6 \times 10^{-2} \text{M sec}^{-1}$. What is the value of $\frac{-d[B]}{dt}$ at $t = 0$ in ms^{-1} ?

A. 2.6×10^{-2}

B. 5.2×10^{-2}

C. 1.3×10^{-2}

D. 1.0×10^{-1}

Answer: B

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12. For the reaction

$N_2 + 3H_2 \rightarrow 2NH_3$ The rate of change of concentration for hydrogen is $0.3 \times 10^{-4} Ms^{-1}$ The rate of change of concentration of ammonia is :

A. -0.2×10^{4}

B. 0.2×10^{-4}

C. 0.1×10^{-4}

D. 0.3×10^{-4}

Answer: B

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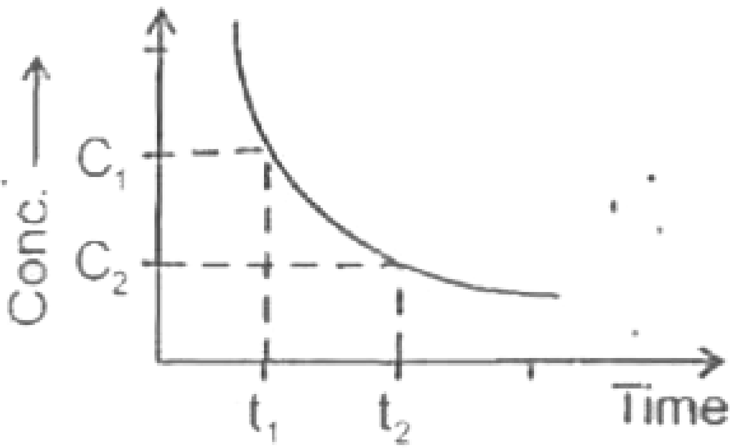
13. The graph plotted between concentration versus time



A. It gives rate of disappearance of reactant

B. Rate $= (d[C_2 - C_1)] \frac{)}{t_2 - t_1}$

C. Both (1) & (2)

D. It predicts the order of reaction

Answer: C

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14. For reaction, $2B + A \to 2C$

Which of the following is correct ?

A. Rate of disappearance of B is twice that of rate of disappearance of C

B. Rate of disappearance of A is twice that of rate of disappearance of C

C. Rate of appearance of C is twice that of rate of disappearance of A

D. All of these

Answer: C

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15. For the homogeneous elementary reaction, $A+B\to C$, the unit of rate constant is

A. s^{-1}

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

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

D. s

Answer: C

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16. The rate law for a reaction between the substances A and B is given by

Rate = $k[A]^n[B]^m$

On doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of the reaction will be as:

A. $\frac{1}{2^{n+m}}$

B. $m+n$

C. 2^{n+m}

D. 2^{n-m}

Answer: C

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17. Consider the reaction,

$2A + B \rightarrow C + D$, If the rate expression is $r = K[A]^2[B]^1$ and if volume is reduced to $\frac{1}{3}$, the rate of reaction will increases

A. 27 times

B. 9 times

C. 8 time

D. Rate will not get affected

Answer: A

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18. The rate constant is numerically the same for three reaction of first , second and third order respectively. Which one is true for the of three reaction, if concentration of reactant is greater than 1M ?

A. $r_1 = r_2 = r_3$

B. $r_1 > r_2 > r_3$

C. $r_1 < r_2 < r_3$

D. All of these

Answer: C

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19. Assuring an elementary reaction $H_2O_2 + 3I^- + 2H^+ \rightarrow 2H_2O + I_3^-$. The effect on the rate of this reaction brought about by doubling the concentration of I^- without changing the order

A. The rate would increase by a factor of 3

B. The rate would increase by a factor of 8

C. The rate would decrease by a factor of 1/3

D. The rate would increase by a factor of 9

Answer: B

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20. For a reaction $A + B \rightarrow$ products, the rate of reaction was doubled when concentration of A was doubled. When concentration of A and B both was double, the rate was again doubled , order of reaction w.r.t. A and B are

A. 1,1

B. 2,0

C. 1,0

D. 0,1

Answer: C

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21. The overall order of reaction between X & Y is 3. Which of the following rate equation must be correct, if on doubling the concentration of X, the rate of reaction gets doubled ?

A. $r = K[X]^2[Y]^0$

B. $r = K[X]^1[Y]^2$

C. $r = K[X]^1[Y]^3$

D. $r = K[X]^2[Y]^1$

Answer: B

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22. For a zero order reaction,

$K = 1 \times 10^{-3} \text{mol L}^{-1} s^{-1}$

If initial concentration of the reactant is 1.0mol L^{-1} , the concentration after 10 minutes would be

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

B. 0.6mol L^{-1}

C. 0.4mol L^{-1}

D. 1.0mol L^{-1}

Answer: C

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23. Which of the following statement is not correct ?

A. Molecularity of a reaction cannot be fractional

B. Molecularity of a reaction cannot be more than three

C. Molecularity of a reaction may or may not be equal to the order of reaction

D. Molecularity of a reaction is obtained from balanced chemical equation

Answer: D

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24. Consider the following in respect of zero order reaction.

I. $t_{1/2}$ is directly proportional to the initial concentration

II. Time taken for the completion of the reaction is twice its $t_{1/2}$

III Concentration of the reactant decreases linearly with time

Which of the statements given above are correct ?

