CHEMISTRY

BOOKS - BRILLIANT PUBLICATION

CHEMICAL KINETICS

QUESTION (LEVEL - I) (HOMEWORK)

1. A graph Is drawn between the concentration of the reactants (taken on y-axis) and the time of reaction (taken on x-axis). The slope of the tangent drawn to the graph at a point corresponding to reaction time t sec. Gives

A. Rate of the reaction

B. Rate of constant of the reaction

C. Rate of reactant at time t

D. Half-life period of the reaction

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2. Which of the following reactions is a fast reaction at laboratory temperature?

A. Reaction between $KMnO_4$ and oxalic acid

B. Reaction between $KMnO_4$ and mohr's salt

C. Hydrolysis of ethyl acetate

D. Thermal decomposition of N_2O_5

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3. For $3A \rightarrow xB$, $\frac{d[B]}{dt}$ is found to be 2/3rd of $\frac{d[A]}{dt}$. Then the value of 'x' is

A. 1.5

B. 3

C. $1/2$

D. 2

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4. In the reaction $2NO + O_2 \rightarrow 2NO_2$, if the rate of disappearance of O_2 is 16gm. min^{-1}, then the rate of appearance of NO_2 is:

A. 90 gm min^{-1}

B. 46 gm min^{-1}

C. 28 gm min^{-1}

D. 32 gm min^{-1}

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5. In the manufacture of NH_3 by Haber process $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ the rate of the reaction was measured as - $\frac{d[N_2]}{dt} = 2 \times 10^{-4} \text{mol} L^{-1} s^{-1}$. The rate of the reaction expressed in terms of H_2 is:

A. 6.6×10^{-5}

B. 6×10^{-4}

C. 2×10^{-4}

D. 4×10^{-4}

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6. For the reaction $Cl_2 + 2I^- \rightarrow I_2 + 2Cl^-$, the initial concentration of I^- was 0.4mol^{-1} and concentration after 20 minutes was 0.28 mol L^{-1}. The rate of formation of I_2 in mol L^{-1} would be

A. 2×10^{-3}

B. 3×10^{-3}

C. 3.4×10^{-4}

D. 2.8×10^{-2}

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7. The chemical reaction $2O_3 \rightarrow 3O_2$ proceeds as follows:

(i) $O_3 \rightarrow O_2 + O$ (fast)

(ii) $O + O_3 \rightarrow 2O_2$ (slow). The rate Law exprssion should be:

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

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

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

D. $r = k[O_2][O]$

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8. In the process $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ at t = 10, rate of reaction w.r.t. N_2O_5, NO_2 & O_2 respectively are:

A. N_2O_5 - 500 mm/min, NO_2 - 400 min/min, O_2- 200 mm/min

B. N_2O_5 - 1000 mm/min, NO_2 - 1000 mm/min, O_2- 500 mm/min

C. N_2O_5 - 1000 mm/min, NO_2 - 2000 mm/min, O_2- 4000 mm/min

D. N_2O_5 - 400 mm/min, NO_2 - 400 mm/min, O_2- 400 mm/min

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9. Consider a system containing NO_2 and SO_2 in which NO_2 is consumed in the following two parallel reactions

$2NO_2 \xrightarrow{K_1} N_2O_4, NO_2 + SO_2 \xrightarrow{K_2} NO + SO_3$

The rate of disappearance of NO_2 will be equal to

A. $K_1[NO_2]^2 + K_2[NO_2]$

B. $K_1[NO_2]^2 + K_2[NO_2][SO_2]$

C. $2K_1[NO_2]^2$

D. $2K_1[NO_2]^2 + K_2[NO_2][SO_2]$

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10. The rate constant of a reaction depends on

A. Temperature

B. Pressure

C. Extent of reaction

D. Initial concentration of the reactant

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11. In the following reaction, how is the rate of appearance of the underlined product related to the rate of disappearance of the underlined reactant:

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

A. $-\frac{d\left[BrO_3^-\right]}{dt} = \frac{d[Br_2]}{dt}$

B. $-\frac{1}{3}\frac{d\left[BrO_3^-\right]}{dt} = \frac{d[Br_2]}{dt}$

C. $\frac{-d\left[BrO_3^-\right]}{dt} = \frac{1}{3}\frac{d[Br_2]}{dt}$

D. None of these

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12. If decomposition reaction $A(g) \rightarrow B(g)$ follows first order kinetics then the graph of rate of (R) of B against time t will be :

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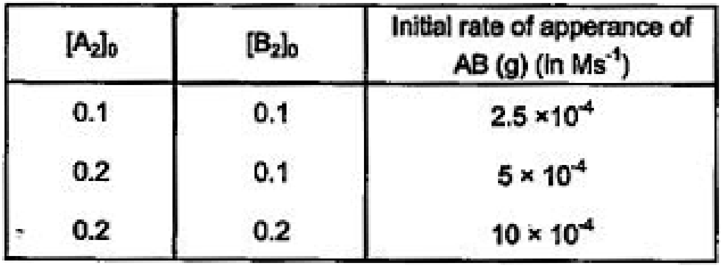
13. The reaction of A_2 and B_2 follows the equation $A_2(g) + B_2(g) \rightarrow 2AB(g)$.

The following data were observed



$[A_2]_0$	$[B_2]_0$	Initial rate of apperance of AB (g) (In Ms^{-1})
0.1	0.1	2.5×10^{-4}
0.2	0.1	5×10^{-4}
0.2	0.2	10×10^{-4}

The value of rate constant for the above reaction is:

A. 2.5×10^{-4}

B. 2.5×10^{-2}

C. 1.25×10^{-2}

D. None of these

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14. The unit of rate constant of elementary reaction depends upon the

A. Temperature of the reaction

B. Concentration of reactants

C. Activation energy of the reaction

D. Molecularity of the reaction

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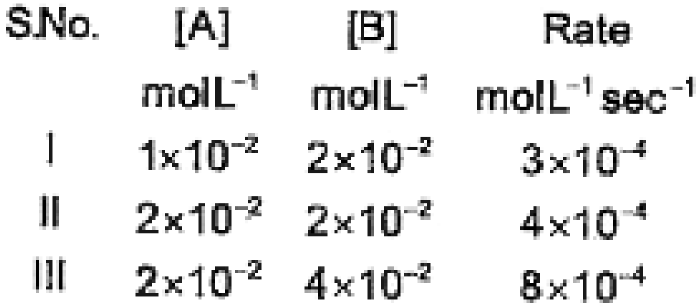
15. The following data pertain to reaction between A and B:



S.No.	[A] $molL^{-1}$	[B] $molL^{-1}$	Rate $molL^{-1}sec^{-1}$
I	1×10^{-2}	2×10^{-2}	3×10^{-4}
II	2×10^{-2}	2×10^{-2}	4×10^{-4}
III	2×10^{-2}	4×10^{-2}	8×10^{-4}

Which one of the following interference(s) can be drawn from the above data?

a) Rate constant of the reaction 10^{-4}

b) Rate law of reaction is k[A][B]

c) Rate of reaction increases four times on doubling the concentration of both the reactants. Select the correct answer

Codes:

A. a, b and c

B. a and b

C. b and c

D. c alone

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16. If 'a' is the initial concentration of the reactant, the half-life period of the reaction of nth order is inversely proportional to:

A. a^{n-1}

B. a^{n}

C. a^{1-n}

D. a^{n+1}

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17.

$$CH_3COOC_2H_5(aq) + H_2O(l) \xrightarrow{H^+(aq)} CH_3COOH(aq) + C_2H_5OH(aq)$$

. What type of reaction is this?

A. Unimolecular elementary

B. Pseudo first order

C. Zero order

D. Second order

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18. When ethyl acetate was hydrolysed in presence of 0.1 M HCl, the rate constant was found to be $5.4 \times 10^{-5} s^{-1}$. But in presence of 0.1 M H_2SO_4 the rate constant was found to be $6.25 \times 10^{-5} s^{-1}$ .Thus it may be concluded that:

A. H_2SO_4 furnishes more H^+ than HCl

B. H_2SO_4 furnishes less H^+ than HCl

C. Both have the same strength

D. Will depend on concentration of ethyl acetate

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19. If 99% of a first order reaction was completed in 32 minutes when will 99.9% of the reaction complete

A. 50 min

B. 46 min

C. 48 min

D. 49 min

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20. For the zero order reaction $A \rightarrow B + C$, initial concentration of Ais 0.1 M. If[A] = 0.08 M after 10 minutes, then its half-life and completion time are respectively:

A. 10 min, 20 min

B. 2×10^{-3} min, 4×10^{-3} min

C. 25 min, 50 min

D. 100 min, 500 min

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21. Consider the following first order competing reactions:

$X \xrightarrow{k_1} A + B$ and $Y \xrightarrow{k_2} C + D$

If 50% of the reaction of X was completed when 96% of the reaction of Y was completed, the ratio of thoir rate constant (k_2 / k_1) is:

A. 4.06

B. 0.215

C. 1.1

D. 4.65

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22. AT 300 K, the half-life of a sample of a gaseous compound initially at 1 atm is 100 sec. When the pressure is 0.5 atm, the half-life is 50 sec. The order of reaction is :

A. 0

B. 1

C. 2

D. 3

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23. The molecularity of a complex reaction given below is:

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

A. 1

B. 2

C. 3

D. Has no meaning

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24. For an endothermic reaction where ΔH represents the enthalpy of reaction in kJ(mol, the minimum value for the energy of activation will be:

A. Less than ΔH

B. More than ΔH

C. Equal to ΔH

D. Zero

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25. When the activation energies of the forward and backward reactions are equal, then:

A. A. $\Delta U = 0, \Delta S = 0$

B. B.$\Delta U = 0, \Delta G = 0$

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

D. D. Only $\Delta U = 0$

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26. The plot of In k versus 1/T is linear with slope of :

A. $-E_a/R$

B. E_a/R

C. $E_a/2.303R$

D. $-E_a/2.303R$

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27. $\frac{k_{35^\circ}}{k_{34^\circ}} > 1$, this means that:

A. Rate increases with the rise in temperature

B. Rate decreases with rise in temperature

C. Rate does not change with rise in temperature

D. None of the above

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28. A first order reaction is 50% completed in 20 minutes at 27°C and in 5 minutes at 47°C. The energy of activation of the reaction is :

A. 43.85 kJ/mol

B. 55.33 kJ/mol

C. 11.97 kJ/mol

D. 6.65 kJ/mol

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29. Collision theory is applicable to

A. First order reactions

B. Zero order reactions

C. Bimolecular elementary reactions

D. Any order reactions

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30. For the first order reaction $A \rightarrow B + C$, carried out at 27°C, 3.8×10^{-16} % of the reactant molecules exists in the activated state. The E_a (activation energy) of the reaction is:

A. 12 kJ/mol

B. 831.4 kJ/mol

C. 100 kJ/mol

D. 88.57 kJ/mol

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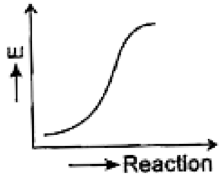
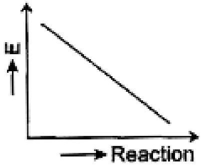
31. Which graph shows zero activation energy?



A.



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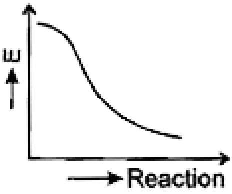
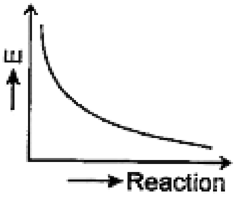


C.

D. 

Answer: D

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32. Which of the following explains the increase of the reaction rate by catalyst?

A. Catalyst decreases the rate of backward reaction so that the rate of forward reaction increases

B. Catalyst provides extra energy to reacting molecules so that they may reduce effective collisions

C. Catalyst provides an alternative path of lower activation energy to the reactants

D. Catalyst increases the number of collisions between the reacting molecules

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33. A hypothetical reaction $A_2 + B_2 \rightarrow 2AB$ follows the mechanism as given below

$A_2 \rightarrow A + A$ (fast)

$A + B_2 \rightarrow AB + B$ (slow)

$A + B \rightarrow AB$ (fast)

The order of the over all reaction by RDS method is:

A. 2

B. 1

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

D. 0

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34. The rate of a reaction gets doubted when temperature increases from 27°C to 37°C. By what factor will it change for the temperature range 17°C to 27°C

A. 1.81

B. 1.71

C. 2.1

D. 2.41

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QUESTION (LEVEL - I) (HOMEWORK) (ASSERTION- REASON)

1. Assertion : Concentration of reactant in zero order reaction is constant.

Reason : For zero order reaction $A \to B$, successive half life of reaction decreases with the progress of the reaction.

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Assertion is false Reason is true

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2. Assertion : Molecularity has no meaning for a complex reaction.

Reason : Molecularity defined only for RDS.

A. Both'Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Assertion is false Reason is true

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3. Assertion : Acid catalysed hydrolysis of esters is pseudo first order reaction.

Reason : Water is present in excess in given reaction.

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Assertion is false Reason is true

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4. Assertion : The plot of k versus 1/T is linear.

Reason : $k = A.\,e^{-E_a/(RT)}$

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Assertion is false Reason is true

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5. Assertion : Active complex is an intermediate product.

Reason : Active complex is unstable with high vibrational energy.

A. Both'Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Assertion is false Reason is true

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6. Assertion : The pre-exponential factor A has the same units for all reactions

Reason : $e^{-E_a/RT}$ has no unit.

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Assertion is false Reason is true

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QUESTION (LEVEL - II)

1. $xA + yB \to zC$. If $-\frac{d[A]}{dt} = -\frac{d[B]}{dt} = 1.5\frac{d[C]}{dt}$ then x,y and z are:

A. 1,1,1

B. 2,2,3

C. 3,2,3

D. 3,3,2

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2. In the manufacture of NH_3 by Haber process $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ the rate of the reaction was measured as - $\frac{d[N_2]}{dt} = 2 \times 10^{-4} \text{mol} L^{-1} s^{-1}$. The rate of the reaction expressed in terms of H_2 is:

A. 6.6×10^{-5}

B. 6×10^{-4}

C. 2×10^{-4}

D. 4×10^{-4}

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3. In the manufacture of NH_3 by Haber process $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ the rate of the reaction was measured as - $\frac{d[N_2]}{dt} = 2 \times 10^{-4} \text{mol} L^{-1} s^{-1}$. The rate of the reaction expressed in terms of H_2 is:

A. 1.0×10^{-4} mol $dm^{-3} s^{-1}$

B. 2.0×10^{-4} mol $dm^{-3} s^{-1}$

C. 3.0×10^{-4} mol $dm^{3} s^{-1}$

D. 4.0×10^{-4} mol $dm^{-3} s^{-1}$

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4. The term rate of reaction and rate of appearance (or disappearance) of reactant (or product)

A. A.represent one and the same physical quantity

B. B. differ by a constant factor

C. C. are positive parameters and have same value

D. D. may or may not have same value depending upon the stoichiometric coefficient of reactant (or product) in the balanced chemical equation

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5. Rate of formation of SO_3 in the following reaction $2SO_2 + O_2 \rightarrow 2SO_3$ is 100g min^{-1}. Hence rate of disappearance of O_2 is:

A. 50 g min^{-1}

B. 40 g min^{-1}

C. 200 g min^{-1}

D. 20 g min^{-1}

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6. In a reaction $A + B \rightarrow$ Products, rate of reaction decreases by a factor two, if the concentration of A and B, both are doubled. If only concentration of B is doubled, the rate decreases by a factor of four. The rate law is:

A. $r = k[A]^{-1}[B]^{-1}$

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

C. $r = k[A]^{2}[B]^{-1}$

D. $r = k[A]^{-2}[B]^{-2}$

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7. In a reaction $2A+B \to 3C$, the concentration of A decreases from 0.5 mol L^{-11} to 0.3 mol L^{-1} in 10 minutes. The rate of production of 'C during this period is:

A. 0.01 mol $L^{-1}\text{min}^{-1}$

B. 0.04 mol $L^{-1}\text{min}^{-1}$

C. 0.05 mol $L^{-1}\text{min}^{-1}$

D. 0.03 mol $L^{-1}\text{min}^{-1}$

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8. For the reaction: 2A+B→A 2 B, the rate =k[A[B]2 with k=2.0×10^−6mol^−2L ^2 s^−1. Calculate the initial rate of the reaction when

[A]=0.1molL −1 ,[B]=0.2 molL −1 . Calculate the rate of reaction after [A] is reduced to 0.06 molL −1

A. 3.89×10^{-9}

B. 3×10^{-6}

C. 16×10^{-9}

D. 9.3×10^{-7}

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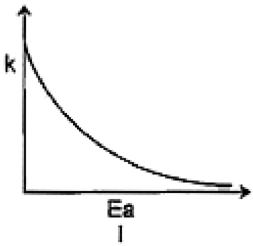
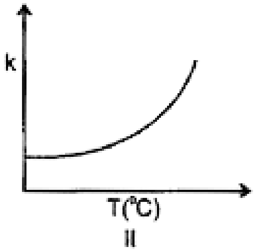
9. Consider the given plots for a reaction obeying Arrhenius equation (0°C < T < 300°C): (k and E_a are rate constant and activation energy, respectively)





Choose the correct option :

A. 1) Both I and II are wrong

B. 2) I is wrong but II is right

C. 3) Both I and II are correct

D. 4) I is right but II is wrong

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10. For an elementary chemical reaction, $A_2 \underset{k_{-1}}{\overset{k_1}{\longrightarrow}} 2A$, the expression for $\frac{d[A]}{dt}$ is :

A. $2k_1[A_2] - k_{-1}[A]^2$

B. $k_1[A_2] - k_{-1}[A]^2$

C. $2k_1[A_2] - 2k_{-1}[A]^2$

D. $k_1[A_2] + k_{-1}[A]^2$

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11. If I is, the intensity of absorbed light and 'C' is the concentration of (AB) for the photochemical process $AB + hv \rightarrow AB^{\cdot}$ the rate of formation of $AB\cdot$ is directly proportional to : $C, I, \mathbf{I}^2, CI$

A. c

B. I

C. I^2

D. c.I

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12. The reaction of ozone with oxygen atoms in the presence of chlorine atoms can occur by a two step process shown below:

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

(ii) $ClO^{\cdot}(g) + O^{\cdot}(g) \rightarrow O_2(g) + Cl^{\cdot}, k_{II} = 2.6 \times 10^{10} L\text{mol}^{-1} s^{-1}$

The closest rate constant for the overall reaction

$O_3(g) + O^{\cdot}(g) \rightarrow 2O_2(g)$ is $:1.4 \times 10^{20} Lmol^{-1}s^{-1}$, $3.1 \times 10^{10} Lmol^{-1}s^{-1}, 5.2 \times 10^{9} Lmol^{-1}s^{-1}, 2.6 \times 10^{10} Lmol^{-1}s^{-1}$

A. $1.4 \times 10^{20} Lmol^{-1}s^{-1}$

B. $3.1 \times 10^{10} Lmol^{-1}s^{-1}$

C. $5.2 \times 10^{9} Lmol^{-1}s^{-1}$

D. $2.6 \times 10^{10} Lmol^{-1}s^{-1}$

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13. The rate law for the reaction below is given by the expression k[A][B]

$A + B \rightarrow$ product.

