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## CHEMISTRY

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## CHEMICAL KINETIC \& NUCLEAR CHEMISTRY

## Exercise

1. The differential rate law equation for the elementary reaction $A+2 B \xrightarrow{k} 3 C$, is
A. $-\frac{d[A]}{d t}=\frac{d[B]}{d t}=\frac{d[C]}{d t}=k[A][B]^{2}$
B. $-\frac{d[A]}{d t}=\frac{1}{2} \frac{d[b]}{d t}=\frac{1}{3} \frac{d[C]}{d t}=k[A]^{2}[B]$
C. $-\frac{d[A]}{d t}=\frac{1}{2} \frac{d[b]}{d t}=\frac{1}{3} \frac{d[C]}{d t}=k[A][B]^{2}$
D. None of these

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2. The rate of a reaction is expressed in different ways as follows:
$+\frac{1}{2} \frac{d[C]}{d t}=-\frac{1}{3} \frac{d[D]}{d t}=+\frac{1}{4} \frac{d[A]}{d t}=-\frac{d[B]}{d t}$
the reaction is
A. $4 A+B \rightarrow 2 C+3 D$
B. $B+3 D \rightarrow 4 A+2 C$
C. $A+B \rightarrow C+D$
D. $B+D \rightarrow C+D$

## Answer: B

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3. In the reaction, $A+2 B \rightarrow 6 C+2 D$, if the initial rate $-\frac{d[A]}{d t}$ at $\mathrm{t}=0$ is $2.6 \times 10^{-2} M \mathrm{sec}^{-1}$, what will be the value of $-\frac{d[B]}{d t}$ at $\mathrm{t}=0$ ?
A. $8.5 \times 10^{-2} M \mathrm{sec}^{-1}$
B. $2.5 \times 10^{-2} M \mathrm{sec}^{-1}$
C. $5.2 \times 10^{-2} M \mathrm{sec}^{-1}$
D. $7.5 \times 10^{-2} M \mathrm{sec}^{-1}$

## Answer: C

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reaction between $k_{1}, k_{2}$ and $k_{3}$ is:
A. $k_{1}=k_{2}=k_{3}$
B. $2 k_{1}=k_{2}=3 k_{2}$
C. $4 k_{1}=k_{2}=3 k_{2}$
D. $\frac{k_{1}}{2}=k_{2}=\frac{k_{3}}{3}$

## Answer: D

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5. The rate constant of $n^{\text {th }}$ order has units :
A. litre ${ }^{1-n} \operatorname{mol}^{1-n} \sec ^{-1}$
B. $\operatorname{Mol}^{1-n}$ litre $e^{1-n} \mathrm{sec}$
C. $\mathrm{Mol}^{1-n^{2}}$ litre ${ }^{n^{2}} \sec ^{-1}$
D. Mole ${ }^{1-n}$ litre $e^{n-1} \sec ^{-1}$

## Answer: D

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6. Which of the following statement is incorrect?
A. Unit of rate of disapearence is $M s^{-1}$
B. Unit if rate of reaction is $M s^{-1}$
C. Unit of rate constant $k$ depends upon order
D. Unit of k for first order reaction is $M s^{-1}$

## Answer: D

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7. Which of the following relation is correct for $k_{f}$ and $k_{b}$ in an equibilirium process that contains equal moles of rectants and products.
A. $k_{f}=k_{b}$
B. $k_{f}>k_{b}$
C. $k_{f}<k_{b}$
D. we cannot predict

## Answer: D

8. Listed in the table are forward and reverse rate constants for the reaction
$2 N O(g) \Leftrightarrow N_{2}(g)+O_{2}(g)$

| Temperature $(K)$ | $k_{f}\left(M^{-1} s^{-1}\right)$ | $k_{b}\left(M^{-1} s^{-1}\right)$ |
| :--- | :--- | :--- |
| 1400 | 0.29 | $1.1 \times 10^{-6}$ |
| 1500 | 1.3 | $1.4 \times 10^{-5}$ |

## Select the correct statement

A. Reaction is exothermic and value of eqilibrium constatnt $\left(K_{e q}\right)$ at 1400 K is $3.79 \times 10^{-6}$
B. Reaction is endothermic and value of $k_{e q} 1400 \mathrm{~K}$ is $2.63 \times 10^{5}$
C. Reaction is exothermic and value of $k_{e q} 1400 \mathrm{~K}$ is $2.63 \times 10^{5}$
D. Reaction is endothermic and value of $k_{e q} 1500 \mathrm{~K}$ is $9.28 \times 10^{4}$

## Answer: C

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9. The rate of constatnt depends on
A. temperature
B. pressure
C. extent of reaction
D. Initial concentraton of the rectant

## Answer: A

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10. In the following reaction, how is the rate of appearance of the underline product related to the rate of disappearance of the underlined reactant?

$$
\mathrm{BrO}_{3}^{-}(a q)+\underline{5 B r^{-}}(a q)+6 H^{+}(a q) \rightarrow \underline{3 B r_{2}}(1)+3 H_{2} O_{(1)}
$$

A. $-\frac{d\left[\mathrm{BrO}_{3}^{-}\right]}{d t}=\frac{d\left[\mathrm{Br}_{2}\right]}{d t}$
B. $-\frac{1}{3} \frac{d\left[\mathrm{Br} \mathrm{O}_{3}^{-}\right]}{d t}=\frac{d\left[B r_{2}\right]}{d t}$
C. $-\frac{d\left[\mathrm{BrO}_{3}^{-}\right]}{d t}=\frac{1}{3} \frac{d\left[\mathrm{Br}_{2}\right]}{d t}$
D. None of these

## Answer: C

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11. Consider a reaction $A(g) \xrightarrow{k=0.1 M \text { min }} 2 B(g)$. If initial concentration of A is 0.5 M then select correct graph.


B.



## Answer: C

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12. Which of the following statement is incorrect?
A. A second order reaction must be a bimolecular elementry reaction
B. A bimolecular elementry reaction must be a second order reacton
C. Zero order reaction must be a complex reaction
D. First order reaction may be complex or elementary reaction

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13. The molecularity of a complex reaction given below is:
$2 \mathrm{~N}_{2} \mathrm{O}_{5}(g) \rightarrow 4 \mathrm{NO}_{2}(g)+\mathrm{O}_{2}(g)$
A. 1
B. 2
C. 3
D. no meaning

## Answer: D

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14. Decomposition of $\mathrm{NH}_{4} \mathrm{NO}_{2}$ (aq into $\mathrm{N}_{2}(g)$ and $2 \mathrm{H}_{2} \mathrm{O}(l)$ is first order reaction.

## A. <br> 


B.
(c)

C.
D.
(d)


## Answer: D

15. Decomposition of $H l(g)$ 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 ?

B.

C.

D.

16. Consider the plots for the types of reaction $n A \rightarrow B+C$




These plots respectively correspond to the reaction orders :
A. 0,2,1
B. 0,1,2
C. 1,1,2
D. 1,0,2

## Answer: D

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17. If decompositon reaction ${ }^{`} \mathrm{~A}(\mathrm{~g})$ toB(g) follows first order linetics then the graph of rate of formation ( $R$ ) of $B$ against time $t$ will be :
A.


B.
C.


D.

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18. Consider the plots for the types of reaction
$n A \rightarrow B+C$

(I)

(II)

(III)

These plots respectively correspond to the reaction orders :
A. $0,1,2$
B. 1,2,0
C. 1,0,2
D. None of these

## Answer: C

19. For a zero order reaction, the plot of concentration, vs time is linear with
A. + ve slope and zero intercept
B. $-v e$ slope and zero intercept
C. + ve slope and non-zero intercept
D. - ve slope and non-zero intercept

## Answer: D

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20. What will be the order of reaction for a chemical change having $\log t_{\frac{1}{2}}$ vs $\log a$ ? ( where $a=$ initial concentration of rectant, $t_{\frac{1}{2}}=$ half life)

A. zero order
B. First order
C. Second order
D. None of these

Answer: A
21. A graph between $\log t_{\frac{1}{2}}$ and $\log$ a (abscissa), a being the initial concentration of A in the reaction For reaction $A \rightarrow$ Product, the rate law is:

## $\log t_{12}$ Slope=-1

A. $-\frac{d[A]}{d t}=K$
B. $-\frac{d[A]}{d t}=K[A]$
C. $-\frac{d[A]}{d t}=K[A]^{2}$
D. $-\frac{d[A]}{d t}=K[A]^{3}$

## Answer: C

22. For the reaction $A \rightarrow B$, for which graph between half life ` $(\mathrm{t}$ _ $(1 / / 2)$ ) and initial concentration (a) of the rectant is given below


Hence graph between $-\frac{d[A]}{d t}$ and time will be:

A.
B.

C.

D.


## Answer: C

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23. For the ideal gaseous reaction, the rate is generally expressed in terms of $\frac{d P}{d t}$ instead of $\frac{d C}{d t}$ or $\frac{d n}{d t}$ (where $\mathrm{C}=\frac{n}{V}$ is concentration and n the no. of moles). What is the relation among these three expressions if T and $V$ are constant?
A. $\frac{d C}{d t}=\frac{d n}{d t}=\frac{d P}{d t}$
B. $\frac{d C}{d t}=\frac{1}{V} \frac{d n}{d t}=\frac{1}{R t}\left(\frac{d P}{d t}\right)$
c. $R T \frac{d C}{d t}=\frac{d n}{d t}=\frac{d P}{d t}$
D. None of these

## Answer: B

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24. $A_{2}+B_{2} \rightarrow 2 A B$, R.O.R. $=k\left[A_{2}\right]^{a}\left[B_{2}\right]^{b}$
$\operatorname{Initial}\left[A_{2}\right] \quad \operatorname{Initial}\left[B_{2}\right] \quad$ R.O.R. $(r) M s^{-1}$

| 0.2 | 0.2 | 0.04 |
| :--- | :--- | :--- |
| 0.1 | 0.4 | 0.04 |
| 0.2 | 0.4 | 0.08 |

Order of reaction with respect to $A_{2}$ and $B_{2}$ are respectively:
A. $a=1, b=1$
B. $a=2, b=0$
C. $a=2, b=1$
D. None

## Answer: A

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25. For a reaction initial rate is given as : $R_{0}=k\left[A_{0}\right]^{2}\left[B_{0}\right]$. By what factor, the initial rate of reaction will increase if initial concentration is taken 1.5 times and B is tripled?
A. 4.5
B. 2.25
C. 6.75
D. None of these

## Answer: C

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26. For $A_{(s)}+B_{(s)} \rightarrow C_{(s)}$, rate $=k[A]^{1 / 2}[B]^{2}$, if initial concentration of $A$ and $B$ are increased by factors 4 and 2 respectively, then the initial rate is changed by the factor:
A. 4
B. 6
C. 8
D. None of these

## Answer: C

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27. Reaction $A \rightarrow B$ follows second order kinetics. Doubling the concentration of $A$ wil increase the rate of formation of $B$ by a factor of:
A. $1 / 4$
B. $1 / 2$
C. 2
D. 4

## Answer: D

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28. The reaction of $A_{2}$ and $B_{2}$ follows the equation
$A_{2}(g)+B_{2}(g) \rightarrow 2 A B(g)$
The following data were observed
$\left[A_{2}\right]_{0} \quad\left[B_{2}\right]_{0} \quad$ Initial rate of appearance of $\mathrm{AB}(\mathrm{g})\left(\mathrm{in} M \mathrm{~s}^{-1}\right.$
$0.10 \quad 0.10 \quad 2.5 \times 10^{-4}$
$0.20 \quad 0.10 \quad 5 \times 10^{-4}$
$0.20 \quad 0.20 \quad 10 \times 10^{-4}$
The value of rate constatnt for the above reaction is :
A. $2.5 \times 10^{-4}$
B. $2.5 \times 10^{-2}$
C. $1.25 \times 10^{-2}$
D. None of these

## Answer: C

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29. 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

