CHEMISTRY

PHYSICAL, INORGANIC, AND ORGANIC CHEMISTRY

CHEMICAL KINETICS

Physical Chemitry Chemical Knietics Radioactivity

1. The half-life of decomposition of gaseous CH_3CHO at initial pressure of $365mm$ and $170mm$ of Hg were $420\,\text{sec}$ and $880\,\text{sec}$ respectively. The order of the reaction is:

A. 2

B. 4

C. 6

D. 8

Answer: 1

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2. A reaction, which is second order,has a rate constant of $0.002 L mol^{-1} s^{-1}$. If the initial cond. Of the reactant is $0.2M$. How long will it take for the concentration to become $0.0400M$?

A. $1000s$

B. $400s$

C. $200s$

D. $10,000s$

Answer: 4

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3. In the following reaction $A \rightarrow B + C$, rate constant is $0.001Ms^{-1}$. If we start with $1M$ of A then , cond, of A and B after 10 minutes are respectively.

A. $0.5M, 0.5M$

B. $0.6M, 0.4M$

C. $0.4M, 0.6M$

D. none of these

Answer: 3

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4. For the reaction $A \rightarrow$ products , the graph of the fraction of A remaining as a function of time $(x -$ axis) is a straight line with $-ve$ slpe . The order of the reaction is therefore

A. 1

B. 2

C. zero

D. -1

Answer: 3

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5. For the zero order reaction $A \rightarrow B + C$, initial concentration of A is $0.1A$. If $A = 0.08M$ after 10 minutes, then it's half $-$ life and completion time are respectively :

A. 10 min, 20 min

B. 2×10^{-3} min, 10^{-3} min

C. 25 min, 50 min

D. 250 min, 500 min

Answer: 3

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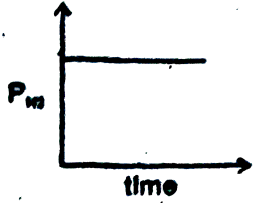
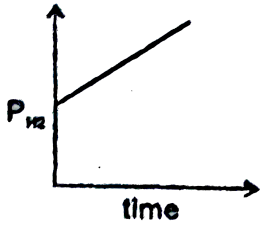
6. Decomposition of $Hl(g)$ on Gold surface is zero order reaction. Initially, few moles of H_2 are present in container then which of the following graph is correct ?

A.



B.



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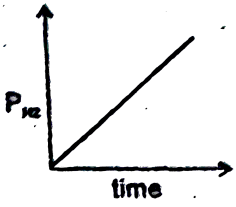
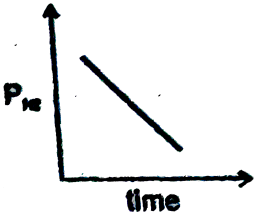


D.



Answer: 2

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7. Which of the following statement is incorrect ?

A. Unit of rate of disappearance is Ms^{-1}

B. Unit of rate of reaction is Ms^{-1}

C. Unit of rate constant k is depend on order

D. Unit of k for first order reaction is Ms^{-1}

Answer: 4

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8. The rate expression for reaction $A(g) + B(g) \rightarrow C(g)$ is rate $= k[A]^{1/2}[B]^{2}$. What

change in rate if initial concentration of A and B increases by factor 4 and 2 respectively ?

A. 4

B. 6

C. 8

D. None of these

Answer: 3

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9. $2NO + 2H_2 \rightarrow N_2 + 2H_2O$. The experimental rate law for above reaction is , Rate $= k[NO]^2[H_2]$. When

time is in minutesand the concentration is in moles $/L$

, the units for k are

A. $\frac{\text{moles}^3}{L^3 - \text{min}}$

B. $\frac{\text{moles}}{L - \text{min}}$

C. $\frac{\text{moles}^2}{L^2 - \text{min}}$

D. $\frac{L^2}{\text{moles}^2 - \text{min}}$

Answer: 4

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10. ${}_{Z}^{M}A(g) \rightarrow {}_{Z-4}^{M-8}B(g) + (\alpha -$ particles $)$

$(\alpha -$ particles are helium nuclei, so will form helium

gas by trapping electrons)

The radioactive disintegration follows first $-$ order kinetics Starting with 1 mol of A in a 1- litre closed flask at $27^{\circ}C$ pressure developed after tow half- lives is approximately.