If the concentration of B is increased from 0.1 to 0.3 mol, keeping the value of A at 0.1 mol, the rate constant will be

A. 3k

B. 9k

C. k/3

D. k

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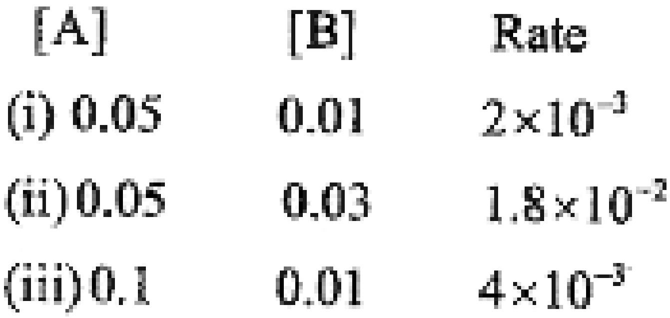
14. For the reaction $A + 2B \rightarrow C + D$, the following data were obtained:



	[A]	[B]	Rate
(i)	0.05	0.01	2×10^{-3}
(ii)	0.05	0.03	1.8×10^{-2}
(iii)	0.1	0.01	4×10^{-3}

The correct rate law expression will be:

A. Rate = $k[A]^1[B]^2$

B. Rate = $k[A]^2[B]^1$

C. Rate = k[A][B]

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

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15. The following mechanism has been proposed for the reaction of (NO) with $(Br)_2$ to form $NOBr$.

$(NO)(g) + (Br)_2(g) \leftrightarrow (NOBr)_2(g). NOBr2(g) + NO(g) = 2NOBr(g)$

.

$Ifthe2ndstepistherate\det er\min\in gstep, the\ \text{or}\ derofthereactionwith$

(NO)(g)` is

A. 2

B. 1

C. 0

D. 3

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16. Consider the reaction, $2A + B \rightarrow$ Products

When concentrations of B alone was doubled, the half-life did not charge. When the concentrations of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is

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

B. No unit

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

D. s^{-1}

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17. Higher order (> 3) are rare due to :

A. A. Low probability of simultaneous collision of ail the reacting species

B. B. Increase in entropy and activation energy as more molecules are involved

C. C.Shifting of equilibrium towards reactants due to elastic collision

D. D. Loss of active species on collision

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18. The slope of plot of [A] versus t for a zero-order reaction $A \rightarrow B$ is:

A. k

B. $k / 2.303$

C. $-k$

D. $-k / 2.303$

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19. For the reaction $A \rightarrow$ products, is zero order w.r.t. A. The half-life time is given as.

A. A. $[A]_0 / v_{k\_}(0)$

B. B. $[A]_0 / k_0$

C. C. $[A]_0 / 2k_0$

D. D. $v[A]_0 / 2k_0$

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20. For the first-order decomposition reaction of N_2O_5 written as:

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$, rate $= k[N_2O_5]$

$N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$, rate $= k'[N_2O_5]$

which of the following facts is true?

A. k=k'

B. $k > k'$

C. $k > 2k'$

D. $2k = k'$

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21. The gaseous reaction $A(g) \to 2B(g) + C(g)$ is found to be first-order respect to A. The reaction is started with p_A = 90 mmHg, the pressure after 10 min is found to be 180 mmHg. The rate constant of the reaction is

A. $1.15 \times 10^{-3} s^{-1}$

B. $2.30 \times 10^{-3} s^{-1}$

C. $3.45 \times 10^{-3} s^{-1}$

D. $4.60 \times 10^{-3} s^{-1}$

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22. The radioactive decay follows

A. A. First-order kinetics

B. B. Second-order kinetics

C. C. A complicated kinetics with temperature dependence behaviour

D. D. Zero-order kinetics

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23. The hydrolysis of an ester was carried out separately with 0.05 M HCl and 0.05 M H_2SO_4. Which of the following will be true?

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

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

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

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

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24. The reaction $2NO(g)+H_2(g)\rightarrow N_2O(g)+H_2O(g)$ follows the rate law $\frac{dp(N_2O)}{dt}=k(p_{NO})^2p_{H_2}$. If the reaction is initiated with $p_{NO}=1000$ mm Hg and p_{H_2}=10mm Hg. The reaction may be considered to follow:

A. First-order kinetics

B. Second order kinetics

C. Zero order kinetics

D. Third order kinetics

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25. For a second-order reaction of the type rate = $k[A]^2$, the plot of $1/[A]_t$ versus t is linear with a

A. Positive slope and zero intercept

B. Positive slope and non-zero intercept

C. Negative slope and zero intercept

D. Negative slope and non-zero intercept

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26. The half-life of a second-order reaction is

A. $t_{1/2} = 0.693/k$

B. $t_{1/2} = k/[A]_0$

C. $t_{1/2} = [A]_0/k$

D. $t_{1/2} = 1/k[A]_0$

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27. Ethylene oxide is decomposed to CH_4 and CO. Rate constant for this reaction may be described by the equation $\log k(s^{-1}) = 4.0 - \frac{1000}{T}$. The frequency factor 'A and activation energy E_a are respectively:

A. $10^4 s^{-1}$ and 239.3 kJ/mol

B. $10^4 s^{-1}$ and 104.4 kJ/mol

C. $10^4 s^{-1}$ and 19.14 kJ/mol

D. $10^6 s^{-1}$ and 19.14 kJ/mol

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28. The rate of reaction, is doubled for every 10° rise in temperature. The increase in reaction rate as a result of temperature rise from 10° to 100°

is

A. 128

B. 512

C. 256

D. 1024

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29. If a reaction $A+B \rightarrow C$, is exothermic to the extent 40 kJ/mol and forward reaction has an activation energy 60 kJ/mol, the activation energy for the reverse reaction will be:

A. 20 kJ/mol

B. 30 kJ/mol

C. 70 kJ/mol

D. 100 kJ/mol

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30. A hydrogenation reaction is carried out at 500 K. If the same reaction is carried out in the presence of catalyst at the same rate, the temperature required is 400 K. Activation energy of reaction if the catalyst lowers the activation energy barrier by 40 kJ/mol

A. 100

B. 200

C. 300

D. 250

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31. For an endothermic reaction where ΔH represents the enthalpy of reaction in kJ(mol, the minimum value for the energy of activation will be:

A. Less than ΔH

B. Zero

C. More than ΔH

D. Equal to ΔH

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32. For the decomposition of N_2O_5 it is given that:

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$, activation energy E_a

$N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ activation energy E'_a

then,

A. $E_a = E'_a$

B. $E_a > E'_a$

C. $E_a < E'_a$

D. $E_a = 2E'_a$

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33. A catalyst lowers the activation energy of the forward reaction by 10 kJ mol^{-1} ,What effect it has on the activation energy of the backward reaction?

A. A. Increase by 10 kJ mol^{-1}

B. B. Decrease by 10 kJ mol^{-1}

C. C. Remains unaffected

D. D. Cannot be predicted

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34. The activation energies of two reactions are E_{a1} and E_{a2} If the temperature of the reacting systems is increased from T_1 to T_2 , predict which of the following alternatives is correct?

A. $\frac{k_1'}{k_1} = \frac{k_2'}{k_2}$

B. $\frac{k_1'}{k_1} > \frac{k_2'}{k_2}$

C. $\frac{k_1'}{k_1} < \frac{k_2'}{k_2}$

D. $\frac{k_1'}{k_1} < 2\frac{k_2'}{k_2}$

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35. Consider an endothermic reaction $X \rightarrow Y$ with the activation energies E_b and E_f for the backward and forward reactions, respectively. In general

A. $E_b = E_f$

B. No definite relation between E_b and E_f

C. $E_b < E_f$

D. $E_b > E_f$

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36. A reactant (A) forms two products (Assume that $A_1 = A_2$, which are pre-exponential factor)

$A \xrightarrow{k_1} B$, Activation energy E_{a1}

$A \xrightarrow{k_2} C$, Activation energy E_{a2}

If $E_{a2} = 2E_{a1}$, then k_1 and k_2 are related as:

A. $k_1 = 2k_2 e^{-E_{a2}/RT}$

B. $k_2 = k_1 e^{-E_{a1}/RT}$

C. $k_2 = k_1 e^{-E_{a2}/RT}$

D. $k_1 = Ak_2 e^{-E_{a1}/RT}$

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QUESTION (LEVEL - II) (Assertion - Reason)

1. Assertion: Precipitation of silver chloride occurs instantaneously by mixing of aqueous solutions of silver nitrate and sodium chloride

Reason: Ionic relations occur very fast

A. A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. C. Assertion is true but Reason is false

D. D. Assertion and Reason are false

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2. Assertion: Reaction does not have zero activation energy

Reason: If $E_a = 0$, A to Arrhenius equation, $K = A.\,e^{-Ea/RT} = Ae^0 = A$ i.e, Rate constant = Collision frequency which cannot be true $E_a \neq 0$

A. A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. C. Assertion is true but Reason is false

D. D. Assertion and Reason are false

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3. Assertion: The kinetics of the reaction :

$mA + nB + pC \rightarrow m'X + n'Y + p'Z$

obeys the rate expression as $\frac{dx}{dt} = k[A]^m[B]^n$

Reason: The rate of reaction does not depend upon the concentration of C

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Assertion and Reason are false

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4. Assertion: The overall order of the reaction is the sum of the exponents of all the reactants in the rate expression.

Reason: There are many higher order reactions

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true and Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Assertion and Reason are false

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QUESTION

1. A chemical reaction $2A \rightarrow 4B$ +C in gas phase occurs in a closed vessel the concentration of B is found to increase by $2.5 \times 10^{-3} molL^{-1}$ in 5 second calculate (i) the rate of appearance of B (ii) the rate of disappearance of A

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2. For the reaction $3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$

express the rate of reaction in terms of $-d[H_2]/dt - d[N_2]/dt$ and $d[NH_3]/dt$

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3. For a reaction $A + B \rightarrow$ products

The rate law expression is

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4. For a reaction $A + B \rightarrow$ products

What are the units of rate constant if concentration is measured in mol dm^{-3} and time in seconds ?

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5. The rate law expression of a reaction $2A+B \rightarrow A_2B$ is rate $=k[A]^2$

with rate constant k =0.65 $mol^{-1}Ls^{-1}$

calculate rate of reaction when

(a) $[A]=0.25molL^{-1}[B]=1.84molL^{-1}$

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6. The rate law expression of a reaction $2A+B \rightarrow A_2B$ is rate = $k[A][B]^2$ with rate constant k =0.65 $mol^{-1}Ls^{-1}$

calculate rate of reaction when concentration of A has been reduced to $1/4$ and concentration of B has been reduced by $1/4$

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7. For the reaction $NO_2(g)+CO(g) \rightarrow CO_2(g)+NO(g)$

what mechanism can be proposed for the above reaction

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8. A first order reaction is 20% complete in 5 minutes. Calculate the time taken for the reaction to be 60% complete

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9. The catalytic decomposition of H_2O_2 was studied by titrating it at different intervals with $KMnO_4$ solution.Calcualte the rate constant from the following data assuming the reaction to be of the first order

time t(seconds): 0 600 1200

$KMnO_4$ (mL) :22.8 13.8 8.2

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10. A first order reaction with respect to reactant A has a rate constant 6.5 $\min^{-1}$. If we start with 2.0 mol L^{-1} of A when would A reach the value 0.5 mol L^{-1}

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11. Show that for a first order reaction the time required for 99.9% of the reaction to take place is ten times that required for half of the reaction

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12. In the reduction of nitrous oxide with hydrogen an equimolar mixture of the gases at 340 mm initial pressure was half changed in 120 second in a second experiment when the intial pressure 288 mm the change was half completed in 140 seconds what is the order of reaction

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13. The rate constant k of a reaction increases three fold when temperature changes from 127° C to 45° C calculate the energy of activation for this reaction

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14. A first order reaction is 50% complete in 40 minutes at 30° C and 20 minutes at 50° C calcualte the reaction rate constant at these temperatures and the energy of acitivation in kj/ mol

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15. From the following data show that the decomposition of hydrogen peroxide in aqueous solution is a first order reaction what is the value of the rate constant

Time (t) in minutes 0 10 20 30 40

V(mL) 25.0 20.0 15.7 12.5 9.6

Where V is volume of $kMnO_4$ solution required decompose a definite volume of hydrogen peroixde

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16. From the following data for the decomposition of ammonium nitrite in aqueous solution,prove that the reaction is first order

Time (minutes) 10 15 20 25 ∞

Volume N_2 (mL) 6.25 9.00 11.40 13.65 35.05

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17. The following data were obtained for the decompostion dintirogen pentoxide in CCl_4 at 325 k

Time (minutes): 10 15 20 25 ∞

volume of O_2 evolved (mL):6.30 8.95 11.40 13.50 34.75

show that this is a first order reaction

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18. 3.5 ml ethyl acetate was added to a flask containing 100 ml of 0.1 M HCl placed in a thermostat maintained at 30°C 5 ml of the reaction mixture was withdrawn at different interval of time and after chilling titrated against standard NaOH the following data were obtained

Time (minutes) 0 75 119 183 ∞

NaOH used (mL) 9.62 12.10 13.10 14.75 21.05

From the above data show that the hydrolysis of ethyl acetate is a first order reaction

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19. The optical rotation of surcose in 0.5 M HCl at 35°C at various time interval are given show that the reaction is first order

Time (minutes) 0 10 20 30 40 $\propto$

Rotation (degrees) +32.4 +28.8 +25.5 +22.4 +19.6 -11.1

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LEVEL I

1. The rate of combination of simple alkyl free radicals:

A. increases with increase in temperature

B. dependent of temperature

C. decreases with increase in temperature

D. altogether different for different reactions and independent of temperature

Answer: D

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2. For a I order reaction which one is not correct?

A. The concentration of product increases linearly with time

B. The concentration of product increases exponentially with time

C. The degree of dissociation α is given by 1 - e^{-kt}

D. The reaction never goes for completion

Answer: A

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3. According to Arrhenius theory, the activation energy is

A. The energy it should posses so that it can enter into an effective collision

B. The energy which the molecule should possess in order to undergo reaction

C. The energy it has to acquire further so that it can enter into effective collision

D. TTjcenergy gained by the molecules on colliding with another molecule

Answer: C

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4. The activation energy of a reaction is zero. The rate constant of this reaction

A. Increases with increase of temperature

B. Decreases with an increase of temperature

C. Decreases with decrease of temperature

D. Is independent of temperature

Answer: D

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5. The reaction rate at given temperature becomes slower, then

A. The free energy of activation is higher

B. The free energy of activation is lower

C. The entropy changes

D. The concentration of the reactants remains constant

Answer: A

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6. A rise in temperature increases the velocity of a reaction. It is because it results in

A. An increased number of molecular collisions

B. An increased momentum of colliding molecules

C. An increase in the activation energy

D. A decrease in the activation energy

Answer: D

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7. The main function of a catalyst in speeding up a reaction is

A. To increase the rate of the forward reaction

B. To change the reaction path so as to decrease the energy of activation for the reaction

C. To reduce the temperature at which the reaction can occur

D. To reduce the temperature at which the reaction can occur

Answer: B

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8. An example of a pseudo - first order reaction is

A. Dissociation of hydrogen iodide

B. Hydrolysis of ethyl acetate in dilute solution

C. Dissociation of phosphorus pentachloride

D. Decomposition of hydrogen peroxide

Answer: B

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9. The rate expression for the reaction $A(g) + B(g) \rightarrow C(g)$ is rate = $kC_A^2 C_B^{1/2}$. What changes in the initial concentrations of A and B will cause the rate of reaction to increase by a factor of eight?

A. $C_A \times 2, C_B \times 2$

B. $C_A \times 2, C_B \times 4$

C. $C_A \times 1, C_B \times 4$

D. $C_A \times 4C_B \times 1$

Answer: B

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10. The term rate of reaction and rate of appearance (or disappearance) of reactant (or product)

A. represent one and the same physical quantity

B. differ by a constant factor

C. differ by a constant factor

D. may or may not have same value depending upon the stoichiometric coefficient of reactant (or product) in 'the balanced chemical equation

Answer: D

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11. For the reaction $N_2 + 3H_2 \rightarrow 2NH_3$ the rate of formation of ammonia was found to be $2.0 \times 10^{-4} mol dm^{-3} s^{-1}$ The rate of consumption of H_2 will be

A. 1.0×10^{-4} mol $dm^{-3} s^{-1}$

B. 2.0×10^{-4} mol $dm^{-3} s^{-1}$

C. 3.0×10^{-4} mol $dm^{-3} s^{-1}$

D. 4.0×10^{-4} mol $dm^{-3}s^{-1}$

Answer: C

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12. The equilibrium reaction A -B is started with^A such that initially one can write a kf $>$ B fa such a case, which of the following will be correct?

A. $k_f = k'_f$

B. $k_f > k'_f$

C. $k_f f < k'_f$

D. k_f may be greater or smaller than k'_f depending upon the concentration of A.

Answer: A

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

A. Order of a reaction can never be equal to zero or fractional value

B. Order of a reaction can never be equal to zero or fractional value

C. It is equal to the molecularity of an elementary reaction

D. It is equal to the molecularity of an elementary reaction

Answer: A

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14. A substance (initial concentration a) reacts according to zero-order kinetics. The time it takes for the completion of the reaction is

A. a/k

B. a/2k

C. k/a

D. 2k/a

Answer: A

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15. The half-life period of a radioactive element is 140 days. After 560 days, one gram of the element will reduce

A. (1/2) g

B. (1/4) g

C. (1/8)g

D. (1/16)g

Answer: D

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16. For a first-order reaction A $\rightarrow$ B the plot of log [A] versus t is linear with a

A. positive slope and zero intercept

B. positive slope and non-zero intercept

C. negative slope and zero intercept

D. negative slope and nonzero intercept

Answer: D

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17. For the first-order decomposition reaction of N_2O_5 written as:

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$, rate $= k[N_2O_5]$

$N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$, rate $= k'[N_2O_5]$

which of the following facts is true?

A. k - k'

B. $k > 2k'$

C. $k > k'$

D. 2k = k'

Answer: A

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18. A first order reaction is 20% complete in 10 min. Calculate the specific rate constant of the reaction.

A. 0.223 $\min^{-1}$

B. 0.0223 $\min^{-1}$

C. 2.23 $\min^{-1}$

D. 22.3 $\min^{-1}$

Answer: B

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19. The rate constant for the reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$ is $3.0 \times 10^{-5} s^{-1}$ If the rate is 2.40×10^{-5} mo $L^{-1}S^{-1}$ then the concentration of N_2O_5 (in mo L^{-1}) is

A. 1.4

B. 1.2

C. 0.04

D. 0.8

Answer: D

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20. The reaction $2NO(g) + H_2(g) \rightarrow N_2O(g) + H_2O(g)$ follows the rate law $\frac{dp(N_2O)}{dt} = k(p_{NO})^2 p_{H_2}$. If the reaction is initiated with $p_{NO} = 1000$ mm Hg and p_{H_2}=10mm Hg. The reaction may be considered to follow:

A. first order kinetics

B. second order kinetics

C. zero order kinetics

D. third order kinetics

Answer: A

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21. The half-life of a reaction $A \rightarrow B$ varies as the inverse of concentration of A. The order of the reaction would

A. zero

B. first

C. second

D. third

Answer: C

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22. For the decomposition of N_2O_5 it is given that:

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$, activation energy E_a

$N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ activation energy E_a'

then,

A. $E_a = E_a'$

B. $E_a > E_a'$

C. $E_a < E_a'$

D. $E_a = 2E_a'$

Answer: A

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23. By increasing the temperature by 10°C, the rate of forward reaction at equilibrium is increased by a factor of 2. The rate of backward reaction by this increase in temperature

A. remains unaffected

B. increases by a factor greater than two

C. decreases by a factor lesser than two

D. is also increased by a factor of two

Answer: D

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24. The rate constant, the activation energy and the Arrhenius parameters of a chemical reaction at 25° C are $2.0 \times 10^{-5} s^{-1}$, 100 kJ mol^{-1} and $6.0 \times 10^{14} s^{-1}$, respectively. The value of rate constant at very high temperature approaches.