## Answer: D

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30. Select the rate law that corresponds to the datashown for the reaction $A+B \rightarrow C$

Exp.

| 1 |  | 0.012 | 0.035 | 0.10 |
| :--- | :--- | :--- | :--- | :--- |
| 2 |  | 0.024 | 0.070 | 0.80 |
| 3 |  | 0.024 | 0.035 | 0.10 |
| 4 |  | 0.012 | 0.070 | 0.80 |

A. Rate $=k[B]^{3}$
B. Rate $=k[B]^{4}$
C. Rate $\mathrm{k}=[A][B]^{3}$
D. Rate $=\mathrm{k}[A]^{2}[B]^{2}$

## Answer: A

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31. An elementary reaction $A$ and $B$ is second order reaction. Which of the following rate equation must be correct?
A. $r=k[A]^{2}[B]^{0}$
B. $r=k[A]^{3 / 2}[B]^{1 / 2}$
C. $r=k[A]^{0}[B]^{2}$
D. $r=k[A][B]$

Answer: D

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32. If $a$ is the initial concentration of the rectant, the half life period of the reaction of $n^{\text {th }}$ order is inversely proportional to :
A. $a^{n-1}$
B. $a^{n}$
C. $a^{1-n}$
D. $a^{n+1}$

## Answer: A

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33. Which of the following expressions is correct for zero and first order respectively [Where a is initial concentration]?
A. $t_{1 / 2} \alpha a, t_{1 / 2} \alpha \frac{1}{a}$
B. $t_{1 / 2} \alpha a, t_{1 / 2} \alpha a^{0}$
C. $t_{1 / 2} \alpha a^{0}, t_{1 / 2} \alpha a$
D. $t_{1 / 2} \alpha a, t_{1 / 2} \alpha \frac{1}{a^{2}}$

## Answer: B

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34. The unit of rate constant of zero order and first order chemical reactions are respectively:
A. $m o l L^{-1} s^{-1}, m o l L^{-1} s^{-1}$
B. $s^{-1}, m o l L^{-1} s^{-1}$
C. $m o l L^{-1} s^{-1}, s^{-1}$
D. None of these

## Answer: C

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35. The unit of rate of reaction and rate of rate constant are same for a:
A. zero order reaction
B. first order reaction
C. Second order reaction
D. third order reaction

## Answer: A

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36. 

$\mathrm{CH}_{3} \mathrm{COOC}_{2} \mathrm{H}_{5}(\mathrm{aq})+\mathrm{H}_{2} \mathrm{O}(\mathrm{l}) \xrightarrow{\mathrm{H}^{+}(a q)} \mathrm{CH}_{3} \mathrm{COOH}(a q)+\mathrm{C}_{2} \mathrm{H}_{5} \mathrm{OH}(a q)$ .What type of reaction is this?
A. unimolecular elementary
B. Pseudo first order
C. Zero order reaction must be a complex reaction
D. Second order

## Answer: B

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37. When ethyl acetate was was hydrolysedin presemce 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 $\mathrm{H}_{2} \mathrm{SO}_{4}$ the rate constant was found to be $6.25 \times 10^{-5} \mathrm{~s}^{-1}$. Thus it may be concluded that:
A. $\mathrm{H}_{2} \mathrm{SO}_{4}$ furnishes more $\mathrm{H}^{+}$than HCl
B. $\mathrm{H}_{2} \mathrm{SO}_{4}$ furnishes less $\mathrm{H}^{+}$than HCl
C. both have the same strength
D. will depend on concentration of ethyl acetate

## Answer: A

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38. For an elementary reaction $2 A+B \rightarrow A_{2} B$ if the volume of vessel is quickly reduced to half of it's original volume then rate of reaction will :
A. remain unchanged
B. increase four times
C. increase eight times
D. decrease eight times

## Answer: C

39. In the reaction $A \rightarrow B+C$, rate constant is $0.001 M s^{-1}$. If we start with 1 M of A then conc. Of A and B after 10 minutes are respectively :
A. $0.5 \mathrm{M}, 0.5 \mathrm{M}$
B. $0.6 \mathrm{M}, 0.4 \mathrm{M}$
C. $0.4 \mathrm{M}, 0.6 \mathrm{M}$
D. none of these

## Answer: C

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40. For a reaction $A \xrightarrow{k_{r}=0.6 M \mathrm{~min}} 2 B$
starting with 1 M of 'A' only, concentration of B (in M) after 100 sec . and 200 sec. is respectively?
A. 2 and 4
B. 1 and 2
C. 2 and 3
D. None of these

## Answer: D

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41. For the zero order reaction $A \rightarrow B+C$, initial concentration of A is 0.1 M . If $[\mathrm{A}]=0.08 \mathrm{M}$ after 10 minutes, then its half-life and completion time are respectively :
A. $10 \mathrm{~min}, 20 \mathrm{~min}$
B. $2 \times 10^{-3} \min , 4 \times 10^{-3} \min$
C. $25 \mathrm{~min}, 50 \mathrm{~min}$
D. $250 \mathrm{~min}, 500 \mathrm{~min}$

## Answer: C

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42. For an elementary reaction , $X(g) \rightarrow Y(g)+Z(g)$
the half life period is 10 min . In what period of time would the concentration of $X$ be reduced to $10 \%$ of original concentration?
A. 20 min
B. 33 min
C. 15 min
D. 25 min

## Answer: B

43. In the presence of acid, the initial concentration, of cane sugar was reduced form $0.2 M$ to 0.1 in $5 h r$ and to $0.05 M$ in $10 h r$. The reaction must be of
A. Zero order
B. First order
C. Second order
D. Third order

## Answer: B

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44. A first order reaction is $75 \%$ completed in 100 minutes. How long time will it take for its $87.5 \%$ completion?
A. 125 min
B. 150 min
C. 175 min
D. 200 min

## Answer: B

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45. The rate constant for a first order reaction whose half life is 480 sec , is
A. $1.44 \times 10^{-3} \mathrm{sec}^{-1}$
B. $1.44 \times \mathrm{sec}^{-1}$
C. $0.72 \times 10^{-3} \mathrm{sec}^{-1}$
D. $2.88 \times 10^{-3} \mathrm{sec}^{-1}$

## Answer: A

46. Rate constant $k=2.303 \mathrm{~min}$ for a particular reaction. The initial concentration of the reactant is $1 \mathrm{~mol} /$ litre then rate of reaction after 1 minute is:
A. $2.303 \mathrm{M} \mathrm{min}^{-1}$
B. 0.2303 M min
C. $0.1 \mathrm{M} \min ^{-1}$
D. None of these

## Answer: B

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47. For the reaction $3 A(g) \xrightarrow{k} B(g)+C(g) \mathrm{k}$ is $10^{-4} L / m o l$. min .

If $[\mathrm{A}]=0.5 \mathrm{M}$ then the value of $-\frac{d[A]}{d t}$ (in $m s^{-1}$ is:
A. $7.5 \times 10^{-5}$
B. $3 \times 10^{-4}$
C. $2.5 \times 10^{-5}$
D. None of these

## Answer: D

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48. $99 \%$ of a first order reaction was completed in 32 in. When wil 99.9\% of the reaction complete?
A. 50 min
B. 46 min
C. 48 min
D. 49 min

## Answer: C

49. Which of the following represents the expression for $3 / 4$ th life of 1st order reaction
A. $\frac{k}{2.303} \log 4 / 3$
B. $\frac{2.303}{k} \log 3 / 4$
C. $\frac{2.303}{k} \log 4$
D. $\frac{2.303}{k} \log 3$

## Answer: C

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50. Consider following two competing first ordr reactions, $P \xrightarrow{k_{1}} A+B, Q \xrightarrow{k_{2}} C+D$
if $50 \%$ of the reaction oof P wascompleted when $96 \%$ of Q was complete ,then the ratio ( $k_{2} / k_{1}$ ) will be :
A. 4.06
B. 0.215
C. 1.1
D. 4.65

## Answer: D

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51. For the reaction
(i) $A \xrightarrow{k_{I}} P$
(ii) $B \xrightarrow{K_{I I}} Q$, following observation is made.



Calculate $\frac{k_{1}}{k_{I I}}$, where $k_{I}$ and $k_{I I}$ and rate constant for the respective reaction.
A. 2.303
B. 1
C. 0.36
D. 0.693

## Answer: D

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52. For the homogenous gaseous reaction $A \rightarrow 3 B$, if pressure after time t was $P_{t}$ and after completion of reaction, pressure was $P_{\infty}$ then select correct relation
A. $k=\frac{1}{t} \operatorname{in}\left(\frac{P_{\infty}}{3\left(P_{\infty}-P_{t}\right)}\right)$
B. $k=\frac{1}{t} \operatorname{in}\left(\frac{2 P_{\infty}}{\left(P_{\infty}-P_{T}\right)}\right)$
C. $k=\frac{1}{t} \operatorname{in}\left(\frac{3 P_{\infty}}{2 P_{\infty}-P_{t}}\right)$
D. $k=\frac{1}{t} \operatorname{in}\left(\frac{2 P_{\infty}}{3\left(P_{\infty}-P_{T}\right)}\right)$

## Answer: D

53. The half-life of first order decomposition of $\mathrm{NH}_{4} \mathrm{NO}_{3}$ is 2.10 hr at 288 K temperature
$\mathrm{NH}_{4} \mathrm{NO}_{3}(\mathrm{aq}) \rightarrow \mathrm{N}_{2} \mathrm{O}(\mathrm{g})+2 \mathrm{H}_{2} \mathrm{O}(\mathrm{l})$. If 6.2 of $\mathrm{NH}_{4} \mathrm{NO}_{3}$ is allowed to decompose, the required for $\mathrm{NH}_{4} \mathrm{NO}_{3}$ to decompose $90 \%$ is :
A. 6.978 hr
B. 0.319
C. 0.319 hr
D. None of these

## Answer: A

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54. For a first order homogeneous gaseous reaction $A \rightarrow 2 B+C$, if the total pressure after time t was $P_{t}$ and after a long time $(\rightarrow \rightarrow \infty)$ was
$P_{\infty}$ then k in terms of $P_{t}, P_{\infty}$ and t is
A. $k=\frac{2.303}{t} \log \left(\frac{2 P_{i}}{3 P_{i}-P_{t}}\right)$
B. $k=\frac{2.303}{t} \log \left(\frac{2 P_{i}}{2 P_{t}-P_{i}}\right)$
C. $k=\frac{2.303}{t} \log \left(\frac{P_{i}}{P_{i}-P_{t}}\right)$
D. None of these

## Answer: A

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55. The decomposition of azo methane, at certain temperature accoording to the equation $\left(\mathrm{CH}_{3}\right)_{2} \mathrm{~N}_{2} \rightarrow \mathrm{C}_{2} \mathrm{H}_{6}+\mathrm{N}_{2}$ is a first order reaction.