A. 25 atm

B. 12 atm

C. 61.5 atm

D. 40 atm

Answer: 3

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11. The reaction $A(g) + 2B(g) \rightarrow C(g) + D(g)$ is an elementary process. In an experiment involvig this reaction, the initial partial pressure of A and B are $p_A = 0.60atm$ and $p_B = 0.80atm$, respectively. When $p_C = 0.20atm$, the rate of reaction relative to the initial rate is

A. $\frac{1}{6}$

B. $\frac{1}{48}$

C. $\frac{1}{4}$

D. $\frac{1}{24}$

Answer: 1

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12. For the reactions :

$$4KClO_3 \rightarrow 3KClO_4 + KCl$$

if $$-\frac{d[KClO_3]}{dt} = k_1[KClO_3]^4$$

$$\frac{d[KClO_4]}{dt} = k_2[KClO_3]^4$$

$$\frac{d[KCl]}{dt} = k_3[KClO_3]^4$$

the correct relation between k_1, $k_2 \& k_3$ is :

A. $k_1 = k_2 = k_3$

B. $4k_1 = 3k_2 = k_3$

C. $3k_1 = 4k_2 = 12k_3$

D. none of these

Answer: C

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13. Half lives of decomposition of NH_3 on the surface of a catalyst for different initial pressure are given as :

$P(\text{torr})$	200	300	500
$t_{1/2}$	10	15	25

The order of the reaction is $-$

A. 2

B. 0

C. 1

D. 0.5

Answer: 2

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14. In the reaction $A \rightarrow$ products, time required to complete $50\ \%$ reaction was found to increase 9 times when the initial concentration of the reactant was decreased to one third. The rate law equation is :

A. $-\frac{d(A)}{dt} = K(A)^{1/2}$

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

C. $-\frac{d(A)}{dt} = K(A)^{2}$

D. $-\frac{d(A)}{dt} = K(A)^{3}$

Answer: D

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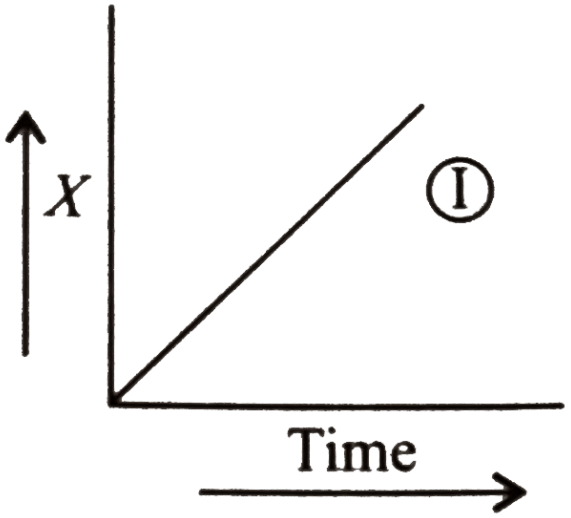
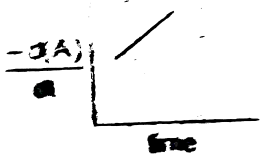
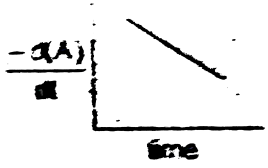
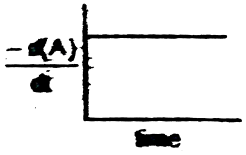
15. The graph between concentration (X) of the Product and time of the reaction $A \rightarrow B$ is of the type 1. Hence, graph between $-\frac{d[A]}{dt}$ and time will be of the type:



A.

B. 

C. 

D. 

Answer: 4

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16. The rate constant of the reaction $A \rightarrow 2B$ is 1.0×10^{-3} mol lit^{-1} min^{-1}, if the initial

concentration of A is 1.0 mole lit^{-1} . What would be the concentration of B after 100 minutes.

A. $0.1 \quad \text{mol lit}^{-1}$

B. 0.2mol lit^{-1}

C. $0.9 \quad \text{mol lit}^{-1}$

D. 1.8mol lit^{-1}

Answer: C

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17. At $227^{\circ}C$, the presence of catalyst causes the activation energy of a reaction to decrease by

$4.606 Kcal$. The rate of the reaction will be increased by : $-$

A. 2 times

B. 10 times

C. 100 times

D. 1000 times

Answer: 3

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18. Half life of reaction $: H_2O_2(aq) \rightarrow H_2O(l) + \frac{1}{2}O_2(g)$is independent of

initial concentration of H_2O_2 volume of O_2 gas after 20 minute is $5L$ at $1atm$ and $27^\circ C$ and after completion of reaction is $50L$. The rate constant is :

A. $\frac{1}{20}\log 10 min^{-1}$

B. $\frac{2.303}{20}\log 10 min^{-1}$

C. $\frac{2.303}{20}\log.\ \frac{50}{45} min^{-1}$

D. $\frac{2.303}{20}\log.\ \frac{45}{50} min^{-1}$

Answer: 3

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19. A first $-$ order reaction is $20\,\%$ complete in 10 minutes. Calculate the rate constant of the reaction.