A. $2.0 \times 10^{-5} s^{-1}$

B. ∞

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

D. $12 \times 10^{-9} s^{-1}$

Answer: C

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25. Which of the following statements is not correct?

A. The efficiency of a solid catalyst depends upon its surface area

B. Catalyst operates by providing alternate path for the reaction that involves a lower activation energy

C. Catalyst lowers the energy of activation of the forward direction without affecting the energy of activation of the backward direction

D. Catalyst does not affect the overall enthalpy change of the reaction.

Answer: C

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26. The activation energies of two raction are E_{a1} and E_{a2} with $E_{a1} > E_{a2}$. If the temperature of the reacting systems is increased from T_1 to T_2 predict which of the following alternatives is correct

A. $\dfrac{k_1'}{k_1 = \frac{k_2'}{k_2}}$

B. $\dfrac{k_1'}{k_1} > \dfrac{k_2'}{k_2}$

C. $\dfrac{k_1'}{k_1 < \frac{k_2'}{k_2}}$

D. $\dfrac{k_1'}{k_1 < 2\frac{k_2'}{k_2}}$

Answer: B

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27. For a reaction $\frac{1}{2}A \rightarrow 2B$ rate of disappearance of A is related to the rate of appearance of B by the expression

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

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

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

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

Answer: B

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28. Consider the reaction: $Cl_2(aq) + H_2S(aq) \rightarrow S(s) + 2H^+(aq) + 2CI^-$ (aq) The rate equation for this reaction is rate = $k[Cl_2][H_2S]$ Which of these mechanisms is/are consistent with this rate equation.

(I) $CI_2 + H_2S \rightarrow H^+ + Cl^- + CI^+ + HS^-$ (slow)

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

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

$Cl_2 + HS^- \rightarrow 2Cl^- + H^+ + S$ (slow)

A. I only

B. II only

C. both I and II

D. neither I nor II

Answer: A

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

A. diminished to one-fourth of its initial value

B. diminished to one-eighth of its initial value

C. increased to eight times of its initial value

D. increased to four times of its initial value

Answer: C

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30. A reaction involving two different reactants can never be

A. unimolecular reaction

B. first-order reaction

C. second-order reaction

D. bimolecular reaction

Answer: A

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

A. lh

B. 4h

C. 0.5h

D. 0.25h

Answer: D

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32. The unit of the rate of reaction is the same as that of the rate constant for a

A. zero-order reaction

B. first-order reaction

C. second-order reaction

D. half-order reaction

Answer: A

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

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

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

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

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

Answer: B

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34. The time $t_{1/4}$ can be taken as the time taken for the concentration of a reactant to drop to 3/4th of its initial value. If the rate constant for a first -order reation 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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35. Consider the reaction, $2A + B \to$ Products

When concentrations of B alone was doubled, the half-life did not charge.

When the concentrations of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is

A. S^{-1}

B. $Lmol^{-1}S^{-1}$

C. no unit

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

Answer: B

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36. The half-life period of a first-order reaction is 15 minutes. The amount of substance left after one hour will be,

A. $\frac{1}{4}$ of the original amount

B. $\frac{1}{8}$ of the original amount

C. $\frac{1}{16}$ of the original amount

D. $\frac{1}{32}$ of the original amount

Answer: C

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37. The rate of a chemical reaction doubles for every 10° C Lrise of temperature. If the temperature is raised by 50° C, the rateofthe^reaction increases by about

A. 24 times

B. 32 times

C. 64 times

D. 10 times

Answer: B

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38. In respect of the eqaution $k = Ae^{-E/RT}$ in chemial kinetics which one of the following statements is correct

A. k is equilbrium costant

B. A is adsorption factor

C. E_a is energy of activation

D. R is Rydberg's constant

Answer: C

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39. The activation energy E_a of a reaction can be calculated by plotting

A. against T

B. k against 1 /log T

C. log k against 1 /T

D. log k against 1 /log T

Answer: C

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40. Under the same reaction conditions intital concentration of 1.386 mol dm^{-3} of a substance becomes half in 40 and 20 through first order and zero order kinetics respectively ratio $\left(k_1 / k_0\right)$ of the rate constants for first order k_1 and zero order k_0 of the reaction is

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

B. $1.0 mol dm^{-3}$

C. $1.5 mol dm^{-3}$

D. $2.0 mol^{-1} dm^3$

Answer: A

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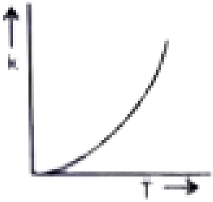
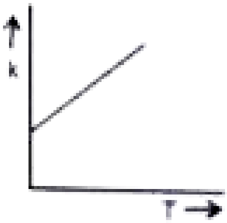
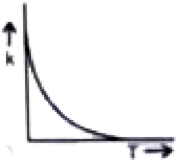
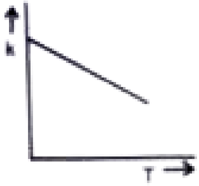
41. Plots showing the variation of rate constant (k) with temperature (T) are given. The plot that follows Arrhenius ^equation is

A. 

B. 

C. 

D. 

Answer: A

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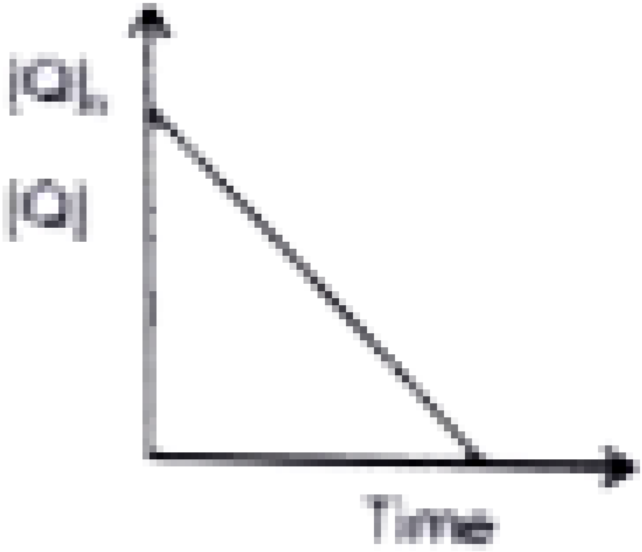
42. In the reaction, P + Q $\rightarrow$ R + S, the time taken for 75% reaction of P is twice the time taken for 50% reaction of P. The concentration of Q varies with reaction time as shown in figure. The overall order of the reaction is



A. 2

B. 3

C. 0

D. 1

Answer: D

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43. The activation energy for a reaction which doubles the rate when the temperature is raised from 300 K to 310 K is

A. $50.6kjmol^{-1}$

B. $53.6kjmol^{-1}$

C. $56.6kjmol^{-1}$

D. $59.6kjmol^{-1}$

Answer: B

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44. Ammonia reacts with oxygen giving nitrogen and water. If the rate of formation of N_2 is 0.70 mol $L^{-1}S^{-1}$ the rate at which O_2 is consumed is

A. $1.05molL^{-1}s^{-1}$

B. $0.70molL^{-1}s^{-1}$

C. $2.10molL^{-1}s^{-1}$

D. $0.35 mol L^{-1} s^{-1}$

Answer: A

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45. The half-life for the thermal decomposition of acetone 80s_and is independent of initial concentration of acetone. The time required for the reaction to go to 80% decomposition is

A. 186.1 s

B. 209.1 s

C. 150.1 s

D. 226.1 s

Answer: A

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46. The reaction $NH_4^+ + OCN^- \rightarrow OC(NH_2)_2$, proceeds through the following mechanism.

$NH_4^+ + OCN^- \xrightarrow{k_{eq}} NH_4$ OCN (fast)

$NH_4OCN \xrightarrow{k} OC(NH_2)_2$ (slow)

The rate constant of the reaction is

A. k

B. kk_{eq}

C. k / k_{eq}

D. k_{eq} / k

Answer: B

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47. Which of the following statements is not correct?

A. Larger the activation energy, lesser the value of rate constant of a reaction

B. Larger the temperature, larger the value of rate constant of a reaction

C. Larger the activation energy, larger theen%clofagjymMnperature increase on the rate constant

D. At the lower temperature, increase in temperature causes lesser change in the value of rate constant than at higher temperature

Answer: D

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48. A catalyst lowers the activation energy from 20 kJ mol^{-1} to 15 kJ mol^{-1} of the forward direction of the reaction A $\rightarrow$ B which of the following statement regarding the reaction is correct

A. Activation energy of the backward reaction is increased by 5 kJ mol^{-1}

B. Activation energy of the backward reaction is decreased by 5 kJ mol^{-1}

C. Enthalpy of reaction is increased by 5 kJ mol^{-1}

D. Equilibrium constant of the reaction is decreased

Answer: B

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49. For a chemical reaction X $\rightarrow$ Y , the rate of reaction increases by a factor of 1.837 when the concentration of X is increased by 1.5 times, the order of the reaction with respect to X is :

A. 1

B. 1.5

C. 2

D. 2.5

Answer: B

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50. The reaction $A+2B+C \rightarrow D$ occurs by the following mechanism.

$A+B \underset{k_2}{\overset{k_1}{\Longleftrightarrow}} E$ (rapid equilibrium)

$E+C \xrightarrow{k_1}$ F(slow)

$F+B \xrightarrow{k_4} D$ (very fast)

The rate law for this reaction is

A. $r=k[c]$

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

C. $r=k[D]$

D. $r=k[A][B][C]$

Answer: D

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51. The rate equation for $2N_2O_5 \to 4NO_2 + O_2$ is r = $(6.3 \times 10^{-4} s^{-1})[N_2O_5]$. The initial rate of decomposition of 0.1 MN_2O_5 will be

A. $6.3 \times 10^{-6} moldm^{-3} s^{-1}$

B. $6.3 \times 10^{-5} moldm^{-3} s^{-1}$

C. $6.2 \times 10^{-4} moldm^{-3} s^{-1}$

D. $6.3 \times 10^{-3} moldm^{-3} s^{-1}$

Answer: B

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52. A reaction $A \xrightarrow{k}$ product follows half-order kinetics with respect to linear plot isobserved between

A. $[A]^{1/2}$ versus with time slope equal to -k

B. $[A]^{1/2}$ versus with time slope equal to -k/2

C. $[A]^{1/2}$ versus with time slope equal to -2k

D. $[A]^{3/2}$ versus with time slope equal to -k

Answer: B

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53. The reaction $2N_2O_5((g) \rightarrow 4NO_2(g) + O_2(g)$ provides a linear plot when In $P_{n_2O_5}$ is plotted against t with a negative slope. The decomposition of N_2O_5 follows

A. zero order kinetics

B. first order kinetics

C. third order kinetics

D. second order kinetics

Answer: B

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54. For a reaction $2NO(g) + H_2(g) \rightarrow N_2O(g) + H_2O(g)$ the rate law is dp $(N_2O)/dt = k(P_{NO})^2(P_{H_2})$ The half life of the reaction when $(P_{NO})_0 = 10 mmHg$ and $(P_{H_2})_0 = 1200$ mmHg is found to be 830 s The half life when $(P_{NO})_0 = 20 mmHg$ and $(P_{H_2})_0 = 1200$ mmHg will be

A. 830 s

B. 415 s

C. 1245 s

D. 208 s

Answer: B

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55. In the Haber's process of the synthesis of ammonia, the use of catalyst helps

A. increasing rate constant without changing the equilibrium amount of NH_3

B. increasing rate constant with increasing the equilibrium amount of NH_3

C. decreasing rate constant with increasing the equilibrium amount of NH_3

D. decreasing rate constant with decreasing the equilibrium amount of NH_3

Answer: A

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LEVEL II

1. Select the incorrect statement:

A. Half life period of all reactions decreases with increase in temperature

B. Half life period of I order reaction is always constant

C. Higher is rate constant of a reaction, lesser will be its energy of activation

D. Rate of reaction whether exothermic or endothcrmic usually increases with temperature

Answer: C

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2. The reaction $A \rightarrow B + C$ has rate constant $1 \times 10^{-3} Ms^{-1}$. If one starts the reaction with one mole of A then $t_{1/2}$ and completion of reaction time would be:

A. 1000s , 500 s

B. 500 s, 1000 s

C. 750 s, 400 s

D. 400 s, 800 s

Answer: B

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3. For an endothermic reaction where ΔH represents the enthalpy of reaction in kJ(mol, the minimum value for the energy of activation will be:

A. less than $\triangle H$

B. zero

C. more than $\triangle H$

D. equal

Answer: C

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4. In a first order reaction, the concentration of reactant decreases from 0.8 mol/dm^3 to 0.05 mol/dm^3 in 2×10^4 sec. The rate constant in $\sec^{-1}$ is:

A. 2×10^4

B. 3.45×10^{-5}

C. 1.386×10^{-4}

D. 2×10^{-4}

Answer: C

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5. For the elementary reaction M $\rightarrow$ N, the rate of disappearance of M increases by a factor of 8 upon doubling the concentration of M. The order of the reaction with respect to M is:

A. 4

B. 3

C. 2

D. 1

Answer: B

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6. According to the collision theory of chemical reactions

A. A chemical reaction occurs with every molecular collision

B. Rate is directly proportional to the number of collisions per second

C. Reactions in the gas phase are always of zero order

D. Reaction rates are of the order of molecular speeds

Answer: B

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7. The activation energy for a simple chemical reaction A $\rightarrow$ B is E_a in forward direction. The activation energy for reverse reaction.

A. Is always double of E_a

B. Is negative of E_a

C. Is always less than E_a

D. Can be less than or more than E_a

Answer: D

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8. The reaction $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ is of first order. Ifvolume of reaction vessel is reduced to 1/3, the rate of reaction would become

A. 1/3 times

B. 2/3 times

C. 3 times

D. 6 times

Answer: C

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9. For the equilibrium, $A(g) \rightarrow B(g), \triangle H$ is - 40 kJ mol^{-1} . If the ratio^f the activation energies of the forward (E_f) and reverse (E_b) reaction is (2/3) then:

A. $E_f = 60kjmol^{-1}, E_b = 100kjmol^{-1}$

B. $E_f = 30kjmol^{-1}, E_b = 70kjmol^{-1}$

C. $E_f = 80kjmol^{-1}, E_b = 120kjmol^{-1}$

D. $E_f = 70kjmol^{-1}, E_b = 30kjmol^{-1}$

Answer: C

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10. 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 of the earlier rate of the reaction will be as

A. (m+n)

B. (n-m)

C. 2^{n-m}

D. $\frac{1}{3^{m+n}}$

Answer: C

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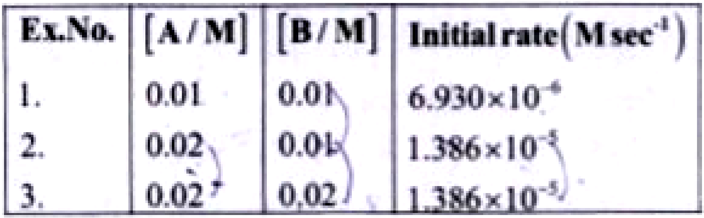
11. The kinetic data for the given reaction A (g) + 2 B (g) $\xrightarrow{k}$ C (g) is provided in the following table for three experiments at 300 K



Ex.No.	$[A/M]$	$[B/M]$	Initial rate $(M\,sec^{-1})$
1.	0.01	0.01	6.930×10^{-6}
2.	0.02	0.01	1.386×10^{-5}
3.	0.02	0.02	1.386×10^{-5}

In another experiment starting with initial concentration of 0.5 and 1 M respectively for A and B at 300 K, find the rate of reaction after 50 minutes from start of experiment (in M/sec).

A. 6.93×10^{-4}

B. 0.25×10^{-7}

C. 4.33×10^{-5}

D. 3.46×10^{-4}

Answer: C

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12. Reaction A + B → C + D follows rate law, $r=k[A]^{1/2}[B]^{1/2}$ starting with 1 MofA and Beach. What is the time taken for concentration of A become 0.1 M? (K = 2.303 * 10 ^(-3))

A. 10 sec

B. 100 sec

C. 1000 sec

D. 434 sec

Answer: B

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13. The reaction A(g) $\rightarrow$ B(g) + 2C(g) is a first order reaction with rate constant $2.772 \times 10^{-3} S^{-1}$. Starting with 0.1 mole of A in 2 litre vessel, find the concentration of A after 250 sec when the reaction is allowed to take place at constant pressrue at 300 K.

A. 0.0125 M

B. 0.025 M

C. 0.05 M

D. 0.125 M

Answer: A

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14. For a first order homogenous gaseous reaction $A \to 2B + C$ if the total pressure after time t was p_t and after long time $(t \to \infty)$ was p_∞ then k in terms of p_t, p_∞ and t is

A. $k = \frac{2.303}{t}\log\left(\frac{p_\infty}{p_\infty - p_t}\right)$

B. $k = \frac{2.303}{t}\log\left(\frac{2p_\infty}{p_\infty + p_t}\right)$

C. $k = \frac{2.303}{t}\log\left(\frac{2p_\infty}{3(p_\infty - p_t)}\right)$

D. $k = \frac{2.303}{t}\log\left(\frac{p_\infty}{p_\infty + p_t}\right)$

Answer: C

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15. The gaseous decomposition reaction, $A(g) \rightarrow 2B(g) + C(g)$ is observed to first order over the excess of liquid water at 25° C. It is found that after 10 minutes the total pressure of system is 188 torr and after very long time it is 388 torn The rate constant of the reaction (in hr^1) is: [Given: vapour pressure of H_2 O at 25° C is 28 torr(In 2 = 0.7, In 3 = 1.1, In 10 = 2.3)]

A. 0.02

B. 1.2

C. 0.2

D. 2.2

Answer: B

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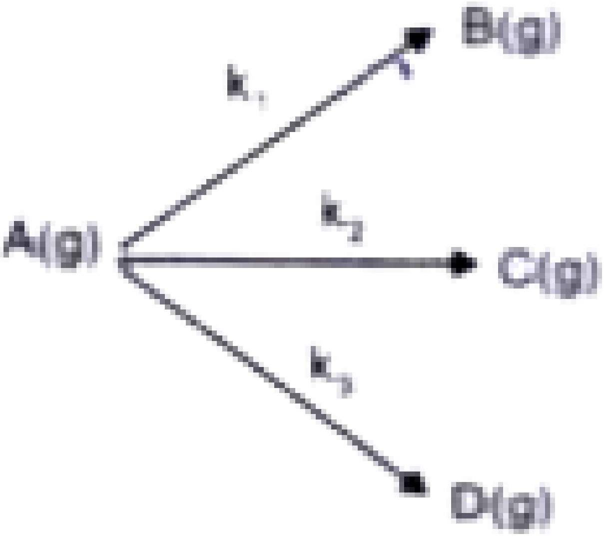
16. A gaseous compound A reacts by three independent first order processes (as shown in figure) with rate . constant $2 \times 10^{-3}, 3X10^{-3}$ and $1.93 \times 10^{-3}\text{sec}^{-1}$ for products B, C and D respectively. If initially pure A was taken in a closed container with P = 8 atm, then the partial pressure of B (in atm) after 100 sec from start of experiment.



A. 0.288

B. 0.577

C. 1.154

D. 0.33

Answer: C

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17. A compound 'A' dissociate by two parallel first order paths atcertain temperature

$$A(g)^{k_1\left(\overset{-1}{\min}\right)} \rightarrow 2B(g)\, k_1 = 6.93 \times 10^{-3} \overset{-1}{\min}$$

$$A(g)^{k_2\left(\overset{-1}{\min}\right)} \rightarrow C(g)\, k_2 = 6.93 \times 10^{-3} \overset{-1}{\min}$$

The reaction started whith 1 mole of pure A in 1 litre closed container with the initial pressure 2 atm what is the pressure (in atm) developed in container after 50 minuts from start of experiment?