A. I & II only

B. I & III only

C. II & III only

D. I, II & III

Answer: D

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25. If initial concentration is reduced to $1/4^{th}$ in a zero order reaction , the time taken for half the reaction to complete

A. Remains same

B. Becomes 4 time

C. Become one fourth

D. Doubles

Answer: C

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26. If initial concentration is doubled, the time for half-reaction is also doubled, the order of reaction is

A. Zero

B. One

C. Two

D. Three

Answer: A

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27. The inversion of cane sugar is represented by

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

It is a reaction of

A. Unimolecular

B. Second order

C. Zero order

D. First order

Answer: D

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28. For a Ist order reaction , a straight line is obtained if you plot

A. log conc. vs time

B. conc. vs time

C. 1/conc. vs time

D. log conc. vs 1/time

Answer: A

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29. Which order reaction obeys the expression $t_{1/2} \propto 1[A]$?

A. First

B. Second

C. Third

D. Zero

Answer: B

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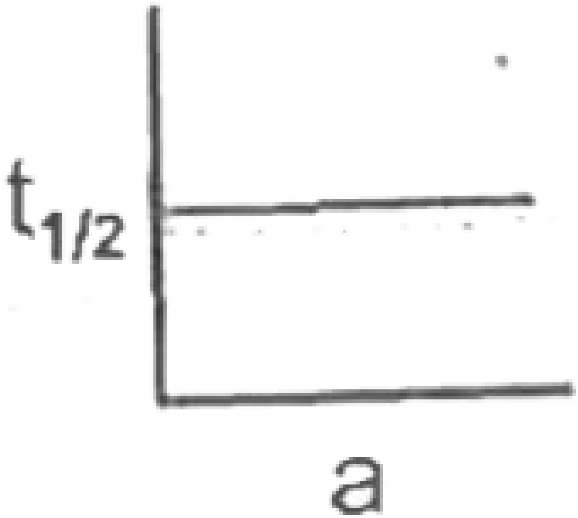
30. The graph of $t_{1/2}$ versus initial concentration 'a' is for



A. First order

B. Second order

C. Zero order

D. Can't predict

Answer: A

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31. Reactant 'A' (initial concentration, a) reacts according to zero order kinetics, the time takews for the completion of the reaction is

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

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

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

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

Answer: A

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32. A first order reaction completes 60% 20 minutes. The time required for the completion of 90% of the reaction is approx...........

A. 30 minutes

B. 40 minutes

C. 50 minutes

D. 60 minutes

Answer: C

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

A. Zero

B. First

C. Second

D. Third

Answer: A

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34. The half life of a second order process, $2A \rightarrow$ products , is

A. Independent of initial concentration

B. Directly proportional to initial concentration of A

C. Inversely proportional to initial concentration of A

D. Inversely proportional to square of initial concentration

Answer: C

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35. The rate law for the reaction

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

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

A. Doubled on doubling the concentration of NaOH

B. Halved on reducing the concentration of alkyl halide to one half

C. Decreases on increasing the temperature

D. Unaffected by increasing the temperature

Answer: B

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36. The rate constant for forward and backward reactions of hydrolysis of ester are 1.1×10^{-2} and 1.5×10^{-3} per minute respectively. Equilibrium constant for the reaction is

A. 7.33

B. 0.733

C. 73.3

D. 733

Answer: A

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37. For a reaction , $A \rightarrow B$, it has been found that the order of the reaction , is zero with respect to A. Which of the following expressions correctly describes the reaction ?

A. $K = \frac{2.303}{t} \log . \frac{[A0]}{[A]}$

B. $[A]_0 - [A] = Kt$

C. $t_{1/2} = \frac{0.693}{K}$

D. $t_{1/2} \propto \frac{1}{[A]_0}$

Answer: B

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38. A sample of a radioactive substance undergoes 80% decomposition in 345 minutes. Its half life is ....minutes

A. $\frac{In2}{In5} \times 345$

B. $\frac{In5}{In2} \times 345$

C. $\frac{In5}{In4} \times 345$

D. $\frac{In4}{In5} \times 345$

Answer: A

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39. 99% at a first order reaction was completed in 32 min. When will 99.9% of the reaction complete.

A. 50 minute

B. 46 minutes

C. 49 minute

D. 48 minute

Answer: D

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40. Check, which of the following statements is false ?

A. A catalyst does not differentiate between forward and backward reaction

B. Large activation energy is associated with low reaction rate

C. Maxwell's distribution of velocities remains- unaltered under all conditions of temperature and pressure

D. A catalyst does not affect the equilibrium state of reaction

Answer: C

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41. Arrhenius parameter (A) depends on

A. Steric factor

B. Collision frequency

C. Both (1) & (2)

D. Neither (1) nor (2)

Answer: C

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42. The chemical reactions in which the reactants require high amount of activation energy are generally

A. Slow

B. Fast

C. Instantaneous

D. Spontaneous

Answer: A

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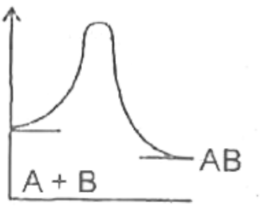
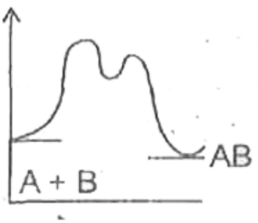
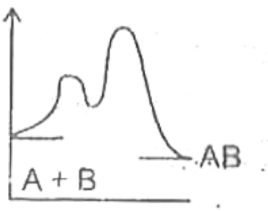
43. For an exothermic chemical process ocuuring in two process occuring in two steps as follows

$(i) A + B \rightarrow X(\text{slow})$ $(ii) X \rightarrow AB(\text{fast})$

The progress of reaction can be best described by :

A. 