A. $0.223 min^{-1}$

B. $0.0322 min^{-1}$

C. $1.023 min^{-1}$

D. $0.123 min^{-1}$

Answer: 2

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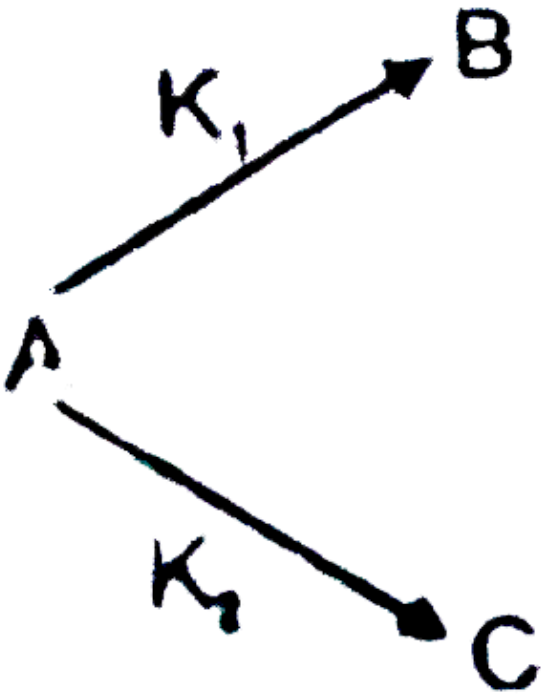
20. A subtance undergoes first order decomposition involving two parallel first order reaction as :



The mole percent of B in the products is :

A. 23.17

B. 76.68

C. 30.16

D. 69.84

Answer: 2

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21. A reaction $A_2 + B \rightarrow$ products, involves the following mechanism :

$A_2 \Leftrightarrow 2A(\text{Fast})$ (A being the intermediate)

$A + B \underset{k_2}{\longrightarrow}$ products (slow). The rate law consistant to this mechanism is :

A. rate $= K[A_2][B]$

B. rate $= K[A_2]^2[B]$

C. rate $= K[A_2]^{1/2}[B]$

D. rate $= K[A_2][B]^2$

Answer: 3

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22. In a 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 :

A. zero

B. one

C. two

D. 0.5

Answer: 3

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23. A catalyst lowers the enrgy of activation by $25\,\%$, temperature at which rate of uncatalysed reaction will be equal to that of the catalyst one at $27^{\circ}C$ is :

A. $400^{\circ}C$

B. $127^{\circ} C$

C. $300^{\circ} C$

D. $227^{\circ} C$

Answer: 2

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24. Half life of a first order reaction is 69.3 minutes. Time required to complete $99.9\,\%$ of the reaction will be :

A. 693 minutes

B. 999 minutes

C. 99.9 minutes

D. 691 minutes

Answer: 4

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25. Gasesous cyclobutane isomerizes to butadiene following first order process which has half life of 150.5 minute at certain temperature. How long will take for the process to occur to the extent of $40\ \%$ at the same temperature ?

A. 103 minutes

B. 121 minutes

C. 111 minutes

D. None of these

Answer: 3

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26. For a first order for the reaction $A \rightarrow$ products : the rate of reaction at $[A] = 0.2M$ is $1.0 \times 10^{-3} molL^{-1}s^{-1}$. The reaction will occur to $75\,\%$ completion in .

A. 138.65

B. $277.2s$

C. 44.25

D. 822.5

Answer: 2

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27. The rate constant for the reaction $2N_2O_5 \rightarrow 4NO_3 + O_2$ is $3.0 \times 10^{-4}s^{-1}$. If start made with $1.0molL^{-1}$ of N_2O_5. Calculate the rate of formation of NO_2 at the moment of the reaction when concentration of O_2 is $0.1molL^{-1}$

A. $2.7 \times 10^{-4} molL^{-1}s^{-1}$

B. $2.4 \times 10^{-4} molL^{-1}s^{-1}$

C. $4.8 \times 10^{-4} molL^{-1}s^{-1}$

D. $9.6 \times 10^{-1} molL^{-1}s^{-1}$

Answer: 4

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28. The decomposition of N_2O into N_2 and O_2 in presence of gaseous argon follows second order kinetics with rate constant, $K = 2.0 \times 10^{11} e^{-30000K/T} mol^{-1}s^{-1}$.