A. 1.25

B. 0.75

C. 1.5

D. 2.5

Answer: D

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18. The reaction cis- $X \underset{k_b}{\rightleftharpoons}{}^{k_f}$ trans-X is first order in both directions. At 25° C, the equilibrium constant is 0.10 and the rate constant $k_f = 3 \times 10^{-4} s^{-1}$. In an experiment starting with the pure cis-form, how long would it take for half of the equilibrium amount of the trans-isomer to be formed?

A. 150 sec

B. 200 sec

C. 240 sec

D. 210 sec

Answer: D

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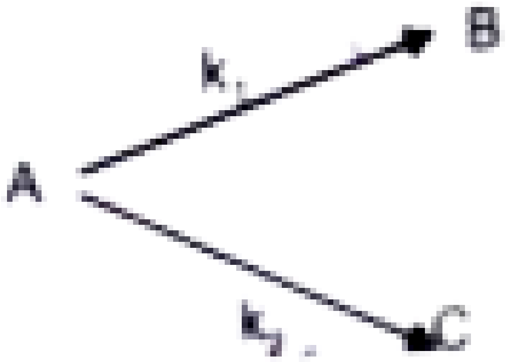
19. For first order parallel reactions k_1 and k_2 are 4 and 2 $\min^{-1}$ respectively at 300 K.. If the activation energies for the formation of B and C are respectively 30,000 and 38,314 joule/mol respectively. The temperature at which B and C will be obtained in equimolar ratio is:



A. 757.48 k

B. 378.74 k

C. 600 k

D. 450 k

Answer: B

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20. Consider the following first order competing reactions:

$X \xrightarrow{k_1} A + B$ and $Y \xrightarrow{k_2} C + D$

If 50% of the reaction of X was completed when 96% of the reaction of Y was completed, the ratio of thoir rate constant (k_2 / k_1) is:

A. 4.6

B. 4.06

C. 1.123

D. 2.303

Answer: A

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21. A reactant (A) forms two products (Assume that $A_1 = A_2$, which are pre-exponential factor)

$A \xrightarrow{k_1} B$, Activation energy E_{a1}

$A \xrightarrow{k_2} C$, Activation energy E_{a2}

If $E_{a2} = 2E_{a1}$, then k_1 and k_2 are related as:

A. $k_2 = k_1 e^{-E_{a1}/RT}$

B. $k_2 = k_1 e^{-E_{a2}/RT}$

C. $k_1 = Ak_2 e^{-E_{a1}/RT}$

D. $k_1 = 2k_2 e^{-E_{a2}/RT}$

Answer: A

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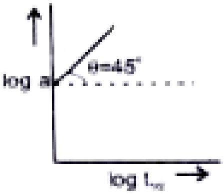
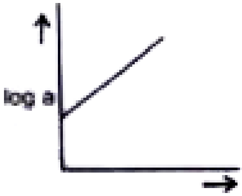
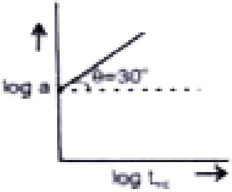
22. Which of the following graphs is correct for the following reaction?

$$Ch_3 - CH_2 - CH = CH_2 \xrightarrow[300^\circ C]{H_2/Ni} CH_3 - CH - CH_2 - CH_3$$

A. 

B. 

C. 

D. 

Answer: A

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23. A reaction takes place in three steps with individual rate constant and activation energy Ea1 = 180 KJ/mol Ea2 = 80 KJ/mol Ea3 = 50 KJ/mol

overall rate constant $k = \left(\frac{k_1 k_2}{k_3}\right)^{2/3}$

overall activation energy of the reaction will be

A. 140 kj/mol

B. 150 kj /mol

C. 130 kj/mol

D. 120 kj/mol

Answer: A

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24. A drug becomes ineffective after 30% decomposition. The original concentration of a sample was 5 mg/mL , which becomes 4.2 mg/mL during 20 months. Assuming the decomposition of first order, calculate the expiry time of the drug in months.

A. 79.4 months

B. 36.2 months

C. 59.4 months

D. 41.0 months

Answer: D

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25. On introducing a catalyst at 500 K, the rate of a first order reaction increases by 1.718 times. The activation energy in the presence of catalyst is 6.05 kJ mol^{-1} . The slope of the plot of In k$\left(\sec^{-1}\right)$ against 1/T in the absence of catalyst is:

A. $+1$

B. -1

C. $+1000$

D. -1000

Answer: D

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

A. 2

B. 1

C. $3/2$

D. $4/3$

Answer: C

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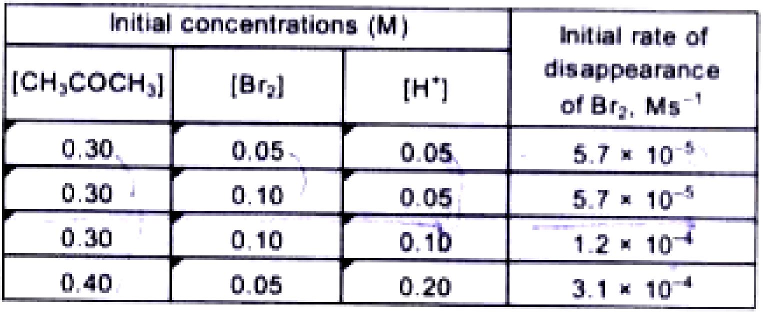
27. The bromination of acetone that occurs in acid solution is represented by

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

These kinetic data were obtained for given reaction concentration



Initial concentrations (M)			Initial rate of disappearance of Br_2, Ms^{-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 equation is

A. Rate $= k[CH_3COCH_3][Br_2][H^+]^2$

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

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

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

Answer: C

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28. The decomposition of N_2O_5 according to the equation, $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ is a first order reaction, After 30 minutes from the start of the decomposition in a closed vessel, the total pressure developed is found to be 284.5 mm Hg and on completion, the total pressure is 584.5 mm Hg. Calculate the rate constant of the reaction.

A. $5.2 \times 10^{-3} \text{ min}^{-1}$

B. $10.1 \times 10^{-3} \text{ min}^{-1}$

C. $8.3 \times 10^{-3} \text{ min}^{-1}$

D. $2.2 \times 10^{-3} \text{ min}^{-1}$

Answer: A

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

A. zero

B. one

C. two

D. three

Answer: A

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30. At a certain temperature, the half change period for the catalytic decomposition of ammonia were found as follows:

Pressure (Pasacals) 66667 133333 266666

Half life period: 3.52 1.92 1.0 Calculate the order of reaction

A. 3

B. 2

C. 0

D. 1

Answer: B

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31. According to the collision model of kinetics, certain activtion energy must be overcome before a reaction can proceed. Based on the data given below, what is a reasonable estimate of the activation energy for the decomposition of NOCl ?

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

Temperature (K)	Rate constant, k(L/mol s)
400	6.6×10^{-4}
500	2.9×10^{-1}
600	1.63×10^{1}

A. 1.00×10^2 kj/mol

B. 1.23×10^3 kj/mol

C. 1.05×10^5 kj/mol

D. 1.34×10^6 kj/mol

Answer: A

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32. The radioactive element, Thallium-201, is used medicinally as a radiotracer to study damage in heart tissue. If a patient is injected with a 0.950 g dose of pure Thallium-201, calculate the amount of time that would be required for the amount of Thallium-201 in the patient's body to reach 0.0500 g. Thallium-201 decays by a first order process with a half-life, $t_{1/2} = 73.0$ hrs.

A. 5.70 hrs

B. 113 hrs

C. 226 hrs

D. 310 hrs

Answer: D

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33. For a reaction A $\rightarrow$ Product half-life measured for two different value of intial concentration 5×10^{-3} M and 25×10^{-4} M are 1.0 and 8.0 hrs respectively. If initial concentration is adjusted to 1.25×10^{-3} M, the new half-life would be

A. 16 hrs

B. 32 hrs

C. 64 hrs

D. 256 hrs

Answer: C

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34. The metabolism of an antibiotic, A,is a first-order rate process. The rate constant, k, for this process depends on temperature and body weight, but for a 70 kg man at 37° C its value is $k = 3.0 \times 10^{-5} S^{-1}$. How long after taking the first pill containing 400 mg of antibiotic must this man take the second pill to keep the concentration at 200 mg per 100 kg body weight? [Asume instantaneous uniform distribution of the antibiotic throughout the body.]

A. 0.7×10^4 s

B. 1.5×10^4 s

C. 1.4×10^4 s

D. 3.5×10^4 s

Answer: D

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35. 80% of a first order reaction was completed in 70 min. How much it will take for 90% completion of a reaction?

A. 114 min

B. 140 min

C. 100 min

D. 200 min

Answer: C

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36. A first order reaction: A $\rightarrow$ Products and a second order reaction: 2R $\rightarrow$ Products both have half time of 20 min when they are carried out taking 4 mol L^{-1} of their respective reactants. The number of mole per litre of A and R remaining unreacted after 60 min from the start of the reaction, respectively, will be

A. 1 and 0.5 M

B. 0.5 M and negligible

C. 0.45 and 1 M

D. 1 and 0.25 M

Answer: C

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37. In a certain reaction, 10% of the reactant decomposes in one hour, 20% in two hours, 30% in three hours, and so on. The dimension of the velocity constant (rate constant) are

A. hr^{-1}

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

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

D. $mols^{-1}$

Answer: B

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38. The mechanism of the reaction, $2NO+O_2 \rightarrow 2NO_2$ is

$NO+NO \xrightarrow[k_{-1}]{k_1} N_2O_2$ (fast)

$N_2O_2+O_2 \xrightarrow{k_2} 2NO_2$ (slow) The rate constant of the reaction is

A. k_2

B. $k_2k_1(k_1)$

C. k_2k_1

D. $k_2\frac{k_1}{k_{-1}}$

Answer: D

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39. Diazonium salt decompose as : $C_6H_5N_2CI^- \rightarrow C_6H_5CI + N_2$ At $0^\circ C$ the evolution of N_2 becomes two times faster when the initial concentration of the salt is doubled. Thus, it is

A. A first order reaction

B. A second order reaction

C. Independent of the intial concentration of reactant

D. A zero order reaction

Answer: A

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40. At 27° C it was observed in the hydrogenation of a reaction, the pressure of H_2 (g) decreases from 10 atm to 2 atm in 10 min. Calculate the rate of reaction in M min^{-1}

A. 0.02

B. 0.03

C. 0.04

D. 0.05

Answer: B

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41. In a catalytic reaction involving the formation of ammonia by haber process $N_2 + 3H_2 \rightarrow 2NH_3$ the rate of appearance of NH_3 was measured as $2.5 \times 10^{-4} mol L^{-1} S^{-1}$ the rate of disappearance or H_2 will be

A. $2.50 \times 10^{-4} mol L^{-1} s^{-1}$

B. $1.25 \times 10^{-4} mol L^{-1} s^{-1}$

C. $3.75 \times 10^{-4} mol L^{-1} s^{-1}$

D. $5.00 \times 10^{-4} mol L^{-1} s^{-1}$

Answer: C

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42. When the concentration of a reactant in reaction A $\rightarrow$ B is increased by 8 times but rate increases only 2 times, the order of the reaction would be

A. 2

B. $1/3$

C. 4

D. $1/2$

Answer: B

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43. The hydrolysis of an ester was carried out with $0.1MH_2SO_4$ and 0.1 M HC1 separately. Which of the following expressions between the rate constants is expected? The rate expression being rate =k $\left[H^{+}\right]$[ester]

A. $K_{HCI=K_{H_2SO_4}}$

B. $K_{HCI>K_{H_2SO_4}}$

C. $K_{HCI} < K_{h_2SO_4}$

D. $K_{H_2SO_4} = 2K_{HCI}$

Answer: B

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44. A reaction of the type A(g) + B(g) $\rightarrow$ Product is taking place in a vessel. Ifthe volume ofthe reaction vessel is suddenly reduced to one fourth of the initial volume, the ratio of final rate initial rate is

A. $4:1$

B. $2:1$

C. $16:1$

D. $1:2$

Answer: C

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45. The reaction $2NO_2 \rightarrow 2NO + O_2$ is second order respect to NO_2. If the intial concentration of $NO_2(g)$ is $6.54 \times 10^{-4} molL^{-1}$ and the intial reaction rate is $4.42 \times 10^{-7} molL^{-1}s^{-1}$ what is the half life of the reaction.

A. 1.48×10^3 s

B. 2.63×10^4 s

C. 1.96×10^2 s

D. 3.06×10^3 s

Answer: A

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46. A first order reaction is carried out starting with 10 mol l^{-1} of the reactant. It is 40% complete in 1h if the same reaction is carried out with an initial concentration of 5 mol l^{-1} the percentage of the reaction that is completed in 1h will be

A. 0.4

B. 0.8

C. 0.2

D. 0.6

Answer: A

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47. The reaction $A(g)+2B(g)\rightarrow C(g)+D(g)$ is an elementary process In an experiment the initial partial pressure of A and B are $p_A=0.60$ and $p_B=0.80$ atm when $p_c=0.2$ atm the rate of the reaction relative to the initial rate is

A. 1/48

B. 1/24

C. 9/16

D. 1/6

Answer: D

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48. The decomposition of A into product has value of k as $4.5x10^3(s)^{-1}$ at 10^oC and energy of activation'60 kj mol^(-1) . $Atw\hat{t}emperaturewo\underline{d}Kbe$1.5 x10^(4) (s)^-1 ?`

A. 12° C

B. 24° C

C. 48° C

D. 36° C

Answer: B

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49. According to the $Cr_2O_7^{2-} + 5H^+ + 3HNO_2 \rightarrow 2Cr^{3+} + 3NO_3^- + 4H_2O$

The rate of disappearance of $Cr_2O_7^{2-}$ is found to be 2.4×10^{-4} mol $L^{-1}S^{-1}$ find the rate of appearance of Cr^{3+} during given time interval

A. $4.8 \times 10^{-4} mol L^{-1} s^{-1}$

B. $5.9 \times 10^{-4} mol L^{-1} s^{-1}$

C. $6.2 \times 10^{-4} mol L^{-1} S^{-1}$

D. $9.5 \times 10^{-4} mol L^{-1} s^{-1}$

Answer: A

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50. In a particular reaction the time required to complete half of the reaction was found to increase 16 times when the initial concentration of the reactant was reduced to one fourth what is the order of the reaction

A. 1

B. 4

C. 2

D. 3

Answer: D

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51. For the reaction A+B $\rightarrow$ C+D doubling the concentration of both the reactants increases the reaction rate by eight times and doubling the concentration of only B simply doubles reaction the rate law is given as

A. $r = k[A]^{1/2}[B]^{1/2}$

B. $r = k[A]^{1/2}[B]^2$

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

D. $r = k[A][B]$

Answer: C

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52. For the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ the rate equation can be express as

$\frac{d[N_2O_5]}{dt} = k[N_2O_5$ and $\frac{d[NO_2]}{dt} = k'[N_2O_5]$ k and k' are related as

A. $k = k'$

B. $2k = k'$

C. $k = 2k'$

D. $k = 4k'$

Answer: B

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53. At a certain moment in the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2N_2O_5$ is decomposing at the rate 108 mg L^{-1} the production rate of NO_2 is

A. 216 mg $L^{-1}s^{-1}$

B. 108 mg $L^{-1}s^{-1}$

C. $56 mg L^{-1} s^{-1}$

D. 92 mg $L^{-1} s^{-1}$

Answer: D

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54. The reaction A $\rightarrow$ X is a first order reaction which takes place in a vessel with initial concentration of A as 10 M. The rate constant for this reaction is $4.16 h^{-1}$. In the presence of a catalyst, the reaction A $\rightarrow$ Y follows second-order kinetics and the rate constant is 0.2 $\min^{-1} M^{-1}$. What should be the initial concentration of A in the presence of catalyst so that the value of $t_{1/2}$ for both the reactions is the same?

A. 30.0 M

B. 0.5 M

C. 5.0 M

D. 10.0 M

Answer: B

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55. The activation energy of a reaction is 24.0 kcal mol^{-1} at $27^{\circ}C$ and the presence of catalyst changes its activation energy to one-fourth at the same temperature. The approximate ratio of rate in the presence of catalyst to rate in the absence of catalyst will be (use R = 2 cal $mol^{-1}K^{-1}$).

A. 1.0×10^{4}

B. 1.0×10^{3}

C. 2.07

D. 1.0×10^{13}

Answer: D

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56. Assertion : The rate of reaction whether exothermic or endothermic, increases with temperature.

Reason : The rate of reaction = K [reactant] and K increases with temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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57. Assertion :Threshold energy of a reaction is dependent of temperature.

Reason :The energy of activation decreases with increase in temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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58. Assertion : Molecularity of a reaction cannot be determined experimentally.

Reason : Molecularity is assigned to the reactions on the basis of mechanism.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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59. Assertion :The rate of the reaction, A $\rightarrow$ B is the rate of change of concentration of a reactant or a product.

Reason: Rate of reaction remains constant duringthe course of reaction.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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60. Assertion :The order of a reaction maybe negative.

Reason:In some cases, the rate of reaction decreases as the concentration of the reactant increases.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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61. Assertion :For each ten degree rise oftemperature the specific rate constant of a reaction is nearly doubled.

Reason : Energy-wise distribution of molecules in a gas is an experimental function oftemperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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62. Assertion : Order of a reaction with respect to any reactant can be zero, positive, negative or fractional.

Reason: Rate of a reaction cannot decrease with increase in concentration of a reactant or a product.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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63. Assertion: The decomposition of gaseous ammonia on a hot platinum surface is a zero order reaction at high pressure.

Reason: For a zero order reaction, the rate of reaction is independent of initial concentration.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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64. Assertion :All molecular collisions lead to the formation of products.

Reason :Reactant molecules undergo chemical change irrespective of their collision.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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65. Assertion : Rate constant of a zero order reaction has same units as the rate of reaction.

Reason: Rate constant of a zero order reaction does not depend upon the units of concentration.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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66. Assertion : In a zero order reaction, if concentration of the reactant is doubled, half-life period is also doubled.

Reason: The total time taken for a zero order reaction to complete is double of the half-life period.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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67. Assertion :In any reaction, the rate of disappearance of a reactant is same as the rate of reaction.

Reason: Both rate of reaction and rate of disappearance of a reactant represent decrease in the concentration of the reactant per unit time.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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68. Assertion: Order of a reaction can be fractional but molecularity is never fractional.

Reason: Order of reaction may not depend upon the stoichiometric coefficients ofthe balanced equation.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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69. Assertion :The molecularity of the reaction $H_2 + Br_2 \rightarrow 2HBr$ is 2.

Reason: The order of the reaction is 3/2.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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70. Assertion :For a first order reaction, the concentration of the reactant decreases exponentially with time.

Reason: Rate of reaction at any time depends upon the concentration of the reactant at that time.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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71. Assertion : The hydrolysis of methyl acetate by dilute HC1 is a pseudo first order reaction.

Reason: HC1 acts as a catalyst for the hydrolysis.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is incorrect, but (R) is correct.

D. If both (A) and (R) are incorrect.

Answer: B

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72. Assertion : For a 2nd order reaction A+B → Product, the rate can be given as: $K[A]^2$or $K[A][B]$ or $K[B]^2$.

Reason: Either [A] or [B] may or may not influence the rate of reaction.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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73. Assertion If in a zero order reaction, the concentration of the reactant is doubled. The half-life period is also doubled.

Reason: For a zero order reaction, the rate of reaction is independent of initial concentration.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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74. Assertion :According to steady state hypothesis,in a multistep reaction, the change in concentration with time for reactive intermediates is zero.