B. 

C. 

D. None of these

Answer: B

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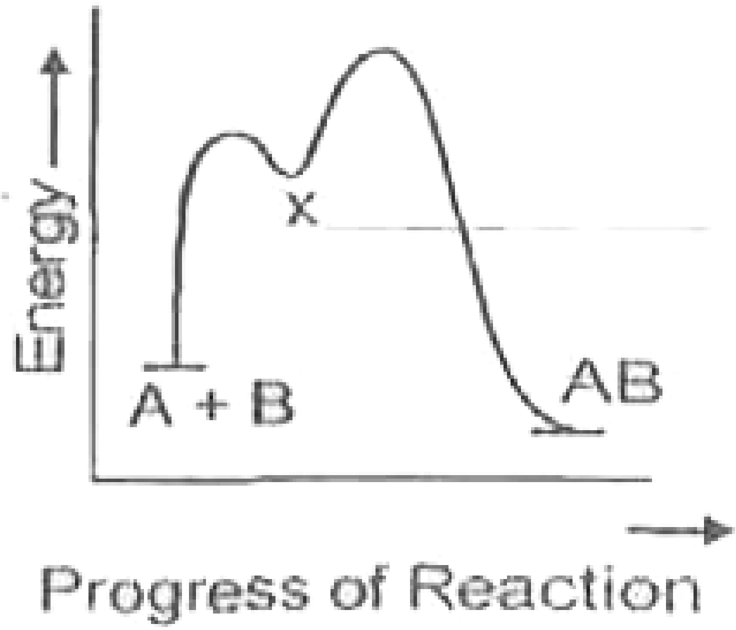
44. A chemical process occurring in two steps , is plotted as



A. Endothermic

$$A + B \rightarrow X(\text{slow})$$
$$X \rightarrow AB(\text{fast})$$

B. Exothermic

$$A + B \rightarrow X(\text{slow})$$
$$X \rightarrow AB(\text{fast})$$

C. Exothermic

$$A + B \rightarrow X(\text{fast})$$
$$X \rightarrow AB(\text{slow})$$

D. Endothermic

$$A + B \rightarrow X(\text{fast})$$
$$X \rightarrow AB(\text{slow})$$

Answer: B

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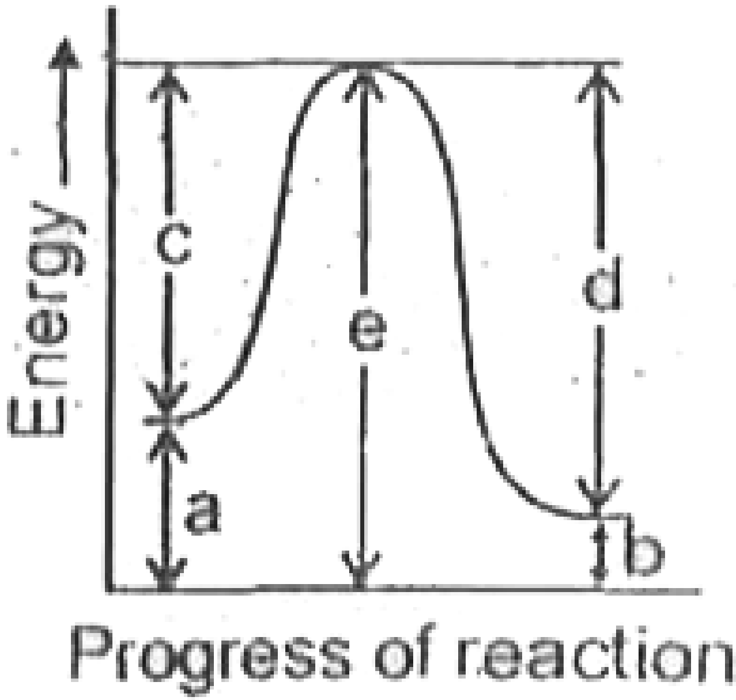
45. For the chemical process energies are plotted in graph.



Which of the following is correct ?

A. It is the exothermic reaction , $\Delta H = b - a$

B. Threshold energy , e = a + c

C. $(E_a)_f < (E_a)_b$

D. All of these

Answer: D

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46. The rate of a reaction becomes 2 times for every $10^\circ C$ rise in temperature . How many times rate of reaction will be increased when temperature is increased from $30^\circ C \text{ to } 80^\circ C$?