After 40 minutes from the start, the total pressure developed is found to be 350 mm Hg in place of initial pressure 200 mm Hg of azo methane. The value of rate constant $k$ is :

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

B. $1.25 \times 10^{-4} \sec (-1)$
C. $5.77 \times 10^{-4} \sec (-1)$
D. None of these

## Answer: C

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56. The hydrolysis of sucrose was studied with the help of calorimeter and following data were

Collected time (min.) $\quad: 0 \quad 70 \quad \infty$
observed rotation (degrees) : $44 \quad 16.5-11$
the time taken when reaction mixture wil be optically inactive? (Given : In
$2=0.7$,in $3=1.1$, in $5=1.6$ )
A. 16 min
B. 69.47 min
C. 160 min
D. None of these

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57. For a partiocular reaction with initial conc. Of the rectents as $a_{1}$ and $a_{2}$, the half-life period are $t_{1}$ and $t_{2}$ respectively. The order of the reaction
$(\mathrm{n})$ is given by :
A. $n=1+\frac{\log \left(t_{2} / t_{1}\right)}{\log \left(a_{2} / a_{1}\right)}$
B. $n=\frac{\log \left(t_{2} / t_{1}\right)}{\log \left(a_{2} / a_{1}\right)}$
C. $n=1+\frac{\log \left(t_{1} / t_{2}\right)}{\log \left(a_{2} / a_{1}\right)}$
D. None of these

## Answer: C

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58. The value of $\frac{t_{0.875}}{t_{0.50}}$ for $n^{\text {th }}$ order reaction is
A. $2^{(2 n-2)}$
B. $2^{(2 n-2)-1}$
C. $\frac{8^{n-1}-1}{2^{n-1}-1}$
D. None of these

## Answer: C

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59. $A \rightarrow B$ first order reaction A is ooptical active and B is optically inactive. A series of experiment were conducted on a solution of A

| Time | 0 | 60 min | $\infty$ |
| :--- | :--- | :--- | :--- |
| optical rotation | $82^{\circ}$ | $77^{\circ}$ | $2^{\circ}$ |

assume some imurity is present calculate the otical rotation for 5 hours.)
(Given in $1.066=0.064, e^{0.16}=1.17$ )
A. 60
B. 30
C. 20
D. 120

## Answer: A

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60. 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

## Answer: A

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61. A decomposes as . The rate of appearance of B, taking 2 M concentration of $A$, is equal to :
A. $2 \times 10^{-3} M s^{-1}$
B. $4 \times 10^{-3} M s^{-1}$
C. $8 \times 10^{-3} M s^{-1}$
D. None of these

## Answer: C

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62. For an endothermic reaction energy of activation is $E_{a}$ and enthalpy of reaction is $\Delta H$ (both in $\mathrm{kJ} \mathrm{mol}^{-1}$ ) Minimum value of $E_{a}$ will be
A. less than $\Delta H$
B. more than $\Delta H$
C. equal to $\Delta H$
D. Zero

## Answer: B

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63. The activation energy of the reaction, $A+B \rightarrow C+D+38 \mathrm{kcal}$ is 20 kcal . What would be the activation energy pof the following reaction. $C+D \rightarrow A+B$
A. 20 kcal
B. -20 kcal
C. 18 kcal
D. 58 kcal

## Answer: D

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64. When the activation energies of the forward and backward reactions are equal, then :
A. $\Delta U=0, \Delta S=0$
B. $\Delta U=0, \Delta G=0$
C. $\Delta S=0, \Delta G=0$
D. Only $\Delta U=0$

## Answer: D

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65. For an exothermic chemical process ocuuring in two process occuring in two steps as follows
$(i) A+B \rightarrow X($ slow $)$
(ii) $X \rightarrow A B$ (fast)

The progress of reaction can be best described by :

A.
A. R.C.

B.
C.



Answer: C

- Watch Video Solution

66. Select the correct diagram for an endothermic reaction that proceeds through two steps with the second steps is rate determining :
A.

reaction coordinate
B.

reaction coordinate
C. reaction coordinate

D.

## Answer: D

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67. $\frac{k_{34^{\circ}}}{k_{35^{\circ}}}<1$, then
A. Rate increase with the rise in temperature
B. rate decrease with rise in temperature
C. rate does not change with rise in temperature
D. None of the above

## Answer: A

## D Watch Video Solution

68. The plot of $\ln 1 / T$ is linear with slope of :
A. $-E_{a} / R$
B. $\left.E_{a} / R\right)$
C. $E_{a} / 2.303 R$
D. $-E_{a} / 2.303 R$

## Answer: A

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69. Rate constant for a chemical reaction taking place at 500 K is expressed as $K=A . e^{-1000}$ The activation energy of the reaction is :
A. $100 \mathrm{cal} / \mathrm{mol}$
B. $1000 \mathrm{kcal} / \mathrm{mol}$
C. $10^{4} \mathrm{kcal} / \mathrm{mol}$
D. $10^{6} \mathrm{kcal} / \mathrm{mol}$

## Answer: B

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

$$
E_{a 1}=180 \mathrm{~kJ} / \mathrm{mole}, E_{a 2}=80 \mathrm{~kJ} / \mathrm{mol}, E_{a 3}=50 \mathrm{~kJ} / \mathrm{mol}
$$

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 $(k J / m o l)$ for the overall reaction is :
A. 100
B. 43.44
C. 150
D. 140

## Answer: D

## - Watch Video Solution

71. For reaction $\mathrm{A} \rightarrow \mathrm{B}$, the rate constant $K_{1}=A_{1}\left(e^{-E_{a_{1}} / R T}\right)$ and the reaction $X \rightarrow Y$, the rate constant $K_{2}=A_{2}\left(e^{-E_{o_{2}} / R T}\right)$. If $A_{1}=10^{9}$,
$A_{2}=10^{10}$ and $E_{a_{1}}=1200 \mathrm{cal} / \mathrm{mol}$ and $E_{a_{2}}=1800 \mathrm{cal} / \mathrm{mol}$, then the temperature at which $K_{1}=K_{2}$ is: (Given , $\mathrm{R}=2 \mathrm{cal} / \mathrm{K}-\mathrm{mol}$ )
A. 300 K
B. $300 \times 2.303 K$
c. $\frac{300}{2.303} K$
D. None of these

## Answer: C

## - Watch Video Solution

72. The activation energies of the forward and backward reactions in the case of a chemical reaction are 30.5 and $45.5 \mathrm{KJ} / \mathrm{mol}$, respectively . The reaction is:
A. exothermic
B. endothermic
C. neither exothermic
D. independent of temperature

## Answer: A

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73. A reaction rate constant is given by : $K=1.2 \times 10^{14} e^{\frac{-25000}{R T}} \sec ^{-1}$. It means :
A. $\log \mathrm{K}$ versus $\log T$ will give a straight line with a slope as 25000
B. $\log K$ versus $\log T$ will give a straight line with a slope as -25000
C. $\log k$ versus $T$ will give a striaght line with a slope as -25000
D. $\log K$ versus $1 / T$ will give a striaght line

## Answer: D

## - Watch Video Solution

74. The temperature coefficient of a reaction is
A. the rate constant
B. the rate constant at a fixed temperature
C. the ratio of rate constant at two temperature
D. the ratio of rate constant differing by $10^{\circ} \mathrm{C}$ preferably $k_{\frac{308}{k_{298}}}$

## Answer: D

## - Watch Video Solution

75. Which graph shows zero activation energy ?



## Answer: C

## - Watch Video Solution

76. A homogenous catalytic reaction takes place through the three alternative plots $A, B$, and $C$ shown in the given figure. Which one of the following indicates the relative ease with which the reaction can take

## place?


A. $A>B>C$
B. $C>B>A$
C. $A>C>B$
D. $A=B=C$

Answer: B
77. The rate of a reaction gets doubled when temperature increase by $27^{\circ} \mathrm{Cto} 37^{\circ}$. By what factor will it change for the temperature range $17^{\circ}$ C to $27^{\circ} \mathrm{C}$
A. 1.81
B. 1.71
C. 2.1
D. 2.41

## Answer: C

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78. Which of the following expkains the increase of reaction rate by a 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.

## Answer: C

## - Watch Video Solution

79. Collision theory satisfactorily explains
A. First order reactions
B. Zero order reactions
C. Bimolecular elementary reactions
D. Any order reactions

## Answer: C

## - Watch Video Solution

80. For the first order reaction $A \rightarrow B+C$, carried out at $27^{\circ} \mathrm{C}$. If $3.8 \times 10^{-16} \%$ of the reactant molecules exists in the activated state, the $E_{a}$ (activation energy) of the reaction is:
A. $12 \mathrm{KJ} / \mathrm{mol}$
B. $831.4 \mathrm{KJ} / \mathrm{mol}$
C. $100 \mathrm{KJ} / \mathrm{mol}$
D. $88.57 \mathrm{KJ} / \mathrm{mol}$

## Answer: C

81. For a reaction the following mechanism has been proposed, $2 A+B \rightarrow D+E$
$A+B \rightarrow C+D$ (slow), $A+C \rightarrow E$ (fast)
The rate law a expression for the reaction is
A. $r=k[A]^{2}[B]$
B. $r=k[A][B]$
C. $r=k[A]^{2}$
D. $r=k[A][C]$

## Answer: B

## - Watch Video Solution

82. A reaction $A_{2}+B_{2} \rightarrow 2 A B$ occurs by the following mechanism:
$A_{2} \Leftrightarrow A+A . . . . . . . . . . .(f a s t)$
$A+B_{2} \rightarrow A B+B \ldots . . . . . . .(s l o w)$
$A+B \rightarrow A B$..............(fast) Its order would be:
A. 2
B. 1
C. $\frac{3}{2}$
D. 0

## Answer: C

## - Watch Video Solution

83. Chemical reaction occurs as a result of collisions between reacting molecules. Therefore, the reaction rate is given by
A. total number of collisions occuring in a unit volume per second
B. fraction of molecules which passes energy less than the threshold
C. total number of effective collisions which have enough activation energy
D. none of the above

## Answer: C

## - Watch Video Solution

84. Radioactivity is affected by:
A. temperature
B. pressure
C. electric and magnetic field
D. none of these

## Answer: D

85. The radiation from naturally occuring radioactive substance as seen
after deflection by a magnetic field in one direction are :
A. $\alpha$-rays
B. $\beta$-rays
C. both $\alpha$ and $\beta$ rays
D. either $\alpha$ or $\beta$-rays

## Answer: D

## - Watch Video Solution

86. During $\alpha$-decay:
A. $\frac{n}{p}$ ratio decreases
B. $\frac{n}{p}$ ratio increases
C. $\frac{n}{p}$ ratio remains emission constant
D. $\frac{n}{p}$ ratio may increase or decrease

## Answer: B

## - Watch Video Solution

87. 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: D

88. . ${ }_{90} T h^{234}$ disintegrates to give ${ }_{82} P b^{206} \mathrm{~Pb}$ as the final product. How many alpha and beta particles are emitted during this process ?
A. 6
B. 7
C. 8
D. 13

## Answer: D

## - Watch Video Solution

89. An isotone of.${ }_{32}^{76} G e$ is-
(a). $\cdot{ }_{32}^{77} G e$
(b). ${ }_{33}^{77} A s$
(c). ${ }_{34}^{77} S e$
(d). ${ }_{34}^{78} S e$
A. ${ }_{32}^{77} G e$
B. ${ }_{33}^{77} A s$
C. ${ }_{34}^{77} \mathrm{Se}$
D. ${ }_{34}^{78} \mathrm{Se}$

## Answer: B

## - Watch Video Solution

90. Isodiaphers are atoms having:
A. n/p same
B. $\mathrm{p} / \mathrm{n}$ same
C. (n-p) same
D. $(n-p)$ different

## Answer: C

91. The number of neutrons accompanying the formation of ${ }_{54} X e^{139}$ and ${ }_{\cdot 38} S r^{94}$ 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: D

## - Watch Video Solution

92. Complete the following nuclear equation by suppling the symbol for the other product of the fission :
${ }_{.}^{235} U+{ }_{0}^{1} n \rightarrow{ }_{38}^{94} S r+\ldots \ldots \ldots .+2{ }_{0}^{1} n$
A..${ }_{54}^{139} X e$
B. . ${ }_{54}^{140} \mathrm{Xe}$
C. ${ }_{64}{ }_{64} G d$
D. none of these

## Answer: B

## - Watch Video Solution

93. $X \rightarrow{ }_{82}^{206} \mathrm{~Pb}+{ }_{2}^{4} \mathrm{He}$. In this reaction predict the position of group of X :
A. II B
B. IV B
C. VI A
D. VIB

## Answer: C

94. .90 $T h$ is a member of III group. After losing $\alpha$-particle it forms a new element belonging to :
A. I group
B. Il group
C. III group
D. IV group

## Answer: B

## - Watch Video Solution

95. Alpha decay of ${ }_{.92}^{238} U$ forms ${ }_{90}^{234} T h$. What kind of decay from ${ }_{90}^{234} T h$ produces ${ }^{234} A c$ ?
A. $\alpha$
B. $\beta$
C. $\beta^{+}$(positron)
D. $\gamma$-emission