Reason: The intermediates are so reactive that after a brief initial period their concentrations rise from zero to a small value and remains constant for most of the duration of reaction.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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75. Assertion :E_a of the forward reaction is higher than that backward reaction in a reversible endothermic reaction. Reason: Increasing the temperature of the substance increase the fraction of molecules which collide with energies greater than E_a .

A. If both (A) and (R) are correct and (R) is the correct explanation of (A)

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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Questions

1. A chemical reaction $2A \rightarrow 4B$ +C in gas phase occurs in a closed vessel the concentration of B is found to increase by $2.5 \times 10^{-3} molL^{-1}$ in 5 second calculate (i) the rate of appearance of B (ii) the rate of disappearance of A

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2. For the reaction $3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$

express the rate of reaction in terms of $-d[H_2]/dt - d[N_2]/dt$ and

$d[NH_3]/dt$

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3. For a reaction : $A + B \rightarrow$ Products,

The rate law expression is, rate $= k[A]^{1/3}[B]^2$

What is the order of a reaction ?

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4. For a reaction : $A + B \rightarrow$ Products,

The rate law expression is, rate $= k[A]^{1/3}[B]^2$

What are the units of rate constant, if concentration is measured in mol dm^{-3} and time in seconds ?

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5. The rate law expression of a reaction $2A + B \rightarrow A_2B$ is rate $= k[A]^2$

with rate constant k =0.65 $mol^{-1}Ls^{-1}$

calculate rate of reaction when

(a) $[A] = 0.25 mol L^{-1} [B] = 1.84 mol L^{-1}$

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6. The rate law expression of a reaction $2A + B \rightarrow A_2B$ is rate = $k[A][B]^2$ with rate constant k =0.65 $mol^{-1}Ls^{-1}$

calculate rate of reaction when concentration of A has been reduced to $1/4$ and concentration of B has been reduced by $1/4$

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7. For the reaction , $NO_2(g) + CO(g) \rightarrow CO_2(g) + NO(g)$

experimentally determiend rate law expression below 400 K is , rate $= k[NO_2]^2$

What mechanism can be proposed for the above reaction ?

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8. A first order reaction is 20% complete in 5 minutes. Calculate the time taken for the reaction to be 60% complete

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9. The catalytic decomposition of H_2O_2 was studied by titrating it at different intervals with $KMnO_4$ solution.Calcualte the rate constant from the following data assuming the reaction to be of the first order

time t(seconds): 0 600 1200

$KMnO_4$ (mL) :22.8 13.8 8.2

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10. A first order reaction with respect to reactant A has a rate constant 6.5 $\min^{-1}$. If we start with 2.0 mol L^{-1} of A when would A reach the value 0.5

mol L^{-1}

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11. Show that for a first order reaction the time required for 99.9% of the reaction to take place is ten times that required for half of the reaction

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12. In the reduction of nitrous oxide with hydrogen an equimolar mixture of the gases at 340 mm initial pressure was half changed in 120 second in a second experiment when the intial pressure 288 mm the change was half completed in 140 seconds what is the order of reaction

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13. The rate constant k of a reaction increases three fold when temperature changes from 127° C to 45° C calculate the energy of activation for this reaction

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14. A first order reaction is 50% complete in 40 minutes at 30° C and 20 minutes at 50° C calcualte the reaction rate constant at these temperatures and the energy of acitivation in kj/ mol

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15. From the following data show that the decomposition of hydrogen peroxide in aqueous solution is a first order reaction what is the value of the rate constant

Time (t) in minutes 0 10 20 30 40

V(mL) 25.0 20.0 15.7 12.5 9.6

Where V is volume of $kMnO_4$ solution required decompose a definite volume of hydrogen peroixde

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16. From the following data for the decomposition of ammonium nitrite in aqueous solution,prove that the reaction is first order

Time (minutes) 10 15 20 25 ∞

Volume N_2 (mL) 6.25 9.00 11.40 13.65 35.05

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17. The following data were obtained for the decompostion dintirogen pentoxide in CCl_4 at 325 k

Time (minutes): 10 15 20 25 ∞

volume of O_2 evolved (mL):6.30 8.95 11.40 13.50 34.75

show that this is a first order reaction

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18. 3.5 ml ethyl acetate was added to a flask containing 100 ml of 0.1 M HCl placed in a thermostat maintained at 30°C 5 ml of the reaction mixture was withdrawn at different interval of time and after chilling titrated against standard NaOH the following data were obtained

Time (minutes) 0 75 119 183 ∞

NaOH used (mL) 9.62 12.10 13.10 14.75 21.05

From the above data show that the hydrolysis of ethyl acetate is a first order reaction

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19. The optical rotation of surcose in 0.5 M HCl at 35°C at various time interval are given show that the reaction is first order

Time (minutes) 0 10 20 30 40 $\propto$

Rotation (degrees) +32.4 +28.8 +25.5 +22.4 +19.6 -11.1

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Level -I

1. The rate of combination of simple alkyl free radicals:

A. increases with increase in temperature

B. dependent of temperature

C. decreases with increase in temperature

D. altogether different for different reactions and independent of temperature

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2. For a I order reaction which one is not correct?

A. The concentration of product increases linearly with time

B. The concentration of product increases exponentially with time

C. The degree of dissociation a' is given by $1-e^{kt}$

D. The reaction never goes for completion

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3. According to Arrhenius theory, the activation energy is

A. The energy it should posses so that it can enter into an effective collision

B. The energy which the molecule should possess in order to undergo reaction

C. The energy it has to acquire further so that it can enter into effective collision

D. The energy gained by the molecules on colliding with another molecule

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4. The activation energy of a reaction is zero. The rate constant of this reaction

A. Increases with increase of temperature

B. Decreases with an increase of temperature

C. Decreases with decrease of temperature

D. Is independent of temperature

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5. The reaction rate at given temperature becomes slower, then

A. The free energy of activation is higher

B. The free energy of activation is lower

C. The entropy changes

D. The concentration of the reactants remains constant

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6. A rise in temperature increases the velocity of a reaction. It is because it results in

A. An increased number of molecular collisions

B. An increased momentum of colliding molecules

C. An increase in the activation energy

D. A decrease in the activation energy

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7. The main function of a catalyst in speeding up a reaction is

A. To increase the rate of the forward reaction

B. To change the reaction path so as to decrease the energy of activation for the reaction

C. To reduce the temperature at which the reaction can occur

D. To increase the energy of the molecules of the reactants

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8. An example of a pseudo - first order reaction is

A. Dissociation of hydrogen iodide

B. Hydrolysis of methyl acetate in dilute solution

C. Dissociation of phosphorus pentachloride

D. Decomposition of hydrogen peroxide

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9. The rate expression for the reaction $A(g) + B(g) \rightarrow C(g)$ is rate = $kC_A^2 C_B^{1/2}$. What changes in the initial concentrations of A and B will cause the rate of reaction to increase by a factor of eight?

A. $C_A \times 2, C_B \times 2$

B. $C_A \times 2, C_B \times 4$

C. $C_A \times 1, C_B \times 4$

D. $C_A \times 4, C_B \times 1$

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10. The term rate of reaction and rate of appearance (or disappearance) of reactant (or product)

A. represent one and the same physical quantity

B. differ by a constant factor

C. are positive parameters and have same value

D. may or may not have same value depending upon the stoichiometric coefficient of reactant (or product) in the balanced chemical equation

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11. For the reaction $N_2 + 3H_2 \rightarrow 2NH_3$ the rate of formation of ammonia was found to be $2.0 \times 10^{-4} moldm^{-3}s^{-1}$ The rate of consumption of H_2 will be

A. $1.0 \times 10^{-4} moldm^{-3}s^{-1}$

B. $2.0 \times 10^{-4} moldm^{-3}s^{-1}$

C. $3.0 \times 10^{-4} moldm^{-3}s^{-1}$

D. $4.0 \times 10^{-4} mol dm^{-3} s^{-1}$

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12. The equilibrium reaction $A \underset{k_b}{\overset{k_f}{\Longleftrightarrow}}$ B is started with A such that initially one can write $A \xrightarrow{k_f} B$. In such a case, which of the following will be correct?

A. $k_f = k'_f$

B. $k_f > k'_f$

C. $k_f < k'_f$

D. k_f, may be greater or smaller than k'_f depending upon the concentration of A.

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

A. Order of a reaction can never be equal to zero or fractional value

B. It is always determined experimentally

C. It is equal to the molecularity of an elementary reaction

D. It is sum of the powers of concentration terms in the differential rate law of a reaction.

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14. A substance (initial concentration a) reacts according to zero-order kinetics. The time it takes for the completion of the reaction is

A. a/k

B. a/2k

C. k/a

D. 2k/a

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15. The half-life period of a radioactive element is 140 days. After 560 days, one gram of the element will reduce

A. (1/2) g

B. (1/4) g

C. (1/8)g

D. (1/6)g

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16. For a first-order reaction A $\rightarrow$ B the plot of log [A] versus t is linear with a

A. positive slope and zero intercept

B. positive slope and nonzero intercept

C. negative slope and zero intercept

D. negative slope and nonzero intercept

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17. For the first-order decomposition reaction of N_2O_5 written as:

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$, rate $= k[N_2O_5]$

$N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$, rate $= k'[N_2O_5]$

which of the following facts is true?

A. $k = k'$

B. $k > 2k'$

C. $k > k'$

D. $2k = k'$

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18. A first order reaction is 20% complete in 10 min. Calculate the specific rate constant of the reaction.

A. 0.223min^{-1}

B. 0.0223min^{-1}

C. 2.23min^{-1}

D. 22.3min^{-1}

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19. The rate constant for the reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$ is $3.0 \times 10^{-5} s^{-1}$ If the rate is 2.40×10^{-5} mo $L^{-1}S^{-1}$ then the concentration of N_2O_5 (in mo L^{-1}) is

A. 1.4

B. 1.2

C. 0.04

D. 0.8

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20. The reaction $2NO(g) + H_2(g) \rightarrow N_2O(g) + H_2O(g)$ follows the rate law $\frac{dp(N_2O)}{dt} = k(p_{NO})^2 p_{H_2}$. If the reaction is initiated with $p_{NO} = 1000$ mm Hg and p_{H_2}=10mm Hg. The reaction may be considered to follow:

A. first order kinetics

B. second order kinetics

C. zero order kinetics

D. third order kinetics

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21. The half-life of a reaction $A \rightarrow B$ varies as the inverse of concentration of A. The order of the reaction would

A. zero

B. first

C. second

D. third

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22. For the decomposition of N_2O_5 it is given that:

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$, activation energy E_a

$N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ activation energy E_a'

then,

A. $E_a = E'_a$

B. $E_a > E'_a$

C. $E_a < E'_a$

D. $E_a = 2E'_a$

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23. By increasing the temperature by 10°C, the rate of forward reaction at equilibrium is increased by a factor of 2. The rate of backward reaction by this increase in temperature

A. remains unaffected

B. increases by a factor greater than two

C. decreases by a factor lesser than two

D. is also increased by a factor of two

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24. The rate constant, the activation energy and the Arrhenius parameters of a chemical reaction at 25° C are $2.0\times10^{-5}s^{-1}$, 100 kJ mol^{-1} and $6.0\times10^{14}s^{-1}$, respectively. The value of rate constant at very high temperature approaches.

A. $2.0\times10^{-5}s^{-1}$

B. infinity

C. $6.0\times10^{14}s^{-1}$

D. $12\times10^{-9}s^{-1}$

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25. Which of the following statements is not correct?

A. The efficiency of a solid catalyst depends upon its surface area

B. Catalyst operates by providing alternate path for the reaction that involves a lower activation energy

C. Catalyst lowers the energy of activation of the forward direction without affecting the energy of activation of the backward direction

D. Catalyst does not affect the overall enthalpy change of the reaction.

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26. The activation energies of two raction are E_{a1} and E_{a2} with $E_{a1} > E_{a2}$. If the temperature of the reacting systems is increased from T_1 to T_2 predict which of the following alternatives is correct

A. $\frac{k'_1}{k_1} = \frac{k'_2}{k_2}$

B. $\frac{k'_1}{k_1} > \frac{k'_2}{k_2}$

C. $\frac{k'_1}{k_1} < \frac{k'_2}{k_2}$

D. $\frac{k'_1}{k_1} < 2\frac{k'_2}{k_2}$

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27. For a reaction $\frac{1}{2}A \rightarrow 2B$ rate of disappearance of A is related to the rate of appearance of B by the expression

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

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

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

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

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28. Consider the reaction: $Cl_2(aq) + H_2S(aq) \rightarrow S(s) + 2H^+(aq) + 2CI^-$ (aq) The rate equation for this reaction is rate = $k[Cl_2][H_2S]$ Which of these mechanisms is/are consistent with this rate equation.

(I) $CI_2 + H_2S \rightarrow H^+ + Cl^- + CI^+ + HS^-$ (slow)

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

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

$Cl_2 + HS^- \rightarrow 2Cl^- + H^+ + S$ (slow)

A. I only

B. II only

C. both I and II

D. neither I nor II

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

A. diminished to one-fourth of its initial value

B. diminished to one-eighth of its initial value

C. increased to eight times of its initial value

D. increased to four times of its initial value

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30. A reaction involving two different reactants can never be

A. unimolecular reaction

B. first-order reaction

C. second-order reaction

D. bimolecular reaction

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

A. 1h

B. 4 h

C. 0.5 h

D. 0.25 h

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32. The unit of the rate of reaction is the same as that of the rate constant for a

A. zero-order reaction

B. first-order reaction

C. second-order reaction

D. half-order reaction

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33. For a first-order reaction A → Products, the concentration of A changes from 0.1 M to 0.025 M in 40 min. The rate of the reaction when the concentration of A is 0.01 M is

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

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

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

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

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34. The time $t_{1/4}$ can be taken as the time taken for the concentration of a reactant to drop to 3/4th of its initial value. If the rate constant for a first -order reation 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

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35. Consider the reaction, $2A + B \rightarrow$ Products

When concentrations of B alone was doubled, the half-life did not charge.

When the concentrations of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is

A. s^{-1}

B. $Lmols^{-1}$

C. no unit

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

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36. The half-life period of a first-order reaction is 15 minutes. The amount of substance left after one hour will be,

A. $\frac{1}{4}$ of the original amount

B. $\frac{1}{8}$ of the original amount

C. $\frac{1}{16}$ of the original amount

D. $\frac{1}{32}$ of the original amount

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37. The rate of a chemical reaction doubles for every 10° C Lrise of temperature. If the temperature is raised by 50° C, the rateofthe^reaction increases by about

A. 24 times

B. 32 times

C. 64 times

D. 10 times

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

A. k is equilibrium constant

B. A is adsorption factor

C. E_a is energy of activation energy

D. R is Rydberg's constant

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39. The activation energy E_a of a reaction can be calculated by plotting

A. k against T

B. k against 1/log T

C. log k against 1/T

D. log k against I/logT

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40. Under the same reaction conditions intital concentration of 1.386 mol dm^{-3} of a substance becomes half in 40 and 20 through first order and zero order kinetics respectively ratio (k_1 / k_0) of the rate constants for first order k_1 and zero order k_0 of the reaction is

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

B. $1.0 mol dm^{-3}$

C. $1.5 mol dm^{-3}$

D. $2.0 mol^{-1} dm^3$

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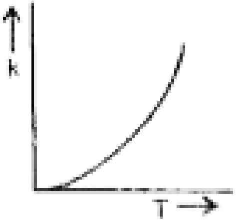
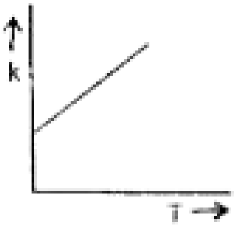
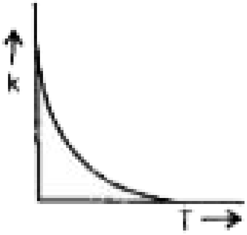
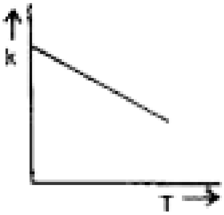
41. Plots showing the variation of rate constant (k) with temperature (T) are given. The plot that follows Arrhenius ^equation is

A. 

B. 

C. 

D. 

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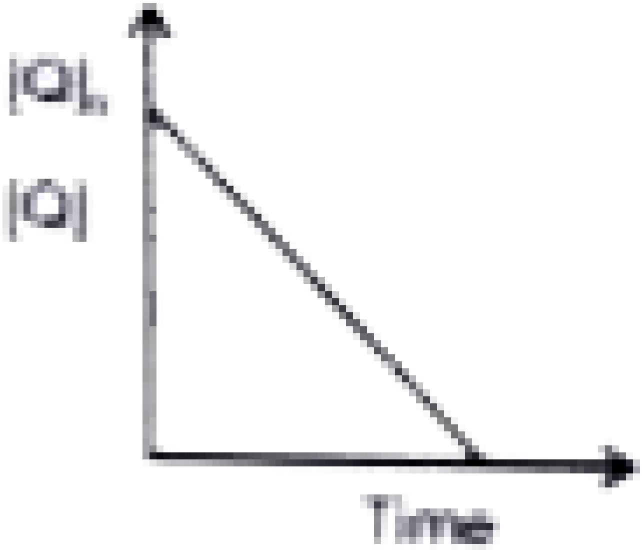
42. In the reaction, P + Q $\rightarrow$ R + S, the time taken for 75% reaction of P is twice the time taken for 50% reaction of P. The concentration of Q varies with reaction time as shown in figure. The overall order of the reaction is



A. 2

B. 3

C. 0

D. 1

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43. The activation energy for a reaction which doubles the rate when the temperature is raised from 300 K to 310 K is

A. $50.6kJmol^{-1}$

B. $53.6kJmol^{-1}$

C. $56.6kJmol^{-1}$

D. $59.6kJmol^{-1}$

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44. Ammonia reacts with oxygen giving nitrogen and water. If the rate of formation of N_2 is 0.70 mol $L^{-1}S^{-1}$ the rate at which O_2 is consumed is

A. $1.05molL^{-1}s^{-1}$

B. $0.70 mol L^{-1} s^{-1}$

C. $2.10 mol L^{-1} s^{-1}$

D. $0.35 mol L^{-1} s^{-1}$

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45. The half-life for the thermal decomposition of acetone 90s_and is independent of initial concentration of acetone. The time required for the reaction to go to 80% decomposition is (log 2 = 0.30)

A. 186.1 s

B. 206.1 s

C. 150.1 s

D. 226.1 s

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46. The reaction $NH_4^+ + OCN^- \to OC(NH_2)_2$, proceeds through the following mechanism.

$NH_4^+ + OCN^- \xrightarrow{k_{eq}} NH_4$ OCN (fast)

$NH_4OCN \xrightarrow{k} OC(NH_2)_2$ (slow)

The rate constant of the reaction is

A. k

B. kK_{eq}

C. k / K_{eq}

D. K_{eq} / k

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47. Which of the following statements is not correct?

A. Larger the activation energy, lesser the value of rate constant of a reaction .

B. Larger the temperature, larger the value of rate constant of a reaction

C. Larger the activation energy, larger the effect of a given temperature increase on the rate constant

D. At the lower temperature, increase in temperature causes lesser change in the value of rate constant than at higher temperature

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48. A catalyst lowers the activation energy from 20 kJ mol^{-1} to 15 kJ mol^{-1} of the forward direction of the reaction A $\rightarrow$ B which of the following statement regarding the reaction is correct

A. Activation energy of the backward direction is increased by 5 kJ mol^{-1}

B. Activation energy of the backward direction is decreased by 5 kJ mol^{-1}

C. Enthalpy of reaction is increased by 5 kJ mol^{-1}

D. Equilibrium constant of the reaction is decreased $5kJmol^{-1}$

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49. For a chemical reaction X $\rightarrow$ Y , the rate of reaction increases by a factor of 1.837 when the concentration of X is increased by 1.5 times, the order of the reaction with respect to X is :

A. 1

B. 1.5

C. 2

D. 2.5

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50. The reaction $A+2B+C \to D$ occurs by the following mechanism.