A. 16

B. 32

C. 64

D. 128

Answer: B

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47. The rate of a reaction increases by 2.5 times when the temperature is raised from 300K to 310K. If K is the rate constant at 310 K will be equal to

A. K

B. 2K

C. 2.5K

D. 3K

Answer: C

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48. The minimum amount of energy that the reacting molecules must possess at the time of collisions in order to produce effective collision is called

A. Activation energy

B. Threshold energy

C. Internal energy

D. Free energy

Answer: B

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49. The rate constant , the activation energy and Arrhenius parameter of a chemical reaction at $25^{\circ} C$ are x, 10x kJ/ mol and $2x s^{-1}$. Value of rate constant as $T \rightarrow \infty$ is

A. $x s^{-1}$

B. $2x s^{-1}$

C. ∞

D. $10x s^{-1}$

Answer: B

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50. At particular concentration , the half life of the reaction is 100 minutes. When the concentration of the reactant become double half life becomes , 25 minutes , then what will be the order of the reaction ?

A. 1

B. 2

C. 0

D. 3

Answer: D

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Assignment Section B Objective Type Questions

1. Consider the data given below for hypothetical reaction $A \rightarrow X$

Time (s)	Rate of the reaction $\left(molL^{-1}s^{-1}\right)$
0	1.60×10^{-2}
10	1.60×10^{-2}
20	1.60×10^{-2}
30	1.59×10^{-2}

From the above data, the order of reaction is:

A. Zero

B. 1

C. 2

D. 3

Answer: A

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2. The graph between the log K versus $\frac{1}{T}$ is a straight line. The slope of the line is

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

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

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

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

Answer: B

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

A. 1 & 3

B. 2 & 3

C. 1 & 4

D. 2 & 4

Answer: B

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

A. One third

B. Three times

C. Nine times

D. Twenty seven times

Answer: D

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5. For the raction $A + B \rightarrow$ products, it is found that order of A is 2 and the order of B is 3. In the rate expression when the concentration of both A and B are doubled the rate will increases by a factor

A. 10

B. 16

C. 32

D. 28

Answer: C

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6. Nitric oxide (NO) reacts with oxygen to produce nitrogen dioxide

$2NO_{(g)} + O_2(g) \rightarrow 2N_{2(g)}$

If the mechanism of reaction is

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

$NO_3 + NO \xrightarrow{K_1} NO_2 + NO_2$ (slow)

then rate law is

A. Rate $= K'[NO][O_2]$

B. Rate $= K'[NO][O_2]^2$

C. Rate $= K'[NO]^2[O_2]$

D. Rate $= K'[NO]^3[O_2]$

Answer: C

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7. For the first order reaction, the taken to reduce the initial concentration to a factor of $\frac{1}{4}$ is 10 minutes if the reduction in concentration is carried out to a factor of $\frac{1}{16}$, then time required will be

A. 10 minutes

B. 20 minutes

C. 40 minutes

D. 60 minutes

Answer: B

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8. For the reaction,

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

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

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

The relation between K_1, K_2 and K_3 is

A. $2K_1 = K_2 = 4K_3$

B. $K_1 = K_2 = K_3$

C. $2K_1 = 4K_2 = K_3$

D. $K_1 = 2K_2 = 3K_3$

Answer: A

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9. For the reaction , $N_2O_4(g) \underset{K_2}{\overset{K_1}{\Longleftrightarrow}} 2NO_2(g)$, the rate of disappearance of NO_2 will be

A. $K_1[N_2O_4] - K_2[NO_2]^2$

B. $2K_1[N_2O_4] - 2K_2[NO_2]^2$

C. $K_2[NO_2]^2 - K_1[N_2O_4]$

D. $2K_2[NO_2]^2 - 2K_1[N_2O_4]$

Answer: D

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10. For a homogeneous gaseous reaction $A \rightarrow B + C + D$, the initial pressure was P_0 white pressure after time 't' was P. if $(P > P_0)$ The expression for the constant K is

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

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

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

D. $K = \frac{2.303}{t} \log. \left(\frac{P_0}{4P_0 - P}\right)$

Answer: A

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11. form the gaseous reaction

$2A + B_2 \rightarrow 2AB$, the following rate data were obtained at $300K$.

	Rate of disappearance of B_2 ($mol\ L^{-1}\ min^{-1}$)	Concentration	
		[A] M	[B_2] M
i	1.8×10^{-3}	0.015	0.15
ii	1.08×10^{-2}	0.090	0.15
iii	5.4×10^{-3}	0.015	0.45

Calculate the rate constant for the reaction and the rate of formation of AB when $[A]$ is 0.02 and $[B_2]$ is $0.04 mol L^{-1}$ at $300K$.

A. $0.5 \text{mol}^{-1} \text{min}^{-1} \text{litre}$

B. $0.8 \text{mol}^{-1} \text{min}^{-1} \text{litre}$

C. $1.5 \text{mol}^{-1} \text{min}^{-1} \text{litre}$

D. $2 \text{mol}^{-1} \text{min}^{-1} \text{litre}$

Answer: B

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

A. $K=\frac{1}{t}\log_{\circ}.\frac{r_1-r_{\infty}}{r_0-r_{\infty}}$

B. $K=\frac{1}{t}In.\frac{r_0-r_{\infty}}{r_t-r_{\infty}}$

C. $K=\frac{1}{t}In.\frac{r_{\infty}-r_0}{r_t-r_{\infty}}$

D. $K=\frac{1}{t}In.\frac{r_{\infty}-r_t}{r_{\infty}-r_0}$

Answer: B

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13. Which of the following is correct

A. $\log. \frac{K_2}{K_1} = \frac{E_a}{2.303}\left[\frac{\Delta T}{T_1 T_2}\right]$

B. For zero order $t_{1/2}$ is inversely proportional to initial concentration

C. Catalyst decreases the activation energy

D. All of these

Answer: C

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14. The rate constant for a reaction is 1.5×10^{-7} at 50°C and $4.5 \times 10^7 s^{-1}$ at 100°C. What is the value of activation energy?