## Answer: C

## - Watch Video Solution

96. A radioactive sample had an initial activity of 56 dpm . After 69.3 minutes, it was found to have an activity of 28 dpm , the number of atoms in a sample having an activity of 100 dpm is $10^{x}$. The value of x is
A. 693
B. 100
C. 1000
D. 10000

## Answer: D

97. A radioactive sample has initial activity of 28 dpm 30 minutes later its activity 14 dpm . How many atoms of nuclide were present initially?
A. 2800
B. 1212
C. 528
D. 2802

## Answer: B

## - Watch Video Solution

98. The value of decay constant of $C o^{60}$ is $2.5 \times 10^{-7} \mathrm{~min}^{-1}$. The activity of 2.0 g of the sample is nearly :
A. $5 \times 10^{5} \mathrm{dpm}$
B. $2.5 \times 10^{10} \mathrm{dpm}$
C. $5 \times 10^{15} \mathrm{dpm}$
D. $10^{10} \mathrm{dpm}$

## Answer: C

## - Watch Video Solution

99. Half-life $\left(t_{1 / 2}\right)$ for a radioactive decay is 6930 sec . The time required to fall the rate of decay to $\left(\frac{1}{100}\right)^{\text {th }}$ of its initial value is:
A. 69.3 sec
B. 20000 sec
C. 46060 sec
D. None of these

## Answer: C

100. A sample of radioactive substance is found $90 \%$ of its 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: B

## - Watch Video Solution

101. If time $t$ is required for a radioactive substance to become one third of its initial amount, what fraction would be left after 0.5 t ?
A. $\frac{1}{2}$
B. $\frac{1}{\sqrt{3}}$
C. $\frac{1}{3}$
D. $\sqrt{\frac{2}{3}}$

## Answer: B

## - Watch Video Solution

102. The present activity of the hair of Egyption mummy is $1.75 \mathrm{dpm} t_{1 / 2}$ of ${ }_{6}^{14} C$ is 5770 year and disintegration rate of fresh smaple of $C^{14}$ is 14 dpm . Find out age of mummy.
A. 23080 year
B. 138480 year
C. 11998.3 year
D. 17310 year

## Answer: D

103. A 0.50 g sample of rock was found to have $2.5 \times 10^{-6} \mathrm{~mol}$ of ${ }_{\cdot 19}^{40} K\left(t_{1 / 2}=1.3 \times 10^{9} \mathrm{yr}\right)$ and $7.5 \times 10^{-6} \mathrm{~mol}$ of ${ }_{20}^{40} \mathrm{Ca}$. How old is the rock?
A. $6.5 \times 10^{8} \mathrm{yr}$
B. $1.3 \times 10^{9} \mathrm{yr}$
C. $2.6 \times 10^{9} \mathrm{yr}$
D. $5.2 \times 10^{9} \mathrm{yr}$

## Answer: C

## - Watch Video Solution

104. Indium - 112 is radioactive and has a very short half-life $\left(t_{1 / 2}=14\right.$ min ). Its decay constant and average life are repectively:
A. $0.0495 \mathrm{~min}^{-1}, 9.7 \mathrm{~min}$
B. $0.495 \mathrm{~min}^{-1}, 20.2 \mathrm{~min}$
C. $9.7 \mathrm{~min}^{-1}, 20.2 \mathrm{~min}$
D. $0.0495 \mathrm{~min}^{-1}, 20.2 \mathrm{~min}$

## Answer: D

## - Watch Video Solution

105. The half-life of a radioactive element is 100 minutes . The time interval between the stage to $50 \%$ and $87.5 \%$ decay will be:
A. 100 min
B. 50 min
C. 200 min
D. 25 min

## Answer: C

106. The half-life of $T c^{99}$ is 6.0 hr . The total residual activity in a patient 30 hr after receiving an injection containing $T c^{99}$ must be more than 0.01 $\mu C_{i}$. What is the maximum activity $\left(\operatorname{in} \mu C_{i}\right)$ that the sample injected can have?
A. 0.16
B. 0.32
C. 0.64
D. 0.08

## Answer: B

## - Watch Video Solution

107. A pure radio-chemical preparation was observed to disintegrate at the rate of 2140 counts/minutes at 12.35 P.M. At 3.55 P.M of the same day,
the disintegration rate of the sample was only 535 count/minutes. What is the half-life of the material?
A. 50 min
B. 100 min
C. 200 min
D. None of these

## Answer: B

## - Watch Video Solution

108. A radioactive substance decay $25 \%$ in 10 minutes . If at start there are $4 \times 10^{20}$ atoms present. After how much time will the number of atoms be reduced to $10^{20}$ atoms? (given In $3=1.098$ )
A. 10.98 min
B. 21.97 min
C. 48.19 min
D. None of these

## Answer: C

## - Watch Video Solution

109. Time taken of decay for a nuclear reaction is given by $t=4 t_{1 / 2}$. The relation between the mean life $(T)$ and time of decay $(t)$ is given by :
A. $2 \mathrm{~T} \ln 2$
B. $4 \mathrm{~T} \ln 2$
C. $2 T^{4} \ln 2$
D. $\frac{1}{T^{2}} \ln 2$

## Answer: B

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110. Two radioactive nuclides $A$ and $B$ have half-lives 50 min and 10 min respectively. A fresh sample contains the nuclides of $B$ to be eight times that of A . How much time should elapse so that the mumber of nuclides of $A$ becomes double of $B$ ?
A. 30
B. 40
C. 50
D. 100

## Answer: C

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111. A radioactive nucleus is being produced at a constant rate $\alpha$ per second. Its decay constant is 2 . If $N_{0}$ are the number of nuclei at time $\mathrm{t}=0$, find the maximum number of nuclei possible
A. $N_{0}$
B. $\alpha / \lambda$
C. $N_{0}+\frac{\alpha}{\lambda}$
D. $\frac{\lambda}{\sigma}+N_{0} s$

## Answer: B

## - Watch Video Solution

112. An analysis of the rock shows that the relative number of $S r^{87}$ and $R b^{87}\left(t_{1 / 2}=4.7 \times 10^{10}\right.$ year $)$ atoms is 0.05 . What is the age of the rock? Assume all the $S r^{87}$ have been formed from $R b^{87}$ only
A. $7.26 \times 10^{9}$ year
B. $1.43 \times 10^{9}$ year
C. $3.28 \times 10^{9}$ year
D. $4.32 \times 10^{8}$ year

## - Watch Video Solution

113. A radioactive substance (parent) decays to its daughter element the age of radioactive substance $(\mathrm{t})$ is related to the daughter (d) parent (p) ratio by the equation :
A. $t=\frac{1}{\lambda} \operatorname{In}\left(1+\frac{p}{d}\right)$
B. $t=\frac{1}{\lambda} \operatorname{In}\left(1+\frac{d}{p}\right)$
C. $t=\frac{1}{\lambda} \operatorname{In}\left(\frac{d}{p}\right)$
D. $t=\frac{1}{\lambda} \operatorname{In}\left(\frac{p}{d}\right)$

## Answer: B

## - Watch Video Solution

114. The reaction $\mathrm{A}(\mathrm{g})+2 \mathrm{~B}(\mathrm{~g}) \rightarrow \mathrm{C}(\mathrm{g})$ is an elementary reaction. In an experiment involving this reaction, the initial pressures of A and B are $P_{A}$ $=0.40 \mathrm{~atm}$ and $P_{B}=1.0 \mathrm{~atm}$ respectively. When $P_{C}=0.3 \mathrm{~atm}$, the rate of the reaction relative to the initial rate is:-
A. $\frac{1}{12}$
B. $\frac{1}{50}$
C. $\frac{1}{25}$
D. none of these

## Answer: C

## - Watch Video Solution

115. Which of the following is incorrect statement ?
A. Stoichiometry of a reaction tells about the order of the elementry reaction.
B. For a zero order reaction. Reate and the rate constant are identical .
C. A zero order reaction is controlled by factors other than concentration of reactants
D. A zero order reaction is an elementary reaction

## Answer: D

## - Watch Video Solution

116. Two first order freaction have half-lives in the ratio $8: 1$ Calculate the ratio of time intervals $t_{1}: t_{2}$ and $t_{1}$ and $t_{2}$ are the time period for $\left(\frac{1}{4}\right)^{t h}$ and $\left(\frac{3}{4}\right)^{t h}$ completion.
A. 1:0.301
B. $0.125: 0.602$
C. 1: 0.602
D. none of these

## Answer: C

## - Watch Video Solution

117. Reaction $A+B \rightarrow C+D$ follows rate law $r=k[A]^{1 / 2}[B]^{1 / 2}$ Starting with 1 M of $A$ and $B$ each. What is the time taken fro concetration of $A$ become $0.1 M$ ?
(Givenk $=2.303 \times 10^{-2} \mathrm{sec}^{-1}$ )
A. 10 sec
B. 100 sec
C. 1000 sec
D. 434 sec

## Answer: B

## - Watch Video Solution

118. For a first order homogeneous gaseous reaction $A \rightarrow 2 B+C$, if the total pressure after time t was $P_{t}$ and after a long time $(\rightarrow \rightarrow \infty)$ was $P_{\infty}$ then k in terms of $P_{t}, P_{\infty}$ and t is
A. $k=\frac{2.303}{t} \log \left(\frac{P \infty}{P \infty-P_{t}}\right)$
B. $k=\frac{2.303}{t} \log \left(\frac{2 P \infty}{P \infty-P_{t}}\right)$
C. $k=\frac{2.303}{t} \log \left(\frac{2 P \infty}{3\left(P \infty-P_{t}\right)}\right)$
D. none of these

## Answer: C

## - Watch Video Solution

119. A hydrogenation reaction is carried out at 500 K . If the same reaction is carried out in the presence of a catalyst at the same rate, the temperature required is 400 K . Calculate the activation energy of the reaction if the catalyst lowers the activation barrier by $20 \mathrm{kJmol}^{-1}$.
A. $100 \mathrm{~kJ} / \mathrm{mol}$
B. $80 \mathrm{~kJ} / \mathrm{mol}$
C. $60 \mathrm{~kJ} / \mathrm{mol}$
D. none of these

## Answer: B

## - Watch Video Solution

120. The following mechanism has been proposed for the exothermic catalyzed cmplex reaction:
$A+B \xrightarrow{\text { Fast }} I A B \xrightarrow{k_{1}} A B+I \xrightarrow{k_{2}} P+A$
If $k_{1}$ is much smaller than $k_{2}$, the most suitable qualitative plot of potential energy ( $P E$ ) versus reaction coordinates for the above reaction is

B.
```
R.C
```

C.

R.C.


Answer: B

- Watch Video Solution

121. A radioactive isotope $X$ with half-life of $693 \times 10^{9}$ years decay to $Y$ which is stable. A sample of rock from of the moon was found to contain both the elements $X Y$ in the mole ratio $1: 7$. What is the age of the rock ?
A. $2.079 \times 10^{12}$ years
B. $1.94 \times 10^{10}$ years
C. $1.33 \times 10^{9}$ years
D. $10^{10}$ years

## Answer: A

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122. The ratio of activities of two ratio niculides $X$ and $Y$ in a mixture at time $t=0$ was found to be 4:1 After two hours, the ratio activities become 1:1. If the $t_{1 / 2}$ of radio nuclide X is 20 min then $t_{1 / 2}$ [in mintes] of ratio nuclide $Y$ is,
A. 10
B. 20
C. 30
D. 40

## Answer: C

## - Watch Video Solution

123. Two consecutive irreversible fierst order reactions can be represented by
$A \xrightarrow{k_{1}} B \xrightarrow{k_{2}} C$

The rate equation for $A$ is readily interated to obtain

$$
[A]_{t}=[A]_{0} . e^{-k_{1} t}, \text { and }[B]_{t}=\frac{k_{1}[A]_{0}}{k_{2}-k_{1}}\left[e^{-k_{1}^{t}}-e^{-k_{2}^{t}}\right]
$$

At what time will B be present in maximum concentration ?
A. $\frac{K_{1}}{K_{2}-K_{1}}$
B. $\frac{1}{k_{1}-k_{2}} \ln \frac{k_{1}}{k_{2}}$
C. $\frac{1}{k_{2}-k_{1}} \ln \frac{k_{1}}{k_{2}}$
D. none of these

## Answer: B

## - Watch Video Solution

124. Two consecutive irreversible fierst order reactions can be represented by
$A \xrightarrow{k_{1}} B \xrightarrow{k_{2}} C$
The rate equation for A is readily interated to obtain
$[A]_{t}=[A]_{0} \cdot e^{-k_{1} t}$, and $[B]_{t}=\frac{k_{1}[A]_{0}}{k_{2}-k_{1}}\left[e^{-k_{1}^{t}}-e^{-k_{2}^{t}}\right]$
When $k_{1}=1 s^{-1}$ and $k_{2}=500 s^{-1}$, select most appropriate graph
A.