$A+B \underset{k_2}{\overset{k_1}{\Longleftrightarrow}} E$ (rapid equilibrium)

$E+C \xrightarrow{k_1}$ F(slow)

$F+B \xrightarrow{k_4} D$ (very fast)

The rate law for this reaction is

A. $r=k[C]$

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

C. $r=k[D]$

D. $r=k[A][B][C]$

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51. The rate equation for $2N_2O_5 \to 4NO_2+O_2$ is r = $(6.3\times10^{-4}s^{-1})[N_2O_5]$. The initial rate of decomposition of 0.1 MN_2O_5

will be

A. $6.3 \times 10^{-6} moldm^{-3} s^{-1}$

B. $6.3 \times 10^{-5} moldm^{-3} s^{-1}$

C. $6.2 \times 10^{-4} moldm^{-3} s^{-1}$

D. $6.3 \times 10^{-3} moldm^{-3} s^{-1}$

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52. A reaction $A \xrightarrow{k}$ product follows half-order kinetics with respect to linear plot isobserved between

A. $[A]^{1/2}$ versust with slope equal to-k

B. $[A]^{1/2}$ versust with slope equal to-k/2

C. $[A]^{1/2}$ versust with slope equal to-2k

D. $[A]^{\frac{13}{2}}$ versust with slope equal to - k

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53. The reaction $2N_2O_5((g) \rightarrow 4NO_2(g) + O_2(g)$ provides a linear plot when In $P_{n_2O_5}$ is plotted against t with a negative slope. The decomposition of N_2O_5 follows

A. zero-order kinetics

B. first-order kinetics

C. third order kinetics

D. second order kinetics

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54. For a reaction $2NO(g) + H_2(g) \rightarrow N_2O(g) + H_2O(g)$ the rate law is dp $(N_2O)/dt = k(P_{NO})^2(P_{H_2})$ The half life of the reaction when

$(P_{NO})_0 = 10mmHg$ and $(P_{H_2})_0 = 1200$ mmHg is found to be 830 s The half life when $(P_{NO})_0 = 20mmHg$ and $(P_{H_2})_0 = 1200$ mmHg will be

A. 830s

B. 415 s

C. 1245 g

D. 208s

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55. In the Haber's process of the synthesis of ammonia, the use of catalyst helps

A. increasing rate constant without changing the equilibrium amount of NH_3

B. increasing rate constant with increasing the equilibrium amount of NH_3

C. decreasing rate constant with increasing the equilibrium amount of NH_3

D. decreasing rate constant with decreasing the equilibrium amount of NH_3

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Level -II

1. Select the incorrect statement:

A. Half life period of all reactions decreases with increase in temperature

B. Half life period of I order reaction is always constant

C. Higher is rate constant of a reaction, lesser will be its energy of activation

D. Rate of reaction whether exothermic or endothermic usually increases with temperature

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2. The reaction $A \rightarrow B + C$ has rate constant $1 \times 10^{-3} M s^{-1}$. If one starts the reaction with one mole of A then $t_{1/2}$ and completion of reaction time would be:

A. 1000 s, 500 s

B. 500 s, 1000 s

C. 750 s, 400 s

D. 400 s, 800 8

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3. For an endothermic reaction where ΔH represents the enthalpy of reaction in kJ(mol, the minimum value for the energy of activation will be:

A. less than ΔH

B. zero

C. more than ΔH

D. equal to ΔH

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4. In a first order reaction, the concentration of reactant decreases from 0.8 mol/dm^3 to 0.05 mol/dm^3 in 2×10^4 sec. The rate constant in $\sec^{-1}$ is:

A. 2×10^4

B. 3.45×10^{-5}

C. 1.386×10^{-4}

D. 2×10^{-4}

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5. For the elementary reaction M $\rightarrow$ N, the rate of disappearance of M increases by a factor of 8 upon doubling the concentration of M. The order of the reaction with respect to M is:

A. 4

B. 3

C. 2

D. 1

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6. According to the collision theory of chemical reactions

A. A Chemical reaction occurs with every molecular collision

B. Rate is directly proportional to the number of collisions per second

C. Reactions in the gas phase are always of zero order

D. Reaction rates are of the order of molecular speeds

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7. The activation energy for a simple chemical reaction A $\rightarrow$ B is E_a in forward direction. The activation energy for reverse reaction.

A. Is always double of E_a

B. Is negative of E_a

C. Is always less than E_a

D. Can be less than or more than E_a

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8. The reaction $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ is of first order. Ifvolume of reaction vessel is reduced to 1/3, the rate of reaction would become

A. 1/3 times

B. 2/3 times

C. 3 times

D. 6 times

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9. For the equilibrium, $A(g) \rightarrow B(g)$, $\triangle H$ is - 40 kJ mol^{-1} . If the ratio^f the activation energies of the forward $\left(E_f\right)$ and reverse (E_b) reaction is (2/3) then:

A. $E_r = 60kJmol^{-1}, E_b = 100kJmol^{-1}$

B. $E_r = 30kJmol^{-1}, E_b = 70kJmol^{-1}$

C. $E_r = 80kJmol^{-1}, E_b = 120kJmol^{-1}$

D. $E_r = 70kJmol^{-1}, E_b = 30kJmol^{-1}$

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10. 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 of the earlier rate of the reaction will be as

A. $(m + n)$

B. $(n - m)$

C. (2^{n-m})

D. $\frac{1}{2^{(m+n)}}$

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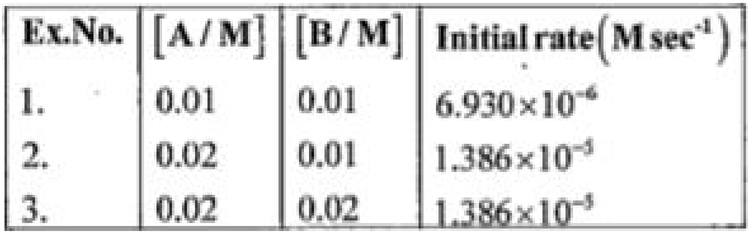
11. The kinetic data for the given reaction $A(g) + 2B(g) \xrightarrow{k} C(g)$ is provided in the following table for three experiments at 300K



Ex.No.	$[A/M]$	$[B/M]$	Initial rate $(M\,sec^{-1})$
1.	0.01	0.01	6.930×10^{-6}
2.	0.02	0.01	1.386×10^{-5}
3.	0.02	0.02	1.386×10^{-5}

In another experiment starting with initial concentration of 0.5 and I M respectively for A and B at 300 K, find the rate of reaction after 50 minutes from start of experiment (in M/sec).

A. 6.3×10^{-4}

B. 0.25×10^{-7}

C. 4.33×10^{-5}

D. 3.46×10^{-4}

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12. Reaction A + B $\rightarrow$ C + D follows rate law, $r = k[A]^{1/2}[B]^{1/2}$ starting with 1 MofA and Beach. What is the time taken for concentration of A become 0.1 M? (K = 2.303 * 10 ^(-3))

A. 10 sec

B. 100 sec

C. 1000sec

D. 434 sec

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13. The reaction A(g) $\rightarrow$ B(g) + 2C(g) is a first order reaction with rate constant $2.772 \times 10^{-3} S^{-1}$. Starting with 0.1 mole of A in 2 litre vessel, find the concentration of A after 250 sec when the reaction is allowed to take place at constant pressrue at 300 K.

A. 0.0125 M

B. 0.025 M

C. 0.05 M

D. 0.125 M

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14. For a first order homogenous gaseous reaction $A \rightarrow 2B + C$ if the total pressure after time t was p_t and after long time $(t \rightarrow \infty)$ was p_∞ then k in terms of p_t, p_∞ and t is

A. $k = \frac{2.303}{t} \log\left(\frac{P_\infty}{p_\infty - P_t}\right)$

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

C. $k = \frac{2.303}{t} \log\left(\frac{2P_\infty}{3(P_\infty - P_1)}\right)$

D. $k = \frac{2.303}{t} \log\left(\frac{P_\infty}{P_\infty + P_t}\right)$

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15. The gaseous decomposition reaction, $A(g) \to 2B(g) + C(g)$ is observed to first order over the excess of liquid water at 25° C. It is found that after 10 minutes the total pressure of system is 188 torr and after very long time it is 388 torn The rate constant of the reaction (in hr^1) is: [Given: vapour pressure of H_2 O at 25° C is 28 torr(In 2 = 0.7, In 3 = 1.1, In 10 = 2.3)]

A. 0.02

B. 1.2

C. 0.2

D. 2.2

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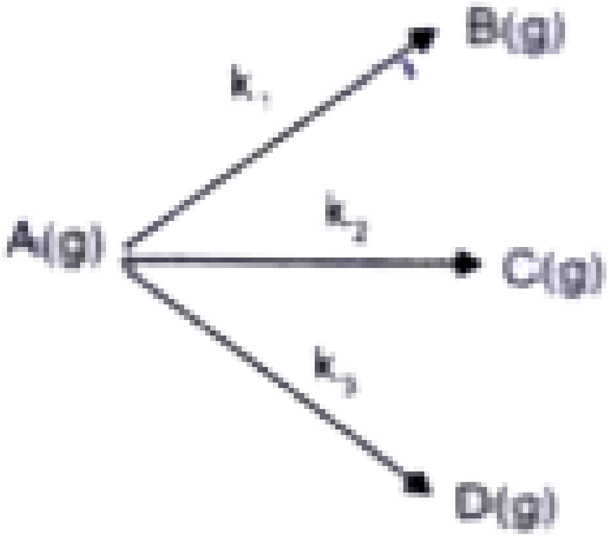
16. A gaseous compound A reacts by three independent first order processes (as shown in figure) with rate . constant $2 \times 10^{-3} \times 10^{-3}$ and $1.93 \times 10^{-3} \sec^{-1}$ for products B, C and D respectively. If initially pure A was taken in a closed container with P = 8 atm, then the partial pressure of B (in atm) after 100 sec from start of experiment.



A. 0.288

B. 0.577

C. 1.154

D. 0.33

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17. A compound 'A' dissociate by two parallel first order paths atcertain temperature

$$A(g)^{k_1\left(\overset{-1}{\min}\right)} \rightarrow 2B(g)\, k_1 = 6.93 \times 10^{-3} \overset{-1}{\min}$$

$$A(g)^{k_2\left(\overset{-1}{\min}\right)} \rightarrow C(g)\, k_2 = 6.93 \times 10^{-3} \overset{-1}{\min}$$

The reaction started whith 1 mole of pure A in 1 litre closed container with the initial pressure 2 atm what is the pressure (in atm) developed in container after 50 minuts from start of experiment?

A. 1.25

B. 0.75

C. 1.50

D. 2.50

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18. The reaction cis- $X \underset{k_b}{\rightleftharpoons}{}^{k_f}$ trans-X is first order in both directions. At 25° C, the equilibrium constant is 0.10 and the rate constant

$k_f = 3 \times 10^{-4} s^{-1}$. In an experiment starting with the pure cis-form, how long would it take for half of the equilibrium amount of the trans-isomer to be formed?

A. 150 sec

B. 200sec

C. 240 sec

D. 210 sec

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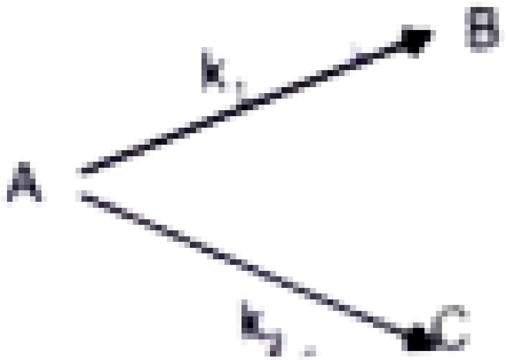
19. For first order parallel reactions k_1 and k_2 are 4 and 2 $\min^{-1}$ respectively at 300 K.. If the activation energies for the formation of B and C are respectively 30,000 and 38,314 joule/mol respectively. The temperature at which B and C will be obtained in equimolar ratio is:



A. 757.48 K

B. 378.74 K

C. 600 K

D. 450 K

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20. Consider the following first order competing reactions:

$X \xrightarrow{k_1} A + B$ and $Y \xrightarrow{k_2} C + D$

If 50% of the reaction of X was completed when 96% of the reaction of Y was completed, the ratio of thoir rate constant (k_2 / k_1) is:

A. 4.6

B. 4.06

C. 1.123

D. 2.303

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21. A reactant (A) forms two products (Assume that $A_1 = A_2$, which are pre-exponential factor)

$A \xrightarrow{k_1} B$, Activation energy E_{a1}

$A \xrightarrow{k_2} C$, Activation energy E_{a2}

If $E_{a2} = 2E_{a1}$, then k_1 and k_2 are related as:

A. $k_2 = k_1 e^{-\frac{E_{a_1}}{R}T}$

B. $k_2 = k_1 e^{-\frac{E_{a_2}}{R}T}$

C. $k_1 = Ak_2 e^{-\frac{E_{a_1}}{R}T}$

D. $k_1 = 2k_2 e^{-\frac{E_{a_2}}{R}T}$

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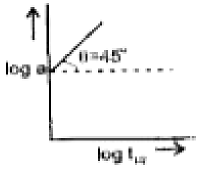
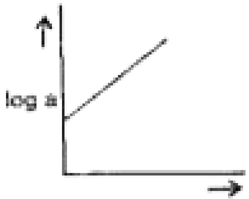
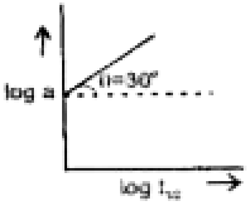
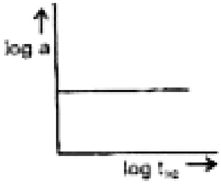
22. Which of the following graphs is correct for the following reaction?

$$Ch_3 - CH_2 - CH = CH_2 \xrightarrow[300^\circ C]{H_2 / Ni} CH_3 - CH - CH_2 - CH_3$$

A. 

B. 

C. 

D. 

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23. A reaction takes place in three steps with individual rate constant and activation energy Ea1 = 180 KJ/mol Ea2 = 80 KJ/mol Ea3 = 50 KJ/mol overall rate constant $k = \left(\frac{k_1 k_2}{k_3}\right)^{2/3}$ overall activation energy of the reaction will be

A. 140 kJ/mol

B. 150 kJ/mol

C. 130 kJ/mol

D. 120 kJ/mol

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24. A drug becomes ineffective after 30% decomposition. The original concentration of a sample was 5 mg/mL , which becomes 4.2 mg/mL during 20 months. Assuming the decomposition of first order, calculate the expiry time of the drug in months.

A. 79.4 months

B. 36.2 months

C. 59.4 months

D. 41.0 months

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25. On introducing a catalyst at 500 K, the rate of a first order reaction increases by 1.718 times. The activation energy in the presence of catalyst is 6.05 kJ mol^{-1} . The slope of the plot of In k$\left(\sec^{-1}\right)$ against 1/T in the absence of catalyst is:

A. $+1$

B. -1

C. $+1000$

D. -100

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

A. 2

B. 1

C. $3/2$

D. $4/3$

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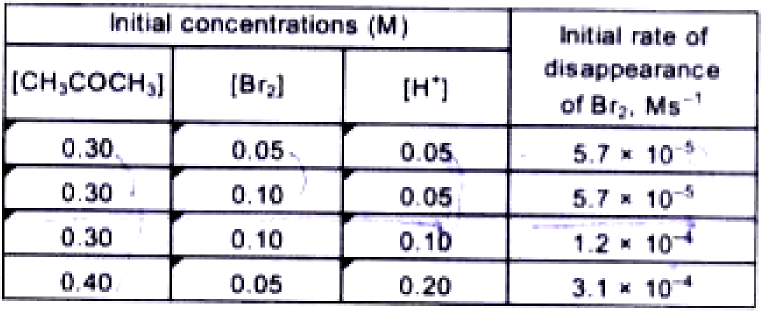
27. The bromination of acetone that occurs in acid solution is represented by

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

These kinetic data were obtained for given reaction concentration



Initial concentrations (M)			Initial rate of disappearance of Br_2, Ms^{-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 equation is

A. Rate $k[CH_3COCH_3][Br_2][H^+]^2$

B. Rate $k[CH_3COCH_3][Br_2][H^+]$

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

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

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28. The decomposition of N_2O_5 according to the equation, $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ is a first order reaction, After 30 minutes from the start of the decomposition in a closed vessel, the total pressure developed is found to be 284.5 mm Hg and on completion, the total pressure is 584.5 mm Hg. Calculate the rate constant of the reaction.

A. $5.2 \times 10^{-3} \text{min}^{-1}$

B. $10.1 \times 10^{-3} \text{min}^{-1}$

C. $8.3 \times 10^{-3} \text{min}^{-1}$

D. $2.2 \times 10^{-3} \text{min}^{-1}$

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

A. zero

B. one

C. Two

D. three

Watch Video Solution

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30. At a certain temperature, the half change period for the catalytic decomposition of ammonia were found as follows:

Pressure (Pasacals) 66667 133333 266666

Half life period: 3.52 1.92 1.0 Calculate the order of reaction

A. 3

B. 2

C. 0

D. 1

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31. According to the collision model of kinetics, certain activtion energy must be overcome before a reaction can proceed. Based on the data given below, what is a reasonable estimate of the activation energy for the decomposition of NOCl ?

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

Temperature (K)	Rate constant, k(L/mol s)
400	6.6×10^{-4}
500	2.9×10^{-1}
600	1.63×10^{1}

A. 1.00×10^2 kJ/mol

B. 1.23×10^3 kJ/mol

C. 1.05×10^5 kJ/mol

D. 1.34×10^6 kJ/mol

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32. The radioactive element, Thallium-201, is used medicinally as a radiotracer to study damage in heart tissue. If a patient is injected with a 0.950 g dose of pure Thallium-201, calculate the amount of time that would be required for the amount of Thallium-201 in the patient's body to reach 0.0500 g. Thallium-201 decays by a first order process with a half-life, $t_{1/2} = 73.0$ hrs.

A. 5.70 hrs

B. 113 hrs

C. 226 hrs

D. 310 hrs

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33. For a reaction A $\rightarrow$ Product half-life measured for two different value of intial concentration 5×10^{-3} M and 25×10^{-4} M are 1.0 and 8.0 hrs respectively. If initial concentration is adjusted to 1.25×10^{-3} M, the new half-life would be

A. 16 hrs

B. 32 hrs

C. 64 hrs

D. 256 hrs

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34. The metabolism of an antibiotic, A,is a first-order rate process. The rate constant, k, for this process depends on temperature and body weight, but for a 70 kg man at 37° C its value is $k = 3.0 \times 10^{-5} S^{-1}$.

How long after taking the first pill containing 400 mg of antibiotic must this man take the second pill to keep the concentration at 200 mg per 100 kg body weight? [Asume instantaneous uniform distribution of the antibiotic throughout the body.]

A. $0.7 \times 10^{4} s$

B. $1.5 \times 10^{4} s$

C. $1.4 \times 10^{4} s$

D. $3.5 \times 10^{4} s$

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35. 80% of a first order reaction was completed in 70 min. How much it will take for 90% completion of a reaction?