The pre − exponential factor and the enrgy of activation are respectively $\left(R = 2calK^{-1}mol^{-1}\right)$

A. $2.0 \times 10^{8} Lmol^{-1}s^{-1}, 30Kcalmol^{-1}$

B. $2.0 \times 10^{8} Lmol^{-1}s^{-1}, 60Kcalmol^{-1}$

C. $2.0 \times 10^{11} Lmol^{-1}s^{-1}, 60Kcalmol^{-1}$

D. None of these

Answer: 3

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29. The rate of a heterogeneous reaction (as iron (solid) any oxygen gas) does not depend on:

A. concentration of reactants

B. surface area of reactants

C. pressure of reactant gases

D. potential energy of reactant

Answer: 4

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30. For a chemical reaction $A \rightarrow$ Products, the rate of disappearance of A is given by: $-\frac{dC_A}{dt} = \frac{K_1 C_A}{1 + K_2 C_A}$ At low C_A, the reaction is of the .... Order with rate constant .....: $(\text{Assume} K_1, K_2 \text{are lesser than} 1)$

A. $I, \frac{K_1}{K_2}$

B. I, K_1

C. $II, K_1 / K_2$

D. $II, \frac{K_1}{K_1 + K_2}$

Answer: 2

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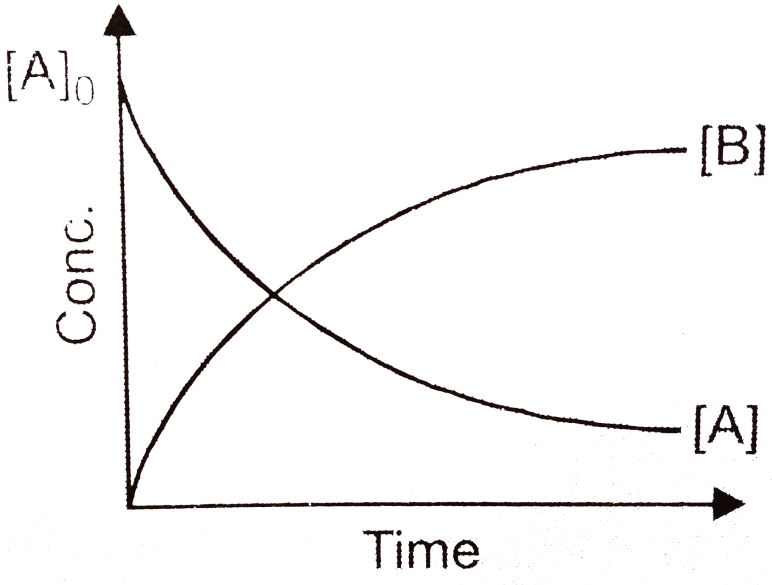
31. At the point of intersection of the two curves shown, the conc. of B is given by ..... for, $A \rightarrow nB$:



A. $\frac{nA_0}{2}$

B. $\frac{A_0}{n-1}$

C. $\frac{nA_0}{n+1}$

D. $\left(\frac{n-1}{n+1}\right)A_0$

Answer: C

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32. The decomposition of N_2O_5 occurs as, $2N_2O_5 \rightarrow 4NO_2 + O_2$ and follows I order kinetics, hence:

A. The reaction is bimolecular

B. The reaction is unimolecular

C. $t_a \propto a^\circ$

D. None of these

Answer: 3

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33. The rate constant for an isomerization reaction, $A \rightarrow B$ is $4.5 \times 10^{-3}\ \mathrm{min}^{-1}$. If the initial concentration of A is $1M$, calculate the rate of the reaction after $1h$.

A. $0.763M$

B. $1.763M$

C. $2.763M$

D. $0.076M$

Answer: 1

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

$A_2 \Leftrightarrow A + A(\text{fast})$

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

$A + B \rightarrow AB$ (fast)

The order of the overall reaction is

A. 2

B. 1

C. $3/2$

D. zero

Answer: C

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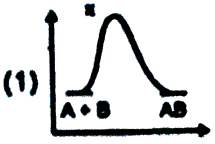
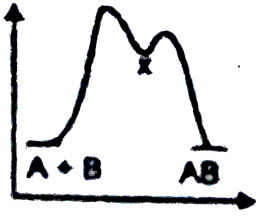
35. For an exothermic chemical process occurring in two as

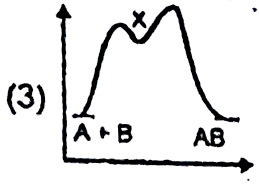
(i) $A + B \rightarrow X$ (slow)

(ii) $X \rightarrow AB$ (fast)

The process of the reaction can be best described by

A. 