B.

C.

(d)


## Answer: B

125. Two consecutive irreversible fierst order reactions can be represented by
$A \xrightarrow{k_{1}} B \xrightarrow{k_{2}} C$
The rate equation for $A$ is readily interated to obtain
$[A]_{t}=[A]_{0} \cdot e^{-k_{1^{t}}}$, and $[B]_{t}=\frac{k_{1}[A]_{0}}{k_{2}-k_{1}}\left[e^{-k_{1}^{t}}-e^{-k_{2}^{t}}\right]$
Select the corret statement for given reaction:
A. A decreases linearly
B. B rise to a max. and then constant
C. B rises to a max and the falls
D. The slowest rate of increases of $C$ occuring where $B$ is max

## Answer: C

## - Watch Video Solution

126. Arrhenius studies the effect of temperature on the rate of a reaction and postulted that rate constant varies with temperature exponentially as $k=A e^{-E_{a} / R T}$. Thuis method is generally used for finding the activation energy of a reaction. Keeping temperature constant, the effect of catalyst on the activation energy has also been studied.

The pre-exponetial factor in the Arrhenius equation of a first order reaction has the unit :
A. $\mathrm{mol} L^{-1} s^{-1}$
B. $L \operatorname{mol}^{1} s^{-1}$
C. $s^{-1}$
D. 'dimensionaless

## Answer: C

## - Watch Video Solution

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If x is the fraction of molecules having energy greater than $E_{a}$ it will be given by :
A. $x=-\frac{E_{a}}{R T}$
B. $\ln x=-\frac{E_{a}}{R T}$
C. $x=e^{-E_{a} / R T}$
D. Any of these

## Answer: B

## - Watch Video Solution

128. Arrhenius studies the effect of temperature on the rate of a reaction and postulted that rate constant varies with temperature exponentially as $k=A e^{-E_{a} / R T}$. Thuis method is generally used for finding the activation energy of a reaction. Keeping temperature constant, the effect of catalyst on the activation energy has also been studied. If the rate of reaction doubles for $10^{\circ} \mathrm{C}$ rise of temperature form 290K to 300K, the activation energy of the reaction will be approximately:
A. $40 \mathrm{Kcal} \mathrm{mol}^{-1}$
B. $12 \mathrm{Kcal} \mathrm{mol}^{-1}$
C. $60 \mathrm{Kcal}_{\mathrm{mol}}{ }^{-1}$
D. $70 \mathrm{Kcal} \mathrm{mol}^{-1}$

## Answer: B

## - Watch Video Solution

129. An important parameter of a photochemical reaction is the quantum effeiciency or quantum yield $(\phi)$ which is defined as
$\phi=\frac{\text { moles of the substance reaction }}{\text { moles of photons absorbed }}$
Absorption of UV radiation decompose acetone according to the reaction $\left(\mathrm{CH}_{3}\right)_{2} \mathrm{CO} \xrightarrow{h v} \mathrm{C}_{2} \mathrm{H}_{6}+\mathrm{CO}$

The quantum yield of a reaction at $\lambda=330 \mathrm{~nm}$ is 0.4 . A sample of acetone absorbs monochromatic radiation at $\lambda 330 \mathrm{mn}$ at the rate of $7.2 \times 10^{-3} J s^{-1}$ (given : $N_{A}=6 \times 10^{23}, h=6.6 \times 10^{-34}$ in S.I unit). The rate of formation of $C O(\mathrm{~mol} / \mathrm{s})$ is :
A. $2 \times 10^{-8}$
B. $8 \times 10^{-8}$
C. $8 \times 10^{-9}$
D. none of these

## Answer: C

## - Watch Video Solution

130. An important parameter of a photochemical reaction is the quantum
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Absorption of UV radiation decompose acetone according to the reaction $\left(\mathrm{CH}_{3}\right)_{2} \mathrm{CO} \xrightarrow{h v} \mathrm{C}_{2} \mathrm{H}_{6}+\mathrm{CO}$

If quantum yield in 0.8 then rate of formation of $C_{2} \mathrm{H}_{6}(\mathrm{~mol} / \mathrm{s})$ is :
A. $2 \times 10^{-8}$
B. $1.6 \times 10^{-9}$
C. $16 \times 10^{-9}$
D. $8 \times 10^{-9}$

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131. Radioactive disintegration is a first order reaction and it's rate depends only upon the nature of nucleus and does not depend upon external factors like temperature and pressure. The rate of radioactive disintegration (Activity) is represented as $-\frac{d N}{d t}=\lambda N$, where $\lambda=$ decay constant, N number of nuclei at time $\mathrm{t}, N_{0}=$ initial no. of nuclei.

The above equation after integration can be represented as $\lambda=\frac{2.303}{t} \log \left(\frac{N_{0}}{N}\right)$
Half-life period of $U^{232}$ is $2.5 \times 10^{5}$ years. In how much time will the amount of $U^{237}$ remaining be only $25 \%$ of the original amount?
A. $2.5 \times 10^{5}$ year
B. $1.25 \times 10^{5}$ years
C. $5 \times 10^{5}$ years
D. none of these

## D Watch Video Solution

132. Radioactive disintegration is a first order reaction and it's rate depends only upon the nature of nucleus and does not depend upon external factors like temperature and pressure. The rate of radioactive disintegration (Activity) is represented as $-\frac{d N}{d t}=\lambda N$, Where $\lambda=$ decay constant, N number of nuclei at time $\mathrm{t}, N_{0}=$ initial no. of nuclei.

The above equation after integration can be represented as $\lambda=\frac{2.303}{t} \log \left(\frac{N_{0}}{N}\right)$
Calculate the half-life period of a radioactive element which remains only 1/16 of it's original amount in 4740 years :
A. 1185 years
B. 2370 years
C. 52.5 years
D. none of these

## D Watch Video Solution

133. Radioactive disintegration is a first order reaction and it's rate depends only upon the nature of nucleus and does not depend upon external factors like temperature and pressure. The rate of radioactive disintegration (Activity) is represented as $-\frac{d N}{d t}=\lambda N$, Where $\lambda=$ decay constant, N number of nuclei at time $\mathrm{t}, N_{0}=$ initial no. of nuclei.

The above equation after integration can be represented as
$\lambda=\frac{2.303}{t} \log \left(\frac{N_{0}}{N}\right)$
What is the activity in Ci (curie) of 1.0 mole of Plutonium - 239 ? ( $t_{1 / 2}=24,000$ years $)$
A. 1.49 Ci
B. 14.9 Ci
C. $5.513 \times 10^{11} \mathrm{Ci}$
D. 'None of these

## Answer: B

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134. Size of nucleus was obtained by the equation $r=R_{0} A^{1 / 3}$, Where $r$ is the radius of nucleus of mass no A . and $R_{0}$ is a constant whose valie is equal to $1.5 \times 10^{-15}$ metre.
(Given : $1 \mathrm{amu}=1.66 \times 10^{-24} \mathrm{~g}$ )
What is the density of a nucleus of mass number $A$ ?
A. $\frac{4}{3} \pi\left(1.5 \times 10^{-15}\right)^{3} \mathrm{~A}$
B. $1.17 \times 10^{17} \mathrm{~kg} / \mathrm{cm}^{3}$
C. $1.17 \times 10^{-17} \mathrm{~kg} / \mathrm{m}^{3}$
D. none of these

## Answer: B

## - Watch Video Solution

135. Size of nucleus was obtained by the equation $r=R_{0} A^{1 / 3}$, Where $r$ is the radius of nucleus of mass no A . and $R_{0}$ is a constant whose valie is equal to $1.5 \times 10^{-15}$ metre.
(Given : $1 \mathrm{amu}=1.66 \times 10^{-24} \mathrm{~g}$ )
Nucleus radius of ${ }_{6} C^{12}$ is $3 \times 10^{-15}$ metre. What is density ratio of $d_{c} / d_{H_{2} \mathrm{O}} ?$
A. $1.76 \times 10^{17}$
B. $1.76 \times 10^{14}$
C. $17.6 \times 10^{7}$
D. $17.6 \times 10^{17}$

## Answer: B

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136. Select the correct statement(s):
A. Rate constant are never negative
B. Partial orders are never negative
C. Molecularity and order of reaction both are equal for elementary reaction
D. Order of reaction may be change with change in practical conditions (temp. and pressure)

## Answer: A::C::D

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137. Select the correct statement(s):
A. the rate of reaction decreases with decreases in temperature
B. The rate of reaction is uniform in zero order reaction
C. The rate of reaction depends upon the surface area of the solid reactants
D. Average and instantaneous rate of reaction defined for macro andmicro-scopic time interval respectively

## Answer: A::B::C

## - Watch Video Solution

138. Select the correct statement(s) :
A. The rate law of the elementary reaction , $2 A \rightarrow B+C$, must be

$$
r=k[A]^{2}
$$

B. The rate law for the complex reaction $A+B \rightarrow C$, might not be $r=k[A][B]$
C. If the partial orders differ from the stoichiometric coofficients in the balanced reaction, the reaction must be complex
D. If the partial orders are equal to corresponding coefficients in the balanced reaction, the reaction must be elementary

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139. Select the correct statement(s) :
A. Every substance tht appears in the rate law of reaction must be a reactant or product in that reaction
B. If we know the rate law of a reaction, we can deduce its mechanism
C. If the reaction has rate $r=k[A][B]^{3 / 2}$ then reaction may be elementary
D. A zero order reaction must be a complex reaction

## Answer: D

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140. Select the correct statement(s) :
A. In the reaction ${ }_{92}^{235} U+{ }_{0}^{1} n \rightarrow{ }_{56}^{140} B a+2_{0}^{1} n+x, x \mathrm{~s}_{36}^{94} \mathrm{Kr}$
B. In the reaction ${ }_{11}^{23} N a+z \rightarrow{ }_{12}^{23} M g+{ }_{0}^{1} n$, the bombarding particle $z$ is deuteron
C. Very large amount of energy is produced during nuclear fusion and nuclear fission
D. In a fission reaction , a loss in mass occurs releasing a vast amount of energy

## Answer: A::C::D

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141. In the decay process:
$A \xrightarrow{-\alpha} B \xrightarrow{-\beta} C \xrightarrow{-\beta} D$
$A . A$ and $B$ are isobars
B. A and D are isotopes
C. B,C and D are isobars
D. A and C are isotones

## Answer: B::C

## D Watch Video Solution

142. 

Match the
following
columns

## Column-I

## Column-II

(A) Unit of $k$ is always equals to
(P) 1/time
(B) Unit of $k$ in zero order
(Q) $M /$ time
(C) Unit of $k$ in first order
(R) $\mathrm{Time}^{-1} M^{-1}$
(D) Unit of $k$ in second order
(S) Unit of $A$ (pre-exponential factor)

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143. Match the
following

## Column-I

(A) Molecularity of a reaction
(B) Order of reaction
(C) The dissociation of $\mathrm{H}_{2} \mathrm{O}_{2}$ (aq) is
(D) $\mathrm{H}_{2}(g)+\mathrm{Cl}_{2}(g) \xrightarrow{h v} 2 \mathrm{HCl}$ is

Column-II
(P) 0, 1 Possible
(Q) 1, 2 Possible
(R) First order reaction
(S) Zero order reaction
144.