A. 114 min

B. 140 min

C. 100 min

D. 200 min

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36. A first order reaction: A $\rightarrow$ Products and a second order reaction: 2R $\rightarrow$ Products both have half time of 20 min when they are carried out taking 4 mol L^{-1} of their respective reactants. The number of mole per litre of A and R remaining unreacted after 60 min from the start of the reaction, respectively, will be

A. 1 and 0.5 M

B. 0.5 M and negligible

C. 0.5 and 1 M

D. 1 and 0.25 M

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37. In a certain reaction, 10% of the reactant decomposes in one hour, 20% in two hours, 30% in three hours, and so on. The dimension of the velocity constant (rate constant) are

A. hr^{-1}

B. $molL^{-1}hr^{-1}$

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

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

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38. The mechanism of the reaction, $2NO + O_2 \rightarrow 2NO_2$ is

$NO + NO \xrightarrow[k_{-1}]{k_1} N_2O_2$ (fast)

$N_2O_2 + O_2 \xrightarrow{k_2} 2NO_2$ (slow) The rate constant of the reaction is

A. k_2

B. $k_2k_1(k_{-1})$

C. k_2k_1

D. $k_2\left(\frac{k_1}{k_{-1}}\right)$

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39. Diazonium salt decompose as : $C_6H_5N_2CI^- \to C_6H_5CI + N_2$ At $0^\circ C$ the evolution of N_2 becomes two times faster when the initial concentration of the salt is doubled. Thus, it is

A. A first order reaction

B. A second order reaction

C. Independent of the initial concentration of reactant

D. A zero order reaction

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40. At 27° C it was observed in the hydrogenation of a reaction, the pressure of H_2 (g) decreases from 10 atm to 2 atm in 10 min. Calculate the rate of reaction in M $\min^{-1}$

A. 0.02

B. 0.03

C. 0.04

D. 0.05

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41. In a catalytic reaction involving the formation of ammonia by haber process $N_2 + 3H_2 \rightarrow 2NH_3$ the rate of appearance of NH_3 was measured as $2.5 \times 10^{-4} molL^{-1}S^{-1}$ the rate of disappearance or H_2 will be

A. $2.50 \times 10^{-4} molL^{-1}s^{-1}$

B. $1.25 \times 10^{-4} mol L^{-1} s^{-1}$

C. $3.75 \times 10^{-4} mol L^{-1} s^{-1}$

D. $5.00 \times 10^{-4} mol L^{-1} s^{-1}$

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42. When the concentration of a reactant in reaction A $\rightarrow$ B is increased by 8 times but rate increases only 2 times, the order of the reaction would be

A. 2

B. $1/3$

C. 4

D. $1/2$

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43. The hydrolysis of an ester was carried out with $0.1 M H_2SO_4$ and 0.1 M HC1 separately. Which of the following expressions between the rate constants is expected? The rate expression being rate =k $[H^+]$[ester]

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

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

C. $k_{HCl} < k_{H_2SO_4}$

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

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44. A reaction of the type A(g) + B(g) $\rightarrow$ Product is taking place in a vessel. Ifthe volume ofthe reaction vessel is suddenly reduced to one fourth of the initial volume, the ratio of final rate initial rate is

A. $4:1$

B. $2:1$

C. $16:1$

D. $1:2$

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45. The reaction $2NO_2 \rightarrow 2NO + O_2$ is second order respect to NO_2. If the intial concentration of $NO_2(g)$ is $6.54 \times 10^{-4} mol L^{-1}$ and the intial reaction rate is $4.42 \times 10^{-7} mol L^{-1} s^{-1}$ what is the half life of the reaction.

A. $1.48 \times 10^3 s$

B. $2.63 \times 10^4 s$

C. $1.96 \times 10^2 s$

D. $3.06 \times 10^3 s$

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46. A first order reaction is carried out starting with 10 mol l^{-1} of the reactant. It is 40% complete in 1h if the same reaction is carried out with an initial concentration of 5 mol l^{-1} the percentage of the reaction that is completed in 1h will be

A. $40\,\%$

B. $80\,\%$

C. $20\,\%$

D. $60\,\%$

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47. The reaction $A(g)+2B(g)\to C(g)+D(g)$ is an elementary process In an experiment the initial partial pressure of A and B are $p_A=0.60$ and $p_B=0.80$ atm when $p_c=0.2$ atm the rate of the reaction relative to the initial rate is

A. $1/48$

B. $1/24$

C. $9/16$

D. $1/6$

Answer: D

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48. The decomposition of A into product has value of k as $4.5x10^3(s)^{-1}$ at 10^oC and energy of activation'60 kj mol^(-1) $. Atw\hat{t}emperaturewo\underline{d}Kbe$1.5 x10^(4) (s)^-1 ?`

A. $12^\circ C$

B. $24^\circ C$

C. $48^\circ C$

D. $36^\circ C$

Answer: B

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49. According to the $Cr_2O_7^{2-} + 5H^+ + 3HNO_2 \rightarrow 2Cr^{3+} + 3NO_3^- + 4H_2O$

The rate of disappearance of $Cr_2O_7^{2-}$ is found to be 2.4×10^{-4} mol $L^{-1}S^{-1}$ find the rate of appearance of Cr^{3+} during given time interval

A. $4.8 \times 10^{-40molL^{-1}s^{-1}}$

B. $5.9 \times 10^{-4}molL^{-1}s^{-1}$

C. $6.2 \times 10^{-4}molL^{-1}s^{-1}$

D. $9.5 \times 10^{-4}molL^{-1}s^{-1}$

Answer: A

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50. In a particular reaction the time required to complete half of the reaction was found to increase 16 times when the initial concentration of the reactant was reduced to one fourth what is the order of the reaction

A. 1

B. 4

C. 2

D. 3

Answer: D

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51. For the reaction A+B $\rightarrow$ C+D doubling the concentration of both the reactants increases the reaction rate by eight times and doubling the concentration of only B simply doubles reaction the rate law is given as

A. $r = k[A]^{1/2}[B]^{1/2}$

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

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

D. $r = [A][B]$

Answer: C

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52. For the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ the rate equation can be express as

$\frac{d[N_2O_5]}{dt} = k[N_2O_5$ and $\frac{d[NO_2]}{dt} = k'[N_2O_5]$ k and k' are related as

A. k = k'

B. 2k = k'

C. k = 2k'

D. k = 4k'

Answer: B

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53. At a certain moment in the reaction $2N_2O_5 \to 4NO_2 + O_2N_2O_5$ is decomposing at the rate 108 mg L^{-1} the production rate of NO_2 is

A. $208mgL^{-1}s^{-1}$

B. $108mgL^{-1}s^{-1}$

C. $56mgL^{-1}s^{-1}$

D. $92mgL^{-1}s^{-1}$

Answer: B

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54. The reaction A → X is a first order reaction which takes place in a vessel with initial concentration of A as 10 M. The rate constant for this reaction is 4.16h^{-1} . In the presence of a catalyst, the reaction A → Y follows second-order kinetics and the rate constant is 0.2 $\min^{-1} M^{-1}$.

What should be the initial concentration of A in the presence of catalyst so that the value of $t_{1/2}$ for both the reactions is the same?

A. 30.0 M

B. 0.5 M

C. 5.0 M

D. 10.0 M

Answer: B

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55. The activation energy of a reaction is 24.0 kcal mol^{-1} at $27^{\circ}C$ and the presence of catalyst changes its activation energy to one-fourth at the same temperature. The approximate ratio of rate in the presence of catalyst to rate in the absence of catalyst will be (use R = 2 cal $mol^{-1}K^{-1}$).

A. 1.0×10^4

B. 1.0×10^3

C. 2.07

D. 1.0×10^{13}

Answer: D

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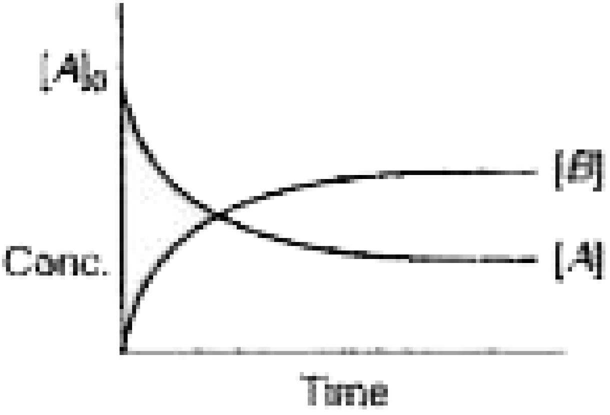
Level - III (Single Correct Answer Type)

1. At the intersection point of two curves $nA \to mB$, the concentration of B can be given by assume first order :



A. $\frac{m}{m+n}[A]_0$

B. $\frac{m}{n}[A_0]$

C. $\frac{m}{m-n}[A_0]$

D. $\frac{n}{m+n}[A_0]$

Answer: A

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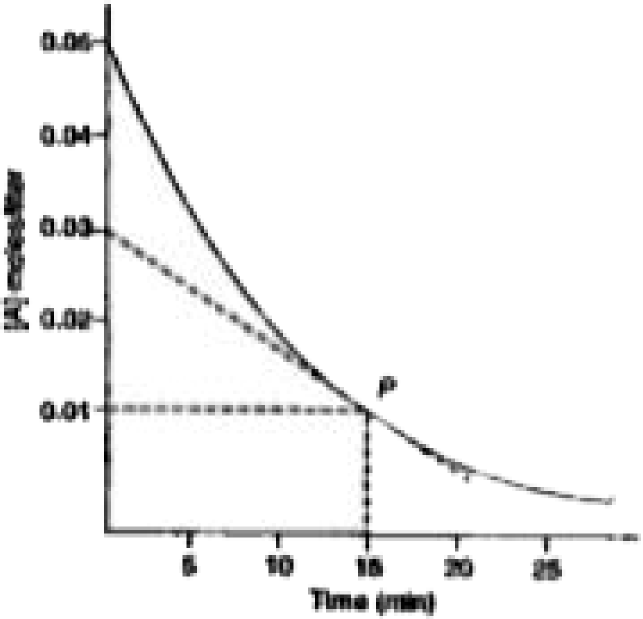
2. For a reaction $A \rightarrow$ Product, [A] is plotted against time as shown in the following figure :



The rate of reaction after reaction aftr 15 min is

A. $1.2 \times 10^{-4} M \min^{-1}$

B. $2.67 \times 10^{-4} M \min^{-1}$

C. $6.67 \times 10^{-4} M \min^{-1}$

D. $1.33 \times 10^{-4} M \min^{-1}$

Answer: D

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3. The reaction, $2N_2O_{5(g)} \rightarrow 4NO_{2(g)} + O_{2(g)}$ follows first-order kinetics. The pressure of a vessel containing only N_2O_5 was found to increase from 50 mn hg to 87.5 mm Hg in 30 min. The pressure exerted by the gas after 60 min will be (assume temperature remains constant) :

A. 106.25 mm Hg

B. 116.25 mm Hg

C. 125 mm Hg

D. 150 mm Hg

Answer: A

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4. The rate constant for a first order reacion is $3.2 \times 10^{-5} s^{-1}$ at a particular temperature. What percentage of reactants will react on heating for 1.5 h ?

A. $16.5\,\%$

B. 20.3%

C. 19.2%

D. 15.9%

Answer: D

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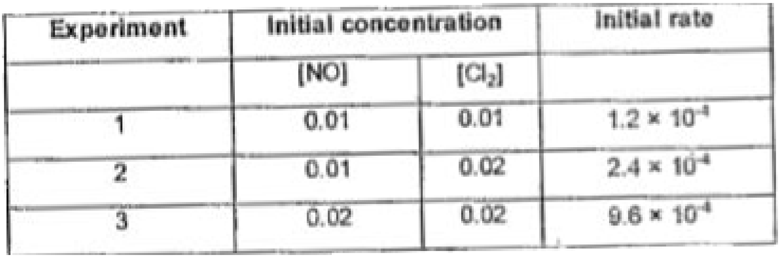
5. For the reaction, $2NO + Cl_2 \rightarrow 2NOCl$ at 300 K, following data are obtained



Experiment	Initial concentration		Initial rate
	[NO]	$[Cl_2]$	
1	0.01	0.01	1.2×10^{-4}
2	0.01	0.02	2.4×10^{-4}
3	0.02	0.02	9.6×10^{-4}

The specific rate constant will be

A. $1.2 \times 10^2 mol^{-2} L^2 s^{-1}$

B. $2.5 \times 10^2 mol^{-2} L^2 s^{-1}$

C. $3.2 \times 10^2 mol^{-2} L^2 s^{-1}$

D. $4.2 \times 10^2 mol^{-2} L^2 s^{-1}$

Answer: A

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6. For a first-order reaction $A \rightarrow P$, the temperature (T) dependent rate constant (k) was found to follow the equation, log k $= -(2000)\frac{1}{T} + 6.0$.

The pre-expontential factor A and activation energy E_a, respectively, are

A. $1.0 \times 10^6 s^{-1}$ and $9.2 kJ mol^{-1}$

B. $6.0 s^{-1}$ and $16.6 kJ mol^{-1}$

C. $1.0 \times 10^6 s^{-1}$ and $16.6 kJ mol^{-1}$

D. $1.0 \times 10^6 s^{-1}$ and $38.3 kJ mol^{-1}$

Answer: D

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7. A gas phase decomposition of dimethyl either follows the 1st order kinetics $CH_3OCH_3CH_3OCH_3 \leftrightarrow CH_4(g) + H_2 \_ (g) + CO_{(g)}$. The reaction is carried out in a costant volume container at (500^oC) and has a half life period of 14.5 (min). Initially only dimethyl ether is present at a pressure of 0.4 atmosphere. What is the total pressure of the system after 12 (min) ? Assume Ideal behaviour

A. 0.9833 atm

B. 1.201 atm

C. 0.7488 atm

D. 2.031 atm

Answer: C

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8. The ionization constant of NH_4^+ in water is 5.6×10^{-10} at $25^\circ C$. The rate constant for the reaction of NH_4^+ and OH^- to form NH_3 and

H_2O at $25^\circ C$ is $3.4 \times 10^{-10} Lmol^{-1}s^{-1}$. Calculate the rate constant for proton transfer from water of NH_3.

A. $6.07 \times 10^5 s^{-1}$

B. $12.03 \times 10^5 s^{-1}$

C. $9.82 \times 10^5 s^{-1}$

D. $16.34 \times 10^5 s^{-1}$

Answer: A

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9. The following mechanism has been proposed for the reaction of (NO) with $(Br)_2$ to form $NOBr$.

$(NO)(g) + (Br)_2(g) \leftrightarrow (NOBr)_2(g). NOBr2(g) + NO(g) = 2NOBr(g)$

.

$Ifthe2ndstepistherate \det er \min \in gstep, the \text{ or } derofthereactionwith$

(NO)(g)` is

A. 1

B. 0

C. 3

D. 2

Answer: D

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10. In a certain reaction B^{n+} is getting converted to $B^{(n+4)^+}$ in solution. The rate constant of this reaction is measured by titrating a volume with a reducing agent which reacts only with B^{n+} and $B^{(n+4)^+}$. In the process it converts B^{n+} to $B^{(n-2)^+}$ and $B^{(n+4)^+}$ to $B^{(n-1)^+}$. At, t = 0 the volume of reagent consumed is 25 mL and at t = 10 min, the volume used is 32 mL. Calculate the rate constant for the conservation of B^{n+} to $B^{(n+4)^+}$ assuming it to be a first order reaction.

A. $2.07 \times 10^{-2} \text{min}^{-1}$

B. $2.07 \times 10^{-4} \text{min}^{-1}$

C. $5.36 \times 10^{-2} \text{min}^{-1}$

D. $5.36 \times 10^{-4} \text{min}^{-1}$

Answer: A

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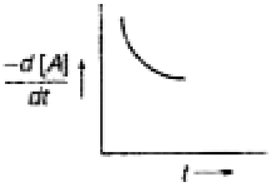
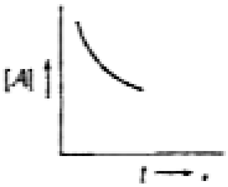
Level - III (Multiple Correct Answer Type)

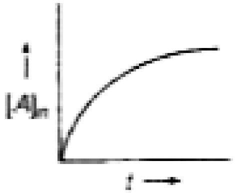
1. Which of the following plots are correct made for the reaction $nA \Leftrightarrow A_n$, if it obeys I^{st} order reaction ?

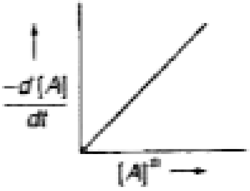
A.



B.



C. 

D. 

Answer: A::B::C::D

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2. Which of the following statements are true according to collision theory of reaction rates ?

A. Collision of molecules is a precondition for any reaction to occur

B. Molecules which have acquired the energy of activation can collide effectively

C. Only activated collisions result in the formation of the products

D. All collisions result in the formation of the products.

Answer: A::B::C

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3. For the reaction $A \rightarrow B$, the rate law expression is : Rate = k[A]

Which of the following statements are correct ?

A. The reaction is said to follow first order kinetics

B. The rate law provides a simple way of predicting the concentration of reactants and products at any time after the start of the reaction

C. k is constant for the reaction at a constant temperature

D. The half life of the reaction will depend on the initial concentration of the reactant

Answer: A::B::C

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4. Which of the following statements about the Arrhenius equation are correct ?

A. The pre exponential factor becomes equal to the rate constant of the reaction at temperature $T \to \infty$

B. When the activation energy of the reaction tends to zero, the rate becomes independent of tempreature.

C. The term $-E_a/RT$ repersents the fractions of the molecules having energy is excess of the threshold value.

D. On raising temperature, rate constant of the reaction of greater activation energy increases less rapidly than that of the reaction of smaller activation energy.

Answer: A::B::C

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5. For a gaseous reaction : $A_{(g)} \rightarrow B_{(g)}$, the expression may be given as

:

A. $-\frac{d[A]}{dt} = K[A]^n$

B. $-\frac{1}{V}\frac{dn_A}{dt} = K[A]^n$

C. $-\frac{1}{RT}\frac{dP_A}{dt} = K[A]^n$

D. $-\frac{dP}{dt} = K[P_A]^n$

Answer: A::B::C::D

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6. The rate expression for the reaction : $NH_4CNO \Leftrightarrow NH_2CONH_2$ can be derived from the mechanism :

(i) $NH_4CNO \underset{K_2}{\overset{K_1}{\Longleftrightarrow}} NH_4NCO$ (Fast) (ii) $NH_4NCO \overset{K_3}{\Longleftrightarrow} NH_3 + HNCO$ (Fast)

(iii) $NH_3 + HNCO \overset{K_4}{\Longleftrightarrow} NH_2CONH_2$ (Slow)

Which of the following statements are correct about rate expression ?

A. $\frac{d[\text{urea}]}{dt} = \frac{K_1K_3}{K_2}[NH_4CNO]$

B. $\frac{d[\text{urea}]}{dt} = \times \frac{K_1K_3}{K_2K_4}[NH_4CNO]$

C. $\frac{d[\text{urea}]}{dt} = K[NH_4CNO]$

D. $\frac{d[\text{urea}]}{dt} = \times \frac{K_1 \times K_2}{K_3 \times K_4}[NH_4CNO]$

Answer: A::C

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7. The rate of formation for $C_6H_6 + 3H_2 \underset{K_b}{\overset{K_f}{\Longleftrightarrow}} C_6H_{12}$ for the forward reaction is first order with respect to C_6H_6 and H_2 each. Which are correct ?

A. $K_c = \frac{K_f}{K_b}$

B. $K_c = \frac{[C_6H_{12}]}{[C_6H_6][H_2]^3}$

C. $r_f = K_f[C_6H_6][H_2]$

D. $r_b = K_b[C_6H_{12}][H_2]^{-2}$

Answer: A::B::C::D

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8. For the first order reaction, $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$

A. the concentration of the reactant decreases exponentially with time

B. the half-life of the reaction decreases with increasing temperature

C. the half-life of the reaction depends on the initial concentration of the reactant

D. the reaction proceeds to 99.61% completion in eight half -life duration

Answer: A::B::D

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9. Which of the following statements are correct (A) The fractional-order reaction cannot take place in one elementary step.