B. 

C. 

D. None of these

Answer: 1

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36. For the reaction $2NO_2 + F_2 \rightarrow 2NO_2F$, following mechanism has been provided:

$$NO_2 + F_2 \xrightarrow{\text{slow}} NO_2F + F$$

$$NO_2 + F \xrightarrow{\text{fast}} NO_2F$$

Thus rate expression of the above reaction can be writtens as:

A. $r = k[NO_2]^2[F_2]$

B. $r = k[NO_2]$

C. $r = k[[NO_2][F_2]$

D. $r = k[F_2]$

Answer: 3

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37. For the reaction,

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

The rate expression can be written in the following ways:

$$\frac{d[N_2]}{dt} = k_1[NO][H_2], \frac{d[H_2O]}{dt} = k_2[NO][H_2]$$

$$-\frac{d[NO]}{dt} = k_3[NO][H_2], \; -\frac{d[H_2]}{dt} = k_4[NO][H_2]$$

The relationship between k_1, k_2, k_3, k_4 is

A. $k = k_1 = k'_1 = k''_1$

B. $k = 2k_1 = k'_1 = k''_1$

C. $k = 2k'_1 = k_1 = k''_1$

D. $k = k_1 = k_1 = 2k''_1$

Answer: 2

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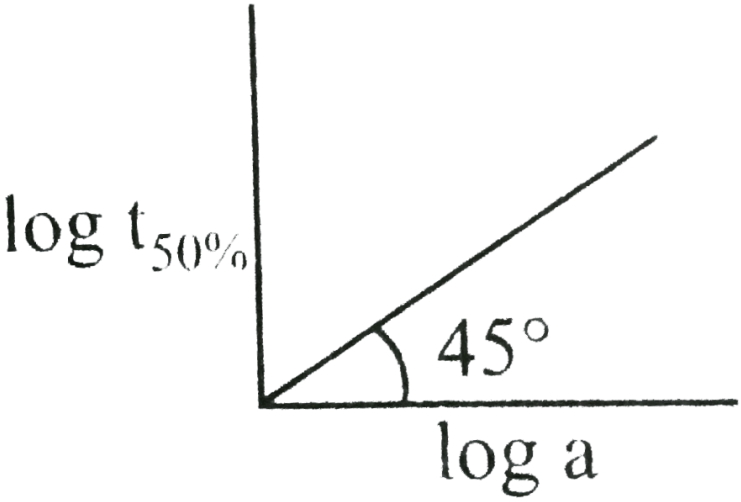
38. What will be the order of reaction and rate constant for a chemical change having $\log t_{50\%}$ versue

log concentration of (a) curves as:



A. zero order

B. First order

C. Second order

D. None of these

Answer: 1

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

A. temperature of the reaction

B. concentration of reactant

C. activation energy of the reaction

D. molecularity of the reaction

Answer: 4

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40. For an elementary reaction $2A + B \rightarrow A_2B$ if the volume of vessel is quickly reduced to half of it's original volume then rate of reaction will :

A. unchange

B. increase four times

C. increase eight time

D. decrease eight time

Answer: 3

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41. The decomposition of azo methane, at certain temperature according to the equation $(CH_3)_3N_2 \rightarrow C_2H_5 + N_2$ is a first order reaction. After 40 minutes from the start, the total pressure developed is found to be $350mmHg$ in place of initial pressure $200mmHg$ of axo methane . The value of rate constant k is $-$

A. $2.88 \times 10^{-4}\,\text{sec}^{-1}$

B. $1.25 \times 10^{-4}\,\text{sec}^{-1}$

C. $5.77 \times 10^{-4}\,\text{sec}^{-1}$

D. None of these

Answer: 3

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42. For a complex reaction $A \xrightarrow{k}$ products

$E_{a1} = 180kJ/mole, E_{a2} = 80kJ/mol, E_{a3} = 50kJ/mol$

Overall rate constant k is related to individual rate constant by the equation $k = \left(\frac{k_1 k_2}{k_3}\right)^{2/3}$. Activation energy (kJ/mol) for the overall reaction is :