## Column-I (Curve)

(A) $C$ vs $t$ (abscissa) for zero order
(B) $\log C$ vs $t$ (abscissa) for first order
(C) $\left(\frac{-d c}{d t}\right)$ vs $C$ for zero order
(D) $\ln \left(\frac{-d c}{d t}\right)$ vs $\ln C$ for first order
(S) $-\frac{k}{2.303}$

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145. 

Match
the
following
columns

## Column-I

(First order of reaction $A \rightarrow B$ )
(A) $[B]$ vs $t$

## Column-II

(P)

(B) $[A]$ vs $t$
(C) $\frac{1}{|A|}$ vs $t$
(b) $\ln k$ vs $\frac{1}{T}$
(Q)

(R)

(S)

146. Match the
following

## Column-I

(A) Isotones
(B) Isobars
(C) Isotopes
(D) Isodiaphers

Column-II
(P) ${ }_{2,1,1}^{2,3} \mathrm{~Pa}$ and ${ }_{40}^{23 / 4} \mathrm{Th}$
(Q) ${ }_{21}^{12} \mathrm{C}$ and ${ }_{6}^{14} \mathrm{C}$
(R) ${ }_{1 \%}^{39} \mathrm{~K}$ and ${ }^{11}{ }_{2}^{2} \mathrm{~F}$
(S) ${ }_{1 \times}^{4 \prime} \mathrm{Ar}$ and ${ }_{10}^{40} \mathrm{~K}$

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147. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1:Molecurity has no meaning for a complex reactions
STATEMENT-2:Molecurity defined only for RDS
A. both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. both the statement are TRUE but STATEMENT-2 is NOT the correct
C. STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: C

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148. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: An elementry reaction cannot have fractional order.

STATEMETNT-2:Stoichiometric coefficients in an elementary reaction can be fractional.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: C

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149. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

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

STATEMENT-2: For zero order reaction $A \rightarrow B$, successive half life of reaction decrease with the progress of the reaction.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: D

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150. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: The order of reaction can have fractional value.

STATEMENT-2: For an elementary reaction, the parial orders are determined by the reaction stoichiometry
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: B

## - Watch Video Solution

151. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: Catalyst may increase the rate constant to a large extent.

STATEMENT-2:By using suitable catalyst, we can significantly increase yield.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: C

## - Watch Video Solution

152. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: Product is formed only when the required orientation and energy conditions are met.

STATEMENT-2: All collisions between reactants yield the desired product
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: C

## - Watch Video Solution

153. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: The plot of $k$ versus $1 / T$ is linear.
STATEMENT-2: $k=A \cdot e^{-E_{a} / R T}$
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: D

## - Watch Video Solution

154. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: For exothermic reaction equilibrium constant decrease with increase in temperature.

STATEMETN-2: For exothermic reaction rate constant decrease with decrease in temperature.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: B

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155. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT -1: If the activation energy of reaction is zero, temperature will have no effect on the rate constant.

STATEMENT-2: Lower the activation energy faster is the raction.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: B

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156. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according
to the instructions given below:
STATEMENT-1: Active complex is an intermediate product.
STATEMENT-2: Active complex is unstable with high vibrational energy.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: D

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157. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according
to the instructions given below:

STATEMENT-1: The pre-exponential factor $A$ has the same units for all reactions.

STATEMENT -2: $e^{-E_{a} / R T}$ has no unit.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: D

## ( Watch Video Solution

158. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2
(Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT -1: $\gamma$ - rays have very high penetrating power.
STATEMENT-2: $\gamma$-rays are electromagnetic raidations of high energy.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: A

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159. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2
(Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: Disintegration of.${ }_{1}^{3} H$ (tritium) is accompanied by $\beta-$ emission.

STATEMENT-2: Tritium has high $\mathrm{n} / \mathrm{p}$ ratio.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: A

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160. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: The life of radiactive object (organic origin) can found with the help of carbon dating.

STATEMENT-2: ${ }_{6}^{14} C$ is a $\alpha$ and $\beta$-emitter.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: C

161. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: Neutron are the best bombarding particles.
STATEMENT-2: Neutrons are neutral particles.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: A

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162. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: Nucleus does not contain fee electrons, yet it emit betaparticles

STATEMENT-2: At high $\mathrm{n} / \mathrm{p}$ ratio, one neutron supposed to give 1 proton and $1 e^{-}(\beta)$.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: A

163. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: Rate of disintegration of thorium increases with the increase in moles of thorium.

STATEMENT-2: Rate of disintegration does not depend upon temperature, pressure
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: B
164. The rate of decomposition of $\mathrm{NH}_{3}(\mathrm{~g})$ at 10 atm on platinum surface is zero order. What is rate of formation (in $\mathrm{M} \min ^{-1}$ ) of $H_{2}(\mathrm{~g})$, if rate constant of reaction $2 \mathrm{NH}_{3(g)} \rightarrow \mathrm{N}_{2}(g)+3 \mathrm{H}_{2}(g)$ is $2.0 \mathrm{M} \mathrm{min}^{-1}$ ?

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165. In an elementary reaction $A(g)+2 B(g) \rightarrow C(g)$ the initial pressure of A and B are $P_{A}=0.40$ atm and $P_{B}=0.60$ atm respectively. After time T, if pressure of C is observed 0.1 atm , then find the value of $r_{i}$ ( initial rate of reaction)
$\overline{r_{t}(\text { rate of reaction after time } \mathrm{t})}$.

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166. Carbon monoxide reacts with $\mathrm{O}_{2}$ to form $\mathrm{CO}_{2}$ :
$2 \mathrm{CO}(\mathrm{g})+\mathrm{O}_{2}(\mathrm{~g}) \rightarrow 2 \mathrm{CO}_{2}(\mathrm{~g})$
Infromations about this reaction are given in the table below.
$[\mathrm{CO}] \mathrm{mol} / \mathrm{L} \quad\left[\mathrm{O}_{2}\right] \mathrm{mol} / \mathrm{L} \quad$ Rate of reaction (mol $/ \mathrm{L} \cdot \mathrm{min}$ )

| 0.02 | 0.02 | $4 \times 10^{-5}$ |
| :--- | :--- | :--- |
| 0.04 | 0.02 | $1.6 \times 10^{-4}$ |
| 0.02 | 0.04 | $8 \times 10^{-5}$ |

What is the value for the rate constant for the reaction in properly related unit?

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167. Half-life for the zero order reaction $A(g) \rightarrow B(g)+C(g)$ and halflife for the first order reaction $X(g) \rightarrow Y(g)+Z(g)$ are equla. If completion time for the zero order reaction is 13.86 min , then calculate the rate constant ( in $h r^{-1}$ ) of the reaction $X(g)+\rightarrow Y(g)+Z(g)$.

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168. For an acid catalysed reaction $A \xrightarrow{H^{+}} B$ half life period is independent of concentration of A at given pH . At same concentrationn of A half tiem is 10 min at $p^{H}=2$ and half life time is 100 min at $P^{H}=3$.

If the rate law expression of reaction is $r=K[A]^{x}\left[H^{+}\right]^{y}$ then calculate $(x+y)$

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169. Iiodine - 131 is a radioactive isdotpe. If 1.0 mg of ${ }^{131} I$ has an activity of $4.6 \times 10^{12} \mathrm{~Bq}$. What is the half-life of ${ }^{131} I$ (in days)

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170. The average life of a radioactive element is 7.2 min . Calculate the time travel (in min ) between the stages of $33.33 \%$ and $66.66 \%$ decay

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171. $A, B$ and $C$ are isodiapher, while $C, D$ and $E$ are isobars. Calculate the difference of protons between A and $\mathrm{E}_{82}^{206} A \rightarrow B \rightarrow C \rightarrow D \rightarrow E$
172. How may $\alpha-$ and $\beta$ - particles will be emitted when .90 $T h^{232}$ changes into $.82 b^{208}$ ?

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173. The difference between number of $\alpha$ and $\beta$ particles emitted during the conversion of $U_{92}^{238} \rightarrow P b_{82}^{206}$ is

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## Level 1 Q 3 To Q 32

1. The reaction of $A_{2}$ and $B_{2}$ follows the equation
$A_{2}(g)+B_{2}(g) \rightarrow 2 A B(g)$
The following data were observed
$\left[A_{2}\right]_{0} \quad\left[B_{2}\right]_{0}$ Initial rate of appearance of $\mathrm{AB}(\mathrm{g})\left(\mathrm{in} M s^{-1}\right.$
$0.10 \quad 0.10 \quad 2.5 \times 10^{-4}$
$0.20 \quad 0.10 \quad 5 \times 10^{-4}$
$0.20 \quad 0.20 \quad 10 \times 10^{-4}$

The value of rate constatnt for the above reaction is :
A. $2.5 \times 10^{-4}$
B. $2.5 \times 10^{-2}$
C. $1.25 \times 10^{-2}$
D. None of these

## Answer: B

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2. The following data pertain to reaction between A and B

| S.No | $[A]$ | $[B]$ | Rate |
| :--- | :--- | :--- | :--- |
|  | $m o l L^{-1}$ | molL $L^{-1}$ | $\mathrm{molL}^{-1} \mathrm{sec}^{-1}$ |
| I | $1 \times 10^{-2}$ | $2 \times 10^{-2}$ | $2 \times 10^{-4}$ |
| II | $2 \times 10^{-2}$ | $2 \times 10^{-2}$ | $4 \times 10^{-4}$ |
| III | $2 \times 10^{-2}$ | $4 \times 10^{-2}$ | $8 \times 10^{-4}$ |

Which of the following interference(s) can be drawn from the above data
(a) Rate constatnt 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 reactant Select the correct answer codes
A. a,b and C
B. $a$ and b
C. b and c
D. c alone

## Answer: C

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## Level 1 Q 33 To Q 62

1. Half-life $\left(t_{1 / 2}\right)$ and completion time ( T ) of the reaction $(A \rightarrow 2 B)$ are if initial concentration $A$ is 1 M and $\mathrm{k}=0.001 \mathrm{M} / \mathrm{min}$ :
A. $500 \mathrm{~min}, 750 \mathrm{~min}$
B. $500 \mathrm{sec}, 750 \mathrm{sec}$
C. $500 \mathrm{sec}, 1000 \mathrm{sec}$
D. None of these

## Answer: C

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2. 

column I
$P$. Zero order reaction
Q. $\quad$ First order reaction
$R$. second order reactions
$S$. Pseudo unimolecular reaction
4. $[A]=[A]_{0} e^{-k t}$
column II

1. $t_{1 / 2} \alpha \frac{1}{[A]_{0}}$
2. $\quad t_{100 \%}=[A]_{0} / k$
3. Involves at least two react
A.
$\begin{array}{llll}P & Q & R & S\end{array}$
$\begin{array}{llll}2 & 1 & 4 & 2\end{array}$
$P \quad Q \quad R \quad S$
B.
$\begin{array}{llll}2 & 4 & 1 & 3\end{array}$
C. $\begin{array}{llll}P & Q & R & S \\ 2 & 1 & 3 & 4\end{array}$
D.