A. $2.2 \times 10^3 \text{ J mol}^{-1}$

B. 2300J mol^{-1}

C. $2.2 \times 10^4 \text{ J mol}^{-1}$

D. 220 J mol^{-1}

Answer: C

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15. In Arrhenius equation , $k = Ae^{\frac{E_a}{RT}}$, A may not be termed as rate constant .

A. When 100% reactant will convert into the product

B. When the temperature becomes infinite.

C. When the fraction of molecule crossing over the energy barrier becomes unity

D. At very low temperature

Answer: D

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16. The rate constant of the production of 2B (g) by the reaction , $A(g) \xrightarrow{\Delta} 2B(g)$ is $2.48 \times 10^{-4} s^{-1}$ A 1 : 1 molar ratio of A to B in the reaction mixture is attained after

A. 26.25 minute

B. 27.25 minute

C. 28.25 minute

D. 0 minute

Answer: B

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17. Two substances A and B are present such that $[A_0] = 4[B_0$ and half-life of A is 5 minutes and that of B is 15 minutes. If they start decaying at the same time following first order kinetics after how much time the concentration of both of them would be same ?

A. 15 minute

B. 10 minute

C. 5 minute

D. 12 minute

Answer: A

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18. If the rate of reaction increases by 27 times , when temperature is increased by 30 K, then temperature coefficient of the reaction is

A. 3

B. 2

C. 1

D. 2.5

Answer: A

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19. The reaction $A \rightarrow B$ follows first order kinetics. The time taken for $0.8 mol$ of A to produce $0.6 mol$ of B is $1 hr$. What is the time taken for the conversion of $9.0 mol$ of A to Product $0.675 mol$ of B ?

A. 1 hour

B. 30 min

C. 15 min

D. 5 min

Answer: A

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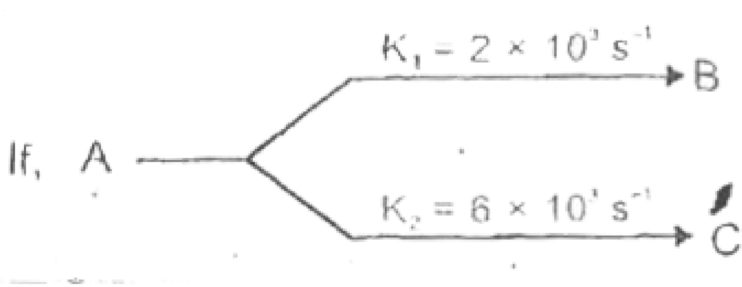
20. If 

find B%

A. $25\ \%$

B. $50\ \%$

C. $75\ \%$

D. 80%

Answer: A

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Assignment Section C Previous Year Questions

1. A first order reaction has a specific reaction rate of $10^{-2}s^{-1}$. How much time will it take for 20 g of the reactant to reduce to 5 g ?

A. 2.38.6 second

B. 138.6 second

C. 346.5 second

D. 693.0 second

Answer: B

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2. Mechanism of a hypothetical reaction

$X_2 + Y_2 \rightarrow 2XY$ is given below:

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

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

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

The overall order of the reaction will be :

A. 1

B. 2

C. 0

D. 1.5

Answer: D

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3. 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 in independent of the surface coverage

D. Rate of decomposition is very slow

Answer: A

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4. The addition of a catallystic during a chemical reaction alters which of the following quantities ?

A. Activation energy

B. Entropy

C. Internal energy

D. Enthalpy

Answer: A

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5. The rate of a first-order reaction is $0.04 \text{mol L}^{-1} s^{-1}$ at 10 seconds and $0.03 \text{mol L}^{-1} s^{-1}$ at 20 seconds after initiation of the reaction. The hlaf-life period of the reaction is :

A. 54.1 s

B. 24.1 s

C. 34.1 s

D. 44.1 s

Answer: B

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6. The rate constant of the reaction $A \to B$ is 0.6×10^{-3} mole per second. If the concentration of A is $5M$, 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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7. The activation energy of a reaction can be determine from the slope of which of the following graphs ?

A. $\dfrac{T}{\text{In K}} - vs\dfrac{1}{T}$

B. In K vs T

C. $\dfrac{\text{In K}}{T} vs T$

D. $\text{In K vs}\dfrac{1}{T}$

Answer: D

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8. When initial concentration of a reactant is doubled in a reaction, its half-life period is not affected. The order of the reaction is

A. More than zero but less than first

B. Zero

C. First

D. Second

Answer: C

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9. A reaction having equal energies of activation for forward and reverse reactions has

A. $\Delta G = 0$

B. $\Delta H = 0$

C. $\Delta H = \Delta G = \Delta S = 0$

D. $\Delta S = 0$

Answer: B

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10. What is the activation energy for a reaction if its rate doubles when the temperature is raised from $20^\circ C$ to $35^\circ C$? $\left(R = 8.314 J \text{mol K}^{-}\right)$