A. 100

B. 43.44

C. 150

D. 140

Answer: 4

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43. Atoms ${}_{7}X^{A}$, ${}_{8}Y^{B}$ and ${}_{9}Z^{17}$ are such that ${}_{8}Y$ is an isobar of ${}_{7}X$ and atom ${}_{9}Z^{17}$ is isotone of ${}_{8}Y$. Mass no. of X and no of neutrons in Y are respectively :

A. $8, 8$

B. $17, 7$

C. $9, 8$

D. $16, 8$

Answer: 4

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44. The number of neutrons accompanying the formation of $._{54}Xe^{139}$ and $._{38}Sr^{94}$ from the absorption of a slow neutron by $._{92}U^{235}$, followed by nuclear fission is

A. 0

B. 1

C. 2

D. 3

Answer: 4

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45. A sample of radiative substance is found 90% of it's initial amount after one day. What $\%$ of the original sample can be found after 3 days ?

A. 81

B. 72.9

C. 25

D. 65.61

Answer: 2

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46. For a given reaction $A \rightarrow$ Product, rate is $1 \times 10^{-4} Ms^{-1}$ when $[A] = 0.01M$ and rate is $1.41 \times 10^{-4} Ms^{-1}$ when $[A] = 0.02M$. Hence, rate law is :

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

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

C. $-\frac{d[A]}{dt} = \frac{k}{4}[A]$

D. $-\frac{d[A]}{dt} = k[A]^{1/2}$

Answer: 4

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47. Milk turns sour at $40^\circ C$ three times as faster as $0^\circ C$. Hence E_a in cal of process of turning of milk sour is :

A. $\frac{2.303 \times 2 \times 313 \times 273}{40} \log 3$

B. $\frac{2.303 \times 2 \times 313 \times 273}{40} \log. \frac{1}{3}$

C. $\frac{2.303 \times 2 \times 40}{273 \times 313} \log 3$

D. None of the above

Answer: 1

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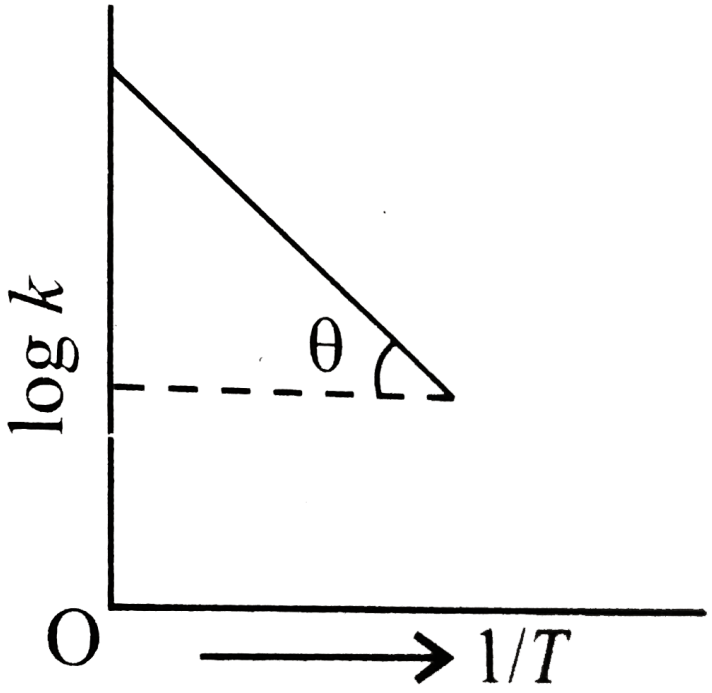
48. Graph between $\log k$ and $1/T$ [k rate constant $\left(s^{-1}\right)$ and T and the temperature (K)] is a straight line with $OX = 5, \theta = \tan^{-1}(1/2.303)$. Hence $-E_a$ will be



A. $2.303 \times 2cal$

B. $\frac{2}{2.303}cal$

C. $2cal$

D. None of these

Answer: 3

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49. In a first order reaction, the concentrations of the reactant, 30 minutes and 40 minutes after the start are C_1 and C_2(in moles / litre) respectively . What was C_0, initial concentration ?

A. $C_0 = \left[\frac{C_1^3}{C_2^4}\right]$

B. $C_0 = \left[\frac{C_1}{C_2}\right]^4$

C. $C_0 = \left[\frac{C_1}{C_2}\right]^3$

D. $C_0 = \left[\frac{C_1^4}{C_2^3}\right]$

Answer: 4

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