## Answer: B

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3. The decomposition of $\mathrm{N}_{2} \mathrm{O}$ in carbon tetrachloride was followed bymesuring the volume of $O_{2}$ gas evolved : $2 N_{2} O_{5}\left(\mathrm{CCL}_{4}\right) \rightarrow 2 \mathrm{~N}_{2} \mathrm{O}_{4}\left(\mathrm{CCL}_{4}\right)+\mathrm{O}_{2}(\mathrm{~g})$. The maximum volume of $O_{2}$ gas obtained was $100 \mathrm{~cm}^{3}$. In 500 minutes, 90 cm of $O_{2}$ were evolved. The first order rate constant (in $\mathrm{min}^{-1}$ for the dissaperance of $\mathrm{N}_{2} \mathrm{O}$ is :
A. $\frac{2.303}{500}$
B. $\frac{2.303}{500} \log \frac{100}{90}$
C. $\frac{2.303}{500} \log \frac{90}{100}$
D. $\frac{100}{10 \times 500}$

## Answer: A

## Level 1 Q 63 To Q 92

1. A first order reaction is $50 \%$ completed in 20 minutes at $27^{\circ} \mathrm{C}$ and in 5 minutes at $47^{\circ}$. The energy of activation of the reaction is :
A. $43.85 \mathrm{KJ} / \mathrm{mol}$
B. $55.14 \mathrm{KJ} / \mathrm{mol}$
C. $11.97 \mathrm{KJ} / \mathrm{mol}$
D. $6.65 \mathrm{KJ} / \mathrm{mol}$

## Answer: B

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2. A catalyst lowers the activation energy for a certain reaction from 83.314 to $75 \mathrm{KJ} \mathrm{mol}^{-1}$ at 500 K . What will be the rate of reaction as
compared to uncatalyst reaction ? Assume other things being equal
A. Double
B. 28 times
C. 7.38 times
D. $7.38 \times 10^{3}$ times

## Answer: C

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## Level 1 Q 93 To Q 122

1. In the radioactive decay
${ }_{.} X^{A} \rightarrow_{Z+1} Y^{A} \rightarrow{ }_{Z-1} Z^{A-4} \rightarrow_{Z-1} Z^{A-4}$
high energy low energy
the sequence of the
radiation emitted is:
A. $\alpha, \beta, \gamma$
B. $\gamma, \alpha, \beta$
C. $\beta, \gamma, \alpha$
D. $\beta, \alpha, \gamma$

## Answer: D

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2. A radioactive nuclide emitts $\gamma$ - rays due to the :
A. emission of an electron from its orbital
B. nuclear energy transition from a higher state to a lower state
C. presence of less neutrons than protons
D. presence of more neutrons than protons

## Answer: B

3. Consider the following decay $.{ }_{Z}^{A} X \rightarrow{ }_{Z+1}^{A} Y+{ }_{-1}^{0} e, X$ is unstable because:
A. its nucleus has excess energy
B. $\frac{n}{p}$ ratio is high
C. $\frac{n}{p}$ ratio is low
D. none of these

## Answer: B

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4. Consider the following decay ${ }_{\cdot}^{A} X \rightarrow{ }_{Z-1}^{A} Y+{ }_{+1}^{0} e,\left(\beta^{+}\right) X$ is unstable because:
A. its nucleus has excess energy
B. $\frac{n}{p}$ ratio is high
C. $\frac{n}{p}$ ratio is low
D. none of these

## Answer: C

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5. Which of the following emissions do not cause the emission of X-ray ?
A. $\alpha$-emission
B. $\beta$-emission
C. $\beta^{+}$(Positron) emission
D. electron capture

## Answer: D

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6. Which of the following processes result in an increase in the atomic number of a nuclide?
A. $\alpha$-emission
B. electron capture
C. $\gamma$-emission
D. $\beta$-(Beta) emission

## Answer: D

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7. .......... Is produced when a positron and an electron collide.
A. X-ray
B. Neutron
C. $\gamma$-radiation
D. Neutrino

## Answer: C

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8. ${ }_{67}^{165} \mathrm{Ho}$ is stable isotope. ${ }_{67}^{150} \mathrm{Ho}$ is expected to distegrate by:
A. $\alpha$-emission
B. $\beta$-emission
C. Positron emission
D. $\gamma$-emission

## Answer: C

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9. $1^{1} H$ is a stable isotope $.1^{3} H$ is expected to disintegrated by :
A. $\alpha$-emission
B. $\beta$-emission
C. Positron emission
D. proton emission

## Answer: B

## D Watch Video Solution

10. Emission of $\beta$-particle is equivatent to:
A. increase of one proton only
B. decrease of one neutron only
C. both (a) and (b)
D. none of these

## Answer: C

11. Pair of isobar is :
A. ${ }_{6}^{17} C,{ }_{7}^{17} N$
B. ${ }_{6}^{13} C,{ }_{7}^{14} N$
C. $._{6}^{14} C,{ }_{8}^{15} N$
D. None of these

## Answer: A

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12. The 'group displacement law' was given by :
A. Bacqueral
B. Rutherford
C. Madam Curie
D. Soddy and Fajan

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13. ${ }_{3}^{7} L i+{ }_{1}^{1} P \rightarrow X$, Identify X if reaction is $(p, \alpha)$ type.
A. ${ }_{4}^{8} B e$
B..${ }_{2}^{4} \mathrm{He}$
C. ${ }_{0}^{0} \gamma$
D. none of these

## Answer: B

Watch Video Solution
14. Identify reaction type:
${ }_{-13}^{27} A l+{ }_{1}^{2} H \rightarrow{ }_{13}^{28} A l+{ }_{1}^{1} H$
A. (d,p)
B. (p,p)
C. $(p, d)$
D. none of these

## Answer: A

## D Watch Video Solution

15. ${ }_{13}^{27} \mathrm{Al}+{ }_{1}^{1} P \rightarrow X+{ }_{0}^{0} \gamma$, type artifical radioactive reaction.
A. ${ }_{13}^{28} A l$
B. ${ }_{14}^{27} S i$
C. ${ }^{28}{ }_{14} S i$
D. none of these

## Answer: C

16. What will be the product of reaction ${ }_{\cdot 101}^{255} M d(\alpha, 2 n)$ ?
A. ${ }_{103}^{256} L r$
B..$_{54}^{257} N o$
C. ${ }_{103}^{257} L r$
D..${ }_{82}^{205} \mathrm{~Pb}$

## Answer: C

## - Watch Video Solution

17. $.{ }_{92}^{235} U+{ }_{0}^{1} n \rightarrow{ }_{56}^{139} \mathrm{Ba}+{ }_{36}^{94} \mathrm{Kr}+3{ }_{0}^{1} n+200 \mathrm{MeV}$

Total energy released (in MeV ) after $5^{\text {th }}$ stage of fission is:
A. 48600
B. 16200
C. 24200
D. None of these

## Answer: C

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18. Proton bombardment on $T h^{230}$ followed by emission of two alpha particles will produce:
A. $R n^{232}$
B. $R a^{233}$
C. $F r^{223}$
D. $F r^{222}$

## Answer: C

19. ${ }_{83}^{214} \mathrm{Bi}$ decays to A by $\alpha$-emission. A then decays to B by beta emission, which further decays to C by another beta emission. Element C decays to D by still another beta emission, and D deacays by $\alpha$-emission to form a stable isotope E . What is element E ?
A. ${ }_{81}^{207} T 1$
B. ${ }_{80}^{206} \mathrm{Hg}$
C. ${ }_{79}^{206} A u$
D. ${ }_{82}^{206} \mathrm{~Pb}$

## Answer: D

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20. The activity of a radionuclide $\left(X^{100}\right)$ is 6.023 curie . If the disintegration constant is $3.7 \times 10^{4} \mathrm{sec}^{-1}$, the mass of the radionuclide is:
A. $6.022 \times 10^{6} \mathrm{~g}$
B. $10^{-13} g$
C. $10^{-15} \mathrm{~g}$
D. $10^{-17} \mathrm{~g}$

## Answer: C

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## Level 1 Q 123 To Q 150

1. Activity of a radioactive substance is $R_{t}$ at time $t_{1}$ and $R_{2}$ at time $t_{2}\left(t_{2}>t_{1}\right)$. Then the ratio $\frac{R_{2}}{R_{1}}$ is
A. $e^{\lambda\left(t_{2}+t_{1}\right)}$
B. $e^{\lambda\left(t_{1}-t_{2}\right)}$
C. $e^{-\lambda\left(t_{1}+t_{2}\right)}$
D. $\frac{t_{2}}{t_{1}}$

## Answer: B

## D Watch Video Solution

2. The half-life of ${ }_{6}^{14} C$ is 5730 year. What fraction of its original $C^{14}$ would left after 22920 year of storage?
A. 0.5
B. 0.25
C. 0.125
D. 0.0625

## Answer: D

## - Watch Video Solution

3. The amount of ${ }_{6}^{14} C$ isotope in a piece of wood is found to one fourth (1/4) of that present in a fresh piece of wood. Calculate the age of the
piece of wood $\left(t_{12}\right.$ of ${ }_{6}^{14} C=5770$ years $)$
A. 7999 year
B. 11540 year
C. 16320 year
D. 23080 year

## Answer: B

## - Watch Video Solution

4. A radioactive element undergoing decay is left $20 \%$ of its initial weight after certain period of time $t$. How many such periods should elapse from the start for the $50 \%$ of the element to be left over?
A. 3
B. 4
C. 5
D. none of these

## Answer: D

## - Watch Video Solution

5. In a sample of wood, the reading of a counter is 32 dpm and in a fresh sample of tree it is 122 dpm . Due to error counter gives the reading 2 dpm in absence of.$^{14} C$. Half life of.${ }^{14} C$ is 5770 years . The approximate age (in years) of wood sample is :
A. 7997.2
B. 57570
C. 11540
D. 15140

## Answer: C

6. A certain radioactive isotope $\cdot{ }_{Z}^{A} X\left(t_{1 / 2}=100\right.$ days decays to ${ }_{Z}^{A-8} Y$. If 1 mole of $\cdot{ }_{Z}^{A} X$ is kept in sealed container, how much He gas will accumulate at STP in 200 days?
A. 11.2 litres
B. 33.6 litres
C. 22.4 litres
D. 44.8 litres

## Answer: B

## - Watch Video Solution

7. Two radio isotopes $A$ and $B$ of atomic mass $X$ and $Y$ are mixed in equal amount by mass. After 20 days, their mass ratio is found to be $1: 4$. Isotope $A$ has a half-life of 1 day. The half-life of isotope B is :
A. $1.11 \frac{Y}{X}$ days
B. $0.11 \frac{X}{Y}$ day
C. 0.6237 day
D. 1.10 day

## Answer: D

## - Watch Video Solution

8. There are two radio nuclei A and B is a $\alpha$-emitter and B is $\beta$-emitter. Their disintegration constant are in the ratio of 1:2. What should be the number of atoms ratio of $A$ and $B$ at time $t=0$, so that initially probability of getting of $\alpha$ and $\beta$-particles are same.
A. $2: 1$
B. $4: 1$
C. 1: 2
D. 1: 4

## D Watch Video Solution

9. $A c^{227}$ has a half-life of 22 years. The decays follows two parallel paths


What are the decay constant $(\lambda)$ for Th and Fr respectively?
A. $0.03087,0.00063$
B. $0.00063,0.03087$
C. $0.02,0.98$
D. None of these

## Answer: B

10. ${ }_{.84}^{218} P o\left(t_{1 / 2}=183 \mathrm{sec}\right)$ decay to ${ }_{.82} P b\left(t_{1 / 2}=161 \mathrm{sec}\right)$ by $\alpha-$ emission, while $P b^{214}$ is a $\beta$-emitter. In an experiment starting with 1 mole of pure $P_{o}^{218}$, how many time would be required for the number of nuclei of.${ }_{82}^{214} \mathrm{~Pb}$ to reach maximum ?
A. 147.5
B. 247.5
C. 182
D. 304