A. 269kJ mol^{-1}

B. $34.7 \quad \text{kJ mol}^{-1}$

C. 15.1kJ mol^{-1}

D. 342kJ mol^{-1}

Answer: B

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11. In a zero order reaction for every 10° rise of temperature , the rate is doubled. If the temperature is increased from $10^{\circ}C \text{ to } 100^{\circ}C$, the rate of the reaction will become

A. 64 times

B. 128 times

C. 256 times

D. 512 times

Answer: D

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

A. Rate = K[A][B]

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

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

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

Answer: B

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

A. Order of reaction is always whole number

B. Order can be determined only experimentally

C. Order is not influenced by stoichiometric coefficient of the reactants

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

Answer: A

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14. The unit of rate constant for a first order reaction

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

B. s^{-1}

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

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

Answer: B

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15. The half life of a substance in a certain enzyme catalyzed reaction is 138s. The time required for the concentration of the substance to fall from $1.28 mgL^{-1} \rightarrow 0.04 mgL^{-1}$:

A. 690 s

B. 276 s

C. 414 s

D. 552 s

Answer: A

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16. For the reaction, $N_2O_5(g) \rightarrow 2NO_2(g) + 1/2O_2(g)$, the value of rate of disappearance of N_2O_5 is given as $6.25 \times 10^{-3} \text{mol L}^{-1} s^{-1}$. The rate of formation of NO_2 and O_2 is given respectively as

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

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

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

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

Answer: B

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17. For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E will be

A. Less than ΔH

B. Equal to ΔH

C. More than ΔH

D. Equal to zero

Answer: C

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

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

Based on the above data which one of the following is correct ?

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

B. Rate = $K[A][B]$

C. Rate = $K[A]^2[B]^2$

D. Rate = $K[A][B]^2$

Answer: D

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19. 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 the Cl_2

D. Doing all of these

Answer: A

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20. For the reaction , $N_2 + 3H_2 \rightarrow 2NH_3$ if $\frac{d[NH_3]}{dt} = 2 \times 10^{-4} \text{mol L}^{-1} s^{-1}$, the value of $\frac{-d[H_2]}{dt}$ would be

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

B. $6 \times 10^{-(4)} \quad \text{mol L}^{-1} s^{-1}$

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

D. $3 \times 10^{-(4)} \ \text{mol L}^{-1} s^{-1}$

Answer: D

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21. In the reaction

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

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

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

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

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

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

Answer: D

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22. Half life period of a first - order reaction is 1396 seconds. The specific rate constant of the reaction is

A. $0.5 \times 10^{-2} s^{-1}$

B. $4.9 \times 10^{-4} s^{-1}$

C. $5.0 \times 10^{-2} s^{-1}$

D. $5.0 \times 10^{-3} s^{-1}$

Answer: B

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23. For the reaction $A + B$ products, it is observed that:

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

(2) on doubling te initial concentration of both A and B, there is a

charge by a factor of 8 in the rate of the reaction.

The rate of this reaction is given by

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

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

C. Rate = k [A][B]

D. Rate = $K[A]^2[B]$

Answer: A

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24. The rate constant k_1 and k_2 for two different reactions are $10^{16}e^{-2000/T}$ and $10^{15}e^{-1000/T}$, respectively. The temperature at which $k_1 = k_2$ is

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

B. 1000 K

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

D. 2000 K

Answer: A

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

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

These kinetic data were obtained for given reaction concentrations :

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

Based on these data, rate equations is :

A. Rate $= k[CH_3COCH_3][Br_2][H^+]$

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

C. Rate $\begin{array}{c} O \\ || \\ [CH_3 - C - CH_3][Br_2] \end{array}$

D. Rate $= k[CH_3COCH_3][Br_2]\left[H^+\right]^2$

Answer: B

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26. In a first order reaction, $A \rightarrow B$, if K is rate constant and initial concentration of the reactant A is 0.7M then half - life is

A. $\dfrac{In2}{K}$

B. $\dfrac{0.693}{0.5K}$

C. $\dfrac{\log 2}{K}$

D. $\dfrac{\log 2}{K\sqrt{0.5}}$

Answer: A

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27. The reaction obey I order with respect to H_2 and ICl both.

$H_2(g) + 2ICl(g) \rightarrow 2HCl(g) + I_2(g)$

Which of the following mechanism is in consistent with the given fact ?

Mechanism A: $H_2(g) + 2Cl \rightarrow 2HCl(g) + I_2(g)$

Mechanism B: (i) $H_2(g) + ICl(g) \xrightarrow{\text{slow}} HCl(g) + HI(g)$

(ii) $HI(g) + ICl(g) \rightarrow HCl(g) + I_2$

A. A only

B. B only

C. Both (1) and (2)

D. Neither (1) nor (2)

Answer: B

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28. If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately (log 4 = 0.60 log

5 = 0.69)

A. 40 minutes

B. 50 minutes

C. 45 minutes

D. 60 minutes

Answer: C

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

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

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

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

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

Answer: A

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30. For this reaction

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

The relation between $\frac{d(NH_3)}{dt}$ and $-\frac{d(H_2)}{dt}$ is :-

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

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

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

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

Answer: B

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

A. 220 s

B. 30 s

C. 300 s

D. 347 s

Answer: D

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32. A nuclide of an alkaine earth metal undergoes radioactive deacy by emission of the $\alpha -$ particles in sucession. The group of the periodic tablle to which the resulting daughter element would belong to:

A. Group 14

B. Group 16

C. Group 4

D. Group 6

Answer: A

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33. The rate of reaction between two A and B decreases by factor 4 if the concentration of reactant B is doubled. The order of this reaction with respect to B is

A. -1

B. -2

C. 1

D. 2

Answer: B

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34. A reaction is 50 % complete in 2 hours and 75 % complete in 4 hours the order of reaction is

A. 0

B. 1

C. 2

D. 3

Answer: B

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35. Activation energy (E_a) and rate constants $(k_1 \text{ and } k_2)$ of a chemical reaction at two different temperature $(T_1 \text{ and } T_2)$ are related by

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

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

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

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

Answer: B::D

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36. The half life of 2g sample of radioactive nuclide 'X' is 15 min. The half life time of 1g sample of X is

A. 7.5 min

B. 15 min

C. 22.5 min

D. 30 min

Answer: B

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37. The rate of reaction.

$2N_2O_5 \rightarrow 4NO_2 + O_2$

can be written in three ways.

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

The relation between k and k' are:

A. $k' = 2k,\ k'' = 2k$

B. $k' = k,\ k'' = k$

C. $k' = 2k,\ k'' = k$

D. $k' = 2k,\ k'' = \frac{k}{2}$

Answer: D

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38. For the following reaction $C_6H_{12}(aq) + H_2(g) \Leftrightarrow C_6H_{14}O_6(aq)$

Which one of the following is not affected by the addition of catalyst ?

A. Rate of forward reaction

B. Rate of backward reaction

C. Time required to reach the equilibrium

D. Spontaneity

Answer: D

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39. A chemical reaction proceeds into the following steps

Step I, $2A \Leftrightarrow X$ fast

Step II, $X + B \rightarrow Y$ slow

Step III, $Y + B \Leftrightarrow$ product fast

The rate law for the overall reaction is

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

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

C. Rate = k [A][B]

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

Answer: D

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40. The data for the reaction: $A + B \xrightarrow{k} C$.

Experiment	$[A]_0$	$[B]_0$	Initial rate
1	0.012	0.035	0.10
2	0.024	0.070	0.80
3	0.024	0.035	0.10
4	0.012	0.070	0.80

The rate law corresponding to the above data is

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

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

A. Rate $= k[A][B]^3$

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

C. Rate $= k[B]^3$

D. Rate $= k[B]^4$

Answer: C

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41. Half - life for radioactive $.^{14}C$ is 5760 years. In how many years 200 mg of $.^{14}C$ will be reduced to 25 mg ?

A. 17280 years

B. 23040 years

C. 5760 years

D. 11524 years

Answer: D

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42. A chemical reaction has catalyst X. Hence X

A. Reduces enthalpy of the reaction

B. Does not affect equilibrium constant of reaction

C. Decreases rate constant of the reaction

D. Increases activation energy of the reaction

Answer: B

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43. The given elementary reaction $2FeCl_3 + SnCl_2 \rightarrow 2FeCl_2 + SnCl_4$ is an example of

A. Third order reaction

B. First order reaction

C. Second order reaction

D. None of these

Answer: A

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44. Carbon 14 dating method is based on the fact that

A. Ratio of carbon - 14 and carbon - 12 is constant

B. Carbon - 14 is the same in all objects

C. Carbon - 14 is highly insoluble

D. All of these

Answer: A

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45. For the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$, the rate of reaction is expressed as

A. $\frac{\Delta[H_2]}{\Delta t} = \frac{1}{2}\frac{\Delta[l_2]}{\Delta t} = -\frac{\Delta[Hl]}{\Delta t}$

B. $-\frac{\Delta[l_2]}{\Delta t} = \frac{\Delta[H_2]}{\Delta t} - \frac{1}{2}\frac{\Delta[Hl]}{\Delta t}$

C. $-\frac{\Delta[l_2]}{\Delta t} = \frac{\Delta[H_2]}{\Delta t} - \frac{\Delta[Hl]}{2\Delta t}$

D. None of these

Answer: D

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

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

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

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

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

C. rate = $k[B_2]$

D. rate = $k[B_2]^2$

Answer: C

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

A. Evaluating rate constants at two different temperatures

B. Evaluating velocities of reaction at two different temperature

C. Evaluating rate constant at standard

D. Changing concentration of reactants

Answer: A

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48. For a first order reaction, the half-life period is independent of

A. First power of final concentration

B. Cube root of initial concentration

C. Initial concentration

D. Square root of final concentration

Answer: C

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49. The half - life of $._6 C^{14}$, if its λ is $2.31 \times 10^{-4} \text{ year}^{-1}$ is

A. 3.5×10^4 years

B. 3×10^3 years

C. 2×10^2 years

D. 4×10^3 years

Answer: B

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50. A 300 gram radioactive sample has life of 3 hour's After 18 hour's remaining quantity will be:

A. 4.68 gram

B. 2.34 gram

C. 3.34 gram

D. 9.37 gram

Answer: A

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51. Enzymes enhance the rate of reaction by