(B) In a fraction involving more than one elementary reaction, the slowest elementary step is the rate determining reaction.

(C) The radioactive decay always follows first order kinetics.

(D) The decay constant of radioactive disintegration is temperature independent.

A.

B.

C.

D.

Answer: a,b,c,d

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10. The rate constant of a reaction is given by , $k = 2.1 \times 10^{10}$ exp (-2700/RT). It means that,

A. log k vs. 1/T will be a straight line with slop = -2700/2.303 R.

B. log k vs. 1/T will be straight line with intercept on log k axis $= 2.1 \times 10^{10}$.

C. the number o effective collisions is $2.1 \times 10^{10} cm^{-3} s^{-1}$.

D. half-life of the reaction increases with increases of temperature

Answer: A::B

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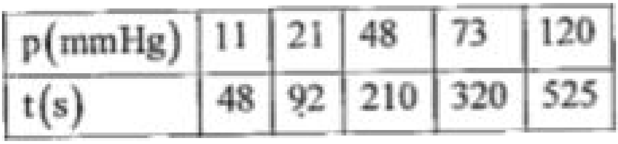
11. The half-period 't' for the decomposition of ammonia on tungsten wire was measured for different initial pressure p of ammonia at $25^{\circ} C$. Then,



p(mmHg)	11	21	48	73	120
t(s)	48	92	210	320	525

A. it is a zero-order reaction.

B. it is a first-order reaction

C. rate constant for reaction is $0.114s^{-1}$

D. rate constant for reaction is 1.14 s

Answer: A::C

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Level - III (Numerical Type)

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

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2. Starting with one mole of a compound A, it is found that the reaction is 3/4 completed in 1 hour. Calculated the rate constant if the reaction if the reaction is of II order.

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3. In the reaction $A \rightarrow$ Products, when start is made from $8.0 \times 10^{-2} M$ of A, half-life is found to be 120 minute. For the initial concentration $4.0 \times 10^{-2} M$, the half-life of the reaction becomes 240 minute. The order of the reaction is :

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4. An organic compound undergoes first-order decomposition. The time taken for this its decomposition to 1/8 and 1/10 of its initial concentration are $t_{1/8}$ and $t_{1/10}$ respectively. What is the value of $\frac{[t_{1/8}]}{[t_{1/10}]} \times 10$?

(Take log 2 = 0.3)

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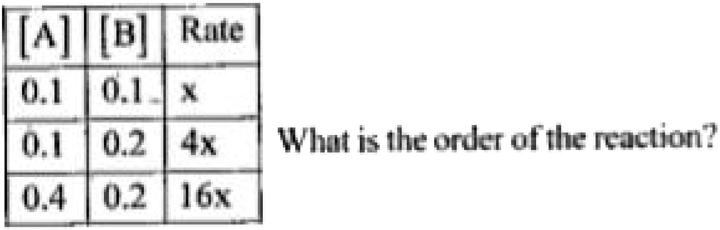
5. $A + B \rightarrow$ products



[A]	[B]	Rate
0.1	0.1	x
0.1	0.2	4x
0.4	0.2	16x

What is the order of the reaction?

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6. A hydrogenation reaction is carried out at 500 K. If the same reaction is carried out in presence of a catalyst at the same rate, the temperature required is 400 K. The activation energy of the reaction, if the catalyst lowers the activation energy barrier by 20 kJ mol^{-1} is .... $\times 10^2 kJmol^{-1}$.

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7. For the reaction, $2NO + H_2 \rightarrow N_2O + H_2O$, the rate of reaction was found to be $1.56 Pas^{-1}$ for a pressure of 373 Pa of NO and 0.25 Pa s^{-1} for a pressure of 152 Pa of NO. The pressure of H_2 being constant. If pressure of NO was kept constant, the rate of reaction was found $1.60 Pas^{-1}$ for a pressure of H_2 289 Pa and $0.79 Pas^{-1}$ for a pressure of 144 Pa of H_2. Calculate the order of reaction.

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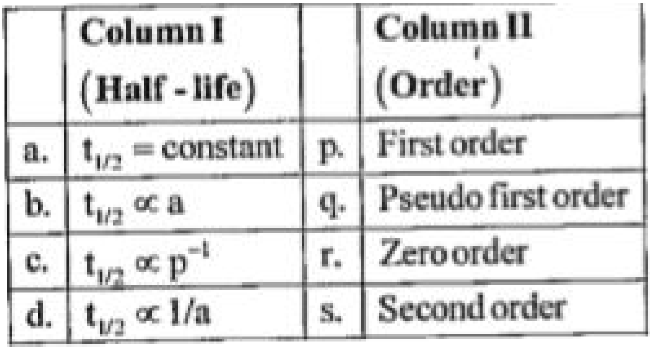
Level - III (Matching Column Type)

1. Match the following column :



	Column I (Half - life)		Column II (Order)
a.	$t_{1/2}$ = constant	p.	First order
b.	$t_{1/2} \propto a$	q.	Pseudo first order
c.	$t_{1/2} \propto p^{-1}$	r.	Zero order
d.	$t_{1/2} \propto 1/a$	s.	Second order

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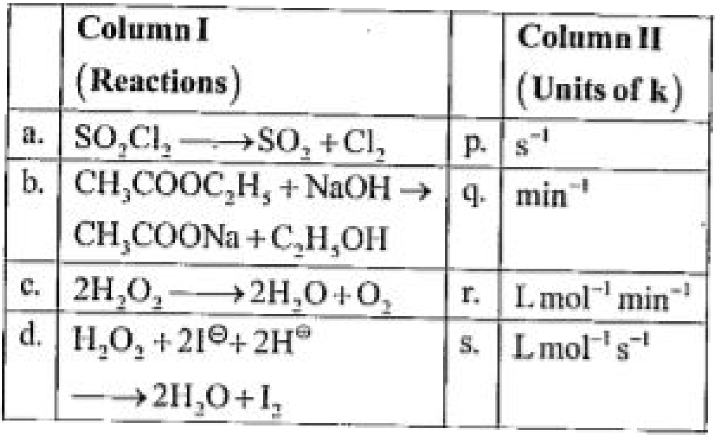
2. Match the following columns



	Column I (Reactions)		Column II (Units of k)
a.	$SO_2Cl_2 \longrightarrow SO_2 + Cl_2$	p.	s^{-1}
b.	$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$	q.	min^{-1}
c.	$2H_2O_2 \longrightarrow 2H_2O + O_2$	r.	$L\,mol^{-1}\,min^{-1}$
d.	$H_2O_2 + 2I^{\ominus} + 2H^{\oplus} \longrightarrow 2H_2O + I_2$	s.	$L\,mol^{-1}\,s^{-1}$

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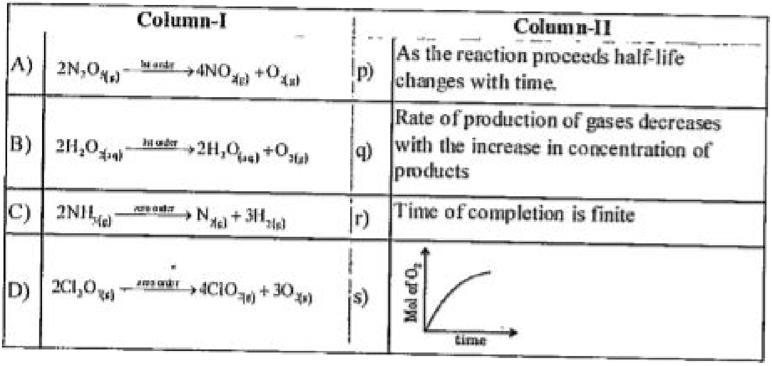

	Column-I		Column-II
A)	$2N_2O_{5(g)} \xrightarrow{\text{Ist order}} 4NO_{2(g)} + O_{2(g)}$	p)	As the reaction proceeds half-life changes with time.
B)	$2H_2O_{2(aq)} \xrightarrow{\text{Ist order}} 2H_2O_{(aq)} + O_{2(g)}$	q)	Rate of production of gases decreases with the increase in concentration of products
C)	$2NH_{3(g)} \xrightarrow{\text{zero order}} N_{2(g)} + 3H_{2(g)}$	r)	Time of completion is finite
D)	$2Cl_2O_{7(g)} \xrightarrow{\text{zero order}} 4ClO_{2(g)} + 3O_{2(g)}$	s)	

3.

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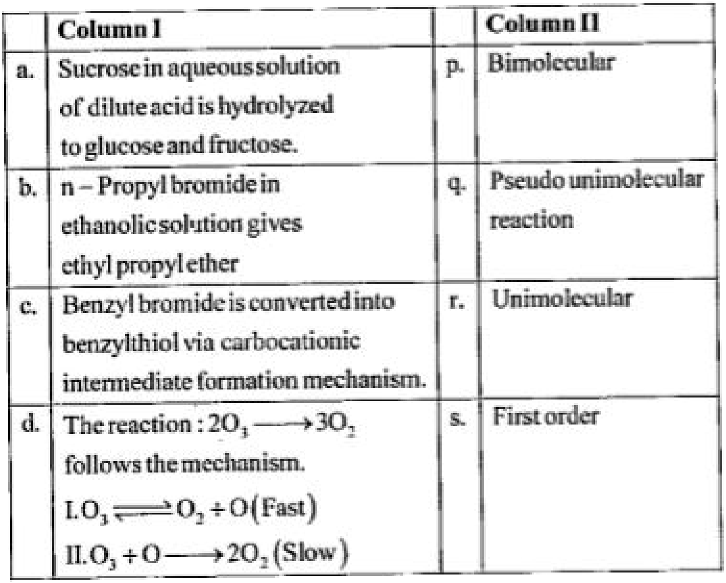
4. Match the column 1 with column 2



	Column I		Column II
a.	Sucrose in aqueous solution of dilute acid is hydrolyzed to glucose and fructose.	p.	Bimolecular
b.	n – Propyl bromide in ethanolic solution gives ethyl propyl ether	q.	Pseudo unimolecular reaction
c.	Benzyl bromide is converted into benzylthiol via carbocationic intermediate formation mechanism.	r.	Unimolecular
d.	The reaction : $2O_3 \longrightarrow 3O_2$ follows the mechanism. I. $O_3 \rightleftharpoons O_2 + O$ (Fast) II. $O_3 + O \longrightarrow 2O_2$ (Slow)	s.	First order

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Level - III (Statement Type)

1. Statement 1: According to the transition state theory, for the formation of an activated complex, one of the vibrational degree of freedom is converted into the translational degree of freedom.

Statement 2: The energy of the activated complex is higher than the energy of the reactant molecules.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement is True, Statement 2 is False.

D. Statement is False, Statement 2 is True.

Answer: B

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2. Assertion : For a 2nd order reaction A+B $\rightarrow$ Product, the rate can be given as: $K[A]^2$or $K[A][B]$ or $K[B]^2$.

Reason: Either [A] or [B] may or may not influence the rate of reaction.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement is True, Statement 2 is False.

D. Statement is False, Statement 2 is True.

Answer: A

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3. Assertion If in a zero order reaction, the concentration of the reactant is doubled. The half-life period is also doubled.

Reason: For a zero order reaction, the rate of reaction is independent of initial concentration.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement is True, Statement 2 is False.

D. Statement is False, Statement 2 is True.

Answer: B

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4. Assertion :According to steady state hypothesis,in a multistep reaction, the change in concentration with time for reactive intermediates is zero.

Reason: The intermediates are so reactive that after a brief initial period their concentrations rise from zero to a small value and remains constant for most of the duration of reaction.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement is True, Statement 2 is False.

D. Statement is False, Statement 2 is True.

Answer: A

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5. Statement 1: A catalyst increases the rate of reaction without itself undergoing any permanent chemical change.

Statement 2: A catalyst changes the Gibbs energy (ΔG) of the reaction and equilibrium constant of the reaction.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement is True, Statement 2 is False.

D. Statement is False, Statement 2 is True.

Answer: C

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6. Assertion :E_a of the forward reaction is higher than that backward reaction in a reversible endothermic reaction. Reason: Increasing the temperature of the substance increase the fraction of molecules which collide with energies greater than E_a .

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement is True, Statement 2 is False.

D. Statement is False, Statement 2 is True.

Answer: B

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Level - III (Linked Comprehension Type)

1. Many thermal decomposition and isomerization reaction follows the mechanism given below :

(i) $A+M \underset{k_{-1}}{\overset{k_1}{\Longleftrightarrow}} A+M$ (ii) $A \xrightarrow{k_2}$ prducts

Where A represents the molecule undergoing the thermal decomposition or isomerization reaction, and M represents any other moelcule.

Steady state rate law will be :

A. $\dfrac{d[\text{Product}]}{dt}=\dfrac{k_2k_1[A]}{k_{-1}[M]+k_2}$

B. $\dfrac{d[\text{Product}]}{dt}=\dfrac{k_2k_1[A][M]}{k_{-1}}$

C. $\dfrac{d[\text{Product}]}{dt}=\dfrac{k_2k_1[A][M]}{k_{-1}[M]+k_2}$

D. none of these

Answer: C

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2. Many thermal decomposition and isomerization reaction follows the mechanism given below :

(i) $A+M \underset{k_{-1}}{\overset{k_1}{\Longleftrightarrow}} A+M$ (ii) $A \xrightarrow{k_2}$ prducts

Where A represents the molecule undergoing the thermal decomposition or isomerization reaction, and M represents any other moelcule.

Steady state rate law will be :

A. zero

B. second

C. first

D. none of these

Answer: C

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3. Many thermal decomposition and isomerization reaction follows the mechanism given below :

(i) $A+M \underset{k_{-1}}{\overset{k_1}{\Longleftrightarrow}} A+M$ (ii) $A \xrightarrow{k_2}$ prducts

Where A represents the molecule undergoing the thermal decomposition or isomerization reaction, and M represents any other moelcule.

Steady state rate law will be :

A. the backward reaction rate constant k_{-1} has a large value and step (i) represents a rapid equilibrium reacton

B. the conc. of M may be high for gaseous phase reaction, this condition may be realized at high gaseous pressure

C. the rate constant k_2 has a value and setp (ii) is rate determining setp

D. all of the above

Answer: D

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4. During hydrolysis of ester is acidic medium ester $+H_2O \xrightarrow{H^+}$ acid + alcohol rate law is given as r = k[ester] $\left[H^+\right]$ and volume of base used at difference time intervals is given as at pH = 3

t (in sec)	0	10	∞
V_b(in mL)	50	100	150

Half life of the reaction at pH = 3 will be :

A. 10 sec

B. 60 min

C. 60 sec

D. 20 sec

Answer: A

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5. During hydrolysis of ester is acidic medium ester $+H_2O \xrightarrow{H^+}$ acid + alcohol rate law is given as r = k[ester] $\left[H^+\right]$ and volume of base used at difference time intervals is given as at pH = 3

t (in sec)	0	10	∞
V_b(in mL)	50	100	150

Value of rate constant at 'k' will be :

A. $69.3\,\text{sec}^{-1}$

B. $6.93\times10^{-2}\,\text{sec}^{-1}$

C. $69.3M^{-1}\,\text{sec}^{-1}$

D. $6.93\times10^{-2}M^{-1}\,\text{sec}^{-1}$

Answer: C

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6. During hydrolysis of ester is acidic medium ester $+H_2O\xrightarrow{H^+}$ acid + alcohol rate law is given as r = k[ester] $\left[H^+\right]$ and volume of base used at difference time intervals is given as at pH = 3

t (in sec)	0	10	∞
V_b(in mL)	50	100	150

For same initial concentration of ester and at same temperature, volume of base and used when 50% of ester will be hydrolysis at pH = 4 :

A. 100 mL

B. 65 mL

C. 55 mL

D. 45 mL

Answer: C

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7. Population growth of humans and bacteria follows first order growth kinetics. Suppose 100 bacteria are placed containing nutrients for the bacteria so that they can multiply. A study at $35^\circ C$ gave the following results :

Time (minutes)	0	15	30	45	60
Number of bacteria	100	200	400	800	1600

The rate constant for the first order growth of bacteria can be calculated using :

A. $k=\frac{2.303}{t}\log_{10}\left(\frac{a}{a-x}\right)$

B. $k=-\frac{2.303}{t}\log\left(\frac{a}{a+x}\right)$

C. $k=\frac{0.693}{t}$ log

D. $k=\frac{x}{t}$

Answer: B

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8. Population growth of humans and bacteria follows first order growth kinetics. Suppose 100 bacteria are placed containing nutrients for the bacteria so that they can multiply. A study at $35^{\circ}C$ gave the following results :

Time (minutes)	0	15	30	45	60
Number of bacteria	100	200	400	800	1600

Unit of rate constant for first order growth is :

A. min^{-1}

B. min^2

C. min^{-3}

D. unitless

Answer: A

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9. Population growth of humans and bacteria follows first order growth kinetics. Suppose 100 bacteria are placed containing nutrients for the bacteria so that they can multiply. A study at $35^{\circ}C$ gave the following results :

Time (minutes)	0	15	30	45	60
Number of bacteria	100	200	400	800	1600

At what time, there will be 6400 bacteria in the flask ?

A. 150 min

B. 90 min

C. 160 min

D. 120 min

Answer: B

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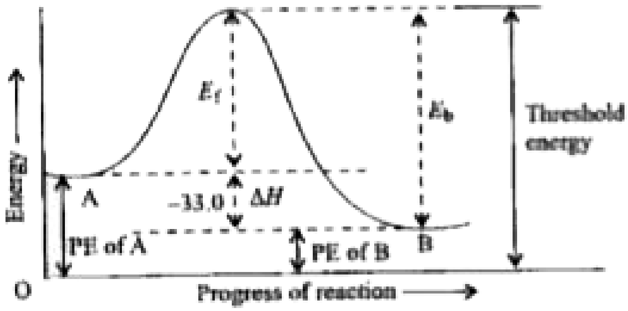
10. The energy change accompanying the equilibrium reaction $A \Leftrightarrow B$ is $-33.0 kJ mol^{-1}$.



Assuming that pre-exponential factor is same for forward and backward reaction answer the following :

The energy of activation for forward and backward reaction (E_f and E_b) at 300 K. Given that E_f and E_b are in the ratio 20:31,

A. 69, 93

B. 60, 93

C. 93, 60

D. 90, 60

Answer: B

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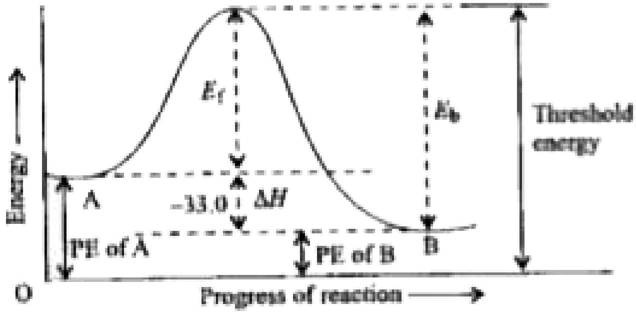
11. The energy change accompanying the equilibrium reaction $A \Leftrightarrow B$ is $-33.0 kJmol^{-1}$.



Assuming that pre-exponential factor is same for forward and backward reaction answer the following :

The threshold energy of the reaction is when PE of B is $30 kJmol^{-1}$. Given that ratioo of forward reaction and backward reaction is that of 20:31

A. 130

B. 140

C. 123

D. 125

Answer: C

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