A. By lowering activation energy

B. By changing activation energy

C. By changing equilibrium constant

D. By forming enzyme substrate complex

Answer: A

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52. For the reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$ rate and rate constant are $1.02 \times 10^{-4} M \sec^{-1}$ and $3.4 \times 10^{-5} \sec^{-1}$ respectively, the concentration of N_2O_5, at that time will be

A. 1.732

B. 3

C. 1.02×10^{-4}

D. 3.4×10^5

Answer: B

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53. A human body required the 0.01 M activity of radioactive substance after 24 h. Half life of radioactive substance is 6h. Then injection of maximum activity of radioactie substance that can be injected will be

A. 0.08

B. 0.04

C. 0.16

D. 0.32

Answer: C

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54. When a biochemical reaction is carried out in laboratory from outside of human body in the absence of enzyme, the rate of reaction obtained is 10^{-6} times, then activation energy of the reaction in the presence of enzyme is

A. $\frac{6}{RT}$

B. P is required

C. Different from E_a obtained in laboratory

D. Can't say anything

Answer: C

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55. $2A + 2C \rightarrow 2B$, rate of reaction $\frac{+d(B)}{dt}$ is equal to

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

B. $-\frac{d(A)}{dt}$

C. $-\frac{1}{3}\frac{d(A)}{dt}$

D. $+2\frac{d(A)}{dt}$

Answer: B

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56. $2A \rightarrow B + C$

It would be a zero order reaction when

A. The rate of reaction is proportional to sequare of conc of A

B. The rate of reaction remains same at any conc of A

C. The rate remains unchanged at any conc of B and C

D. The rate of reaction doubles if conc of B is increased to double

Answer: B

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57. The activation energy for a simple chemical reaction $A \rightarrow B$ is E_a in the forward reaction: The activation of the reverse reaction

A. Is negative of E_a

B. Is always less than E_a

C. Can be less than or more than E_a

D. Is always double of E_a

Answer: C

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58. The reaction A $\rightarrow$ B follows first order reaction. 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 moles of B?

A. 1 hour

B. 0.5 hour

C. 0.25 hour

D. 2 hour

Answer: A

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59. If the rate of the reaction is equal to the rate constant , the order of the reaction is

A. 1

B. 2

C. 0

D. 3

Answer: A

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

A. k Vs T

B. k Vs $\dfrac{1}{\log T}$

C. log k Vs $\dfrac{1}{T}$

D. log k Vs T

Answer: C

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61. The radioisotope , tritium $\left({}_1^3H\right)$ has a half-life of 12.3 years. If the initial amount of tritium is 32 mg , how many milligrams of it would remain after 49.2 years ?

A. 1 mg

B. 2 mg

C. 4 mg

D. 8 mg

Answer: B

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62. The rate of a first order reaction is 1.5×10^{-2} and $L^{-1}\text{min}^{-1}$ at 0.8 M concentration of the reactant. The half - life of the reaction is

A. 0.383 min

B. 36.97 min

C. 8.73 min

D. 7.53 min

Answer: B

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Assignment Section D Assertion Reason Type Questions

1. A : Rate of reaction depends upon the concentration of the reactants.

R : The order of reaction can be negative with respect to substance present in the reaction.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: B

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2. A : $NO_2 + CO \xrightarrow{\text{Slow}} CO_2 + NO$

Rate $= K[NO_2]^2$

R : Rate does not depend upon [CO] because it is involved in the first step.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: D

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3. A : If temperature does not affect the rate of reaction , $E_a = 0$

R : Lesser the activation energy, slower will be the reaction.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: C

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4. A : The rate constant of first order reaction is used to calculate population if growth rate is given.

R : The rate constant is independent of concentration for first order reaction.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: B

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5. A : A positive catalyst increases the rate of reaction .

R : A positive catalyst alters reaction mechanism and decreases activation energy.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: A

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6. A : The molecularity of reaction can never be fractional.

R : Molecularity is the number of molecules needed to form activated complex, which will never be fractional.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: A

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7. A : The decomposition of gaseous N_2O_5 follows first order kinetics.

R : The plot of log of its partial pressure versus time is linear with slope , $-\frac{k}{2.303}$ and having intercept equal to log P.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: A

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8. Assertion: Order and molecularity of a reaction are always equal.

Reason: Complex reactions take place in steps and slowest step determines the reaction order.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: D

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9. A : Rate constant increases with temperature.

R : Rate of exothermic reaction increases with temperature.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: B

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10. A : Hydrolysis of ester in acidic medium follows first order kinetics.

R : Hydrolysis of ester is independent of the concentration of acid used.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: A

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11. A : The rate constant of zero order reaction is equal to rate of reaction.

R : $t_{1/2}$ for zero order reaction is directly proportional to initial concentration.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: B

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12. A : For exothermic reaction,

$\Delta H = E_a$ (forward) $- E_a$ (backward)

R : The value of activation energy for forward direction is less than activation energy for backward reaction.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: A

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13. A : Arrhenius parameter

(A) = P (steric factor) $\times$ z (collision frequency)

R : On increasing temperature , the value of A increases.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: C

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14. A : In presence of +ve catalyst, activation energy & threshold energy decreases.

R : Minimum energy required to permit a reaction is known as threshold energy.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: B

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15. A : when temperature becomes ∞ then the value of rate constant is maximum.

R : a is also known as maximum rate constant.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion , then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion , then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements , then mark (4)

Answer: B

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