## Answer: B

## - Watch Video Solution

1. The forward rate constant for the elementary reversible gaseous reaction
$C_{2} H_{6}<\Rightarrow 2 C_{3}$ is $1.57 \times 10^{-3} s^{-1} a t 100 K$
What is the rate constant for the backward reaction at this temperature if $10^{-4}$ moles of $C H_{3}$ and 10 moles of $C_{2} H_{6}$ are present in a 10 litre vessel at equilibrium .
A. $1.57 \times 10^{9} \mathrm{Lmole}^{-1} \mathrm{~s}^{-1}$
B. $1.57 \times 10^{10} \mathrm{Lmole}^{-1} \mathrm{~s}^{-1}$
C. $1.57 \times 10^{11} \mathrm{Lmole}^{-1} \mathrm{~s}^{-1}$
D. $1.57 \times 10^{7} \mathrm{Lmole}^{-1} s^{-1}$

## Answer: D

## - Watch Video Solution

2. For a hypothetical reaction,
$A+3 B \rightarrow P \quad \Delta H=-2 x \mathrm{Kj} /$ "mole" of A
$\& M \rightarrow 2 Q+R \quad \Delta H=+\times \mathrm{kJ} /$ "mole" of M
These reactions are carried simultaneously in a reactor such that temperature is not changing If rate of disppearance of $B$ is $y \sec ^{-1}$ then rate of formation (in $\mathrm{Msec}^{-1}$ ) of $Q$ is :
A. $\frac{2}{3} y$
B. $\frac{3}{2} y$
C. $\frac{4}{3} y$
D. $\frac{3}{4} y$

## Answer: C

## - Watch Video Solution

## Level 2 Q 3 To Q 32

1. For the two reactions $I: A \rightarrow B I I: C \rightarrow D$ following graph is obtained.


Which of the following is true:
A. If $[B]=[A]$ then at that time $[D]=0.75$
B. If $[\mathrm{C}]=[\mathrm{A}]$ then at that time $[B]=[D]$
C. $\left(t_{100 \%}\right)_{\text {ReactonI }}=\left(t_{100 \%}\right)_{\text {Reaction } I I}$
D. $[\mathrm{A}]=[\mathrm{C}]$ at $t=\frac{\sqrt{3}}{2} \mathrm{~min}$.

## Answer: A

2. The reaction $A(g) \rightarrow B(g)+2 C(g)$ 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 pressure and at 300 K ?
A. $0.0125 M$
B. $0.025 M$
C. 0.05 M
D. none of these

## Answer: B

## - Watch Video Solution

3. $A(a q) \rightarrow B(a q)+C(a q)$ is first order reaction.

Time $\quad t \quad \infty$
moles of reagent

$$
n_{1} \quad n_{2}
$$

Reaction prgress is measured with the help of titration of reagent 'R'. If
all $A, B$ and $C$ react with reagent and have ' $n$ ' factors [ $n$ factor,eq. mass= $\underline{\text { mol.mass }}$ in the ratio of $1: 2: 3$ with the reagent, the k in terms of $n$
$t, \quad n_{1}$ and $n_{2}$ is :
A. $k=\frac{10}{t} \ln \left(\frac{n_{2}}{n_{2}-n_{1}}\right)$
B. $k=\frac{1}{t} \ln .\left(\frac{2 n_{2}}{n_{2}-n_{1}}\right)$
C. $k=\frac{1}{t} \ln .\left(\frac{4 n_{2}}{n_{2}-n_{1}}\right)$
D. $k=\frac{1}{t} \ln .\left(\frac{4 n_{2}}{5\left(n_{2}-n_{1}\right)}\right)$

## Answer: D

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4. The gaseous decomposition reaction, $A(g) \rightarrow 2 B(g)+C(g)$ is observed to first order over the excess of liquid water at $25^{\circ} \mathrm{C}$. It is found that after 10 minutes the total pressure of system is 188 torr and after very long time it is 388 torr. The rate constant of the reaction (in hr ^ $(-1)$ ) is: [Given : vapour pressure of $\mathrm{H}_{2} \mathrm{O}$ at $25^{\circ}$ is 28 torr (In $2=0.7, \ln 3=1.1, \ln 10=2.3)]$
A. 0.02
B. 1.2
C. 0.2
D. none of these

## Answer: B

## - Watch Video Solution

5. The reaction ,Sucrose $\xrightarrow{H^{+}}$Glucose + Fructose, take place at certain temperature while the volume of solution is maintained at 1 litre. At time zero the initial rotation of the mixture is $34^{\circ}$. After 30 minutes the total rotation of solutions is $19^{\circ}$ and after a very long time, the total roation is $-11^{\circ} \mathrm{C}$ Find the time when solution was potically inaactive.
A. 135 min
B. 103.7 min
C. 38.7 min
D. 45 min

## Answer: B

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6. A gaseous compound A reacts by three independent first order process (as shown in figure) with rate constant $2 \times 10^{-3}, 3 \times 10^{-3}$ and $1.93 \times 10^{-3} \mathrm{sec}^{-1}$ for products $B, C$ and $D$ respectively, If initially pure $A$ was taken in a closed container with $\mathrm{p}=8$ atm then the partial pressure of B (in atm) after 100 sec from starting the experiment.
A. 0.288
B. 0.577
C. 1.154
D. none of these

## Answer: C

7. A compound A dissociates by two parallel first order paths at certain temperature
$A(g) \xrightarrow{k_{1}\left(\frac{-1}{\min }\right)} 2 B(g) \quad k_{1}=6.93 \times 10^{-3} \mathrm{~min}^{-1}$
$A(g) \xrightarrow{k_{1}\left(\mathrm{~min}^{-1}\right)} C(g) \quad k_{2}=6.93 \times 10^{-3} \mathrm{~min}^{-1}$
The reaction is started with 1 mole of pure 'A' litre closed container with initial pressure 2 atm. What is the pressure (in atm) developed in container after 50 minutes from start of experiment?
A. 1.25
B. 0.75
C. 1.50
D. 2.50

## Answer: D

8. For given hypothetical elementary parallel reaction, where $\mathrm{k} 1 / \mathrm{k} 2=1 / 2$

Intially only 2 moles of A are present. The total no. of moles of A, B and C at the end of $75 \%$ reaction are:
A. 2
B. 3
C. 4
D. 3.5

## Answer: D

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9. The reaction cis-X $\underset{k_{b}}{k_{f}} \Rightarrow$ trans-X is first order in both direction At $25^{\circ} \mathrm{C}$, 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- from ,
how long would it take for half of the equilibrium amount of the transiomer to be fromed?
A. 150 sec
B. 200 sec
C. 240 sec
D. 210 sec

## Answer: D

10. Consider the reaction.


The rate constant for two parallel reactions were found to be $10^{-2} \mathrm{dm}^{-2} \mathrm{~mol}^{-1} \mathrm{~s}^{-1}$ and $4 \times 10^{-2} \mathrm{dm}^{-3} \mathrm{~mol}^{-1} \mathrm{~s}^{-1}$. If the corresponding energies of activation of the parallel reaction are 100 and $120 \mathrm{~kJ} / \mathrm{mol}$ respectively, what is the net energy of activation $\left(E_{a}\right)$ of A
A. $100 \mathrm{~kJ} / \mathrm{mol}$
B. $120 \mathrm{~kJ} / \mathrm{mol}$
C. $116 \mathrm{~kJ} / \mathrm{mol}$
D. $220 \mathrm{~kJ} / \mathrm{mol}$

## Answer: C

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11. A reaction takes place in various steps. The rate constatn for first, second, third and fifth steps are $k_{1}, k_{2}, k_{3}$ and $k_{5}$ respectively The overall rate constant is given by
$k=\frac{k_{2}}{k_{3}}\left(\frac{k_{1}}{k_{5}}\right)^{1 / 2}$
If activation energy are $40,60,50$, and $10 \mathrm{~kJ} / \mathrm{mol}$ respectively, the overall energy of activation $(\mathrm{kJ} / \mathrm{mol})$ is :
A. 10
B. 20
C. 25
D. none of these

## Answer: C

12. For reaction $A \rightarrow B$, the rate constant $k_{1}=A_{1} e^{-E a_{1 /(R T)}}$ and for the reactio $X \rightarrow Y$, the rate constant $k_{2}=A_{2} e^{-E a_{1 /(R T)}}$. If $A_{1}=10^{8}, A_{2}=10^{10}$ and $E_{a_{1}}=600 \mathrm{cal} / \mathrm{mol}, E_{a_{2}}=1800 \mathrm{cal} / \mathrm{mol}$ then the temperature at which $k_{1}=k_{2}$ is (Given : $\mathrm{R}=2 \mathrm{cal} / \mathrm{K}-\mathrm{mol}$ )
A. 1200 K
B. $1200 \times 4.606 K$
c. $\frac{1200}{4.606} K$
D. $\frac{600}{4.606} K$

## Answer: D

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13. 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. none of these

## Answer: B

14. In the series reaction
$A \xrightarrow{K_{2}} B \xrightarrow{K_{2}} C \xrightarrow{K_{2}} D$, if $K_{1}>K_{2}>K_{3}$ then the rate determing step of the reaction is
A. $A \rightarrow B$
B. $C \rightarrow D$
C. $B \rightarrow C$
D. Any step

## Answer: B

## - Watch Video Solution

15. The mechanism of esterification in presence of acid catalyst $\left(\mathrm{H}_{2} \mathrm{SO}_{4}\right)$ is proposed as follows:

$$
\begin{aligned}
& \mathrm{CH}_{3} \mathrm{COH} \quad \stackrel{\begin{array}{c}
k_{1} \\
\text { (I) } \\
-\mathrm{H}^{+} \text {(fast) }
\end{array}}{\substack{\mathrm{H}^{+} \text {(fast) } \\
k_{1}^{\prime}}} \\
& \text { (II) } \\
& \text { fast } k_{3}^{\prime} \| k_{3} \text { fast }
\end{aligned}
$$

Which of the following potential energy $V s$ reaction co-ordinate diagram is consitent with given mechanism ?

A.
B.

C.

D.
P.E.


## Answer: A

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16. For the first order reaction $A \rightarrow B+C$, carried out at $27^{\circ} \mathrm{C}$. If $3.8 \times 10^{-16} \%$ of the reactant molecules exists in the activated state, the $E_{a}$ (activation energy) of the reaction is:
A. $12 \mathrm{~kJ} / \mathrm{mol}$
B. $831.4 \mathrm{~kJ} / \mathrm{mol}$
C. $100 \mathrm{~kJ} / \mathrm{mol}$
D. $88.57 \mathrm{~kJ} / \mathrm{mol}$

## Answer: C

17. Upon irradiating californium with neutrons, a scientist discovered a new nuclide having mass number of 250 and a half-life of 30 min . After 90 min. of irradiation, the observed radioactivity due to nuclied was 100 dis/min. How many atoms of the nucliede were prepared intially?
A. $2.4 \times 10^{4}$
B. $3.46 \times 10^{4}$
C. 1900
D. 800

## Answer: B

## - Watch Video Solution

18. The average (mean) life of a radio nuclide which decays by parallel path is
$A \xrightarrow{\lambda_{1}} B: \lambda_{1}=1.8 \times 10^{-2} \mathrm{sec}^{-1}$
$2 A \xrightarrow{\lambda_{2}} B, \lambda_{2}=10^{-3} \mathrm{sec}^{-1}$
A. 52.63 sec
B. 500 sec
C. 50 sec
D. none of these

## Answer: C

## - Watch Video Solution

19. The radioactive decay.$_{83}^{211} \mathrm{Bi} \rightarrow_{81}^{207} \mathrm{Ti}$, takes place in 100 L closed vessel at $27^{\circ} \mathrm{C}$ Starting with 2 mols of.$_{83}^{211} \mathrm{Bi}\left(t_{1 / 2}=130 \mathrm{sec}\right)$, the presuure development in the vessel after 520 sec will be:
A. 1.875 atm
B. 0.2155 atm
C. 0.4618 atm
D. 4.618 atm

## Answer: C

## - Watch Video Solution

20. A fresh radioactive mixture contians short lived sppecies A and B. Both emitting $\alpha$-particles intially of $8000 \alpha$ particles per minute. 20 minutes later, they emis at the rate of $3500 \alpha$-particles per minute. If the half-lives of the species $A$ and $B$ are 10 minutes and 500 hours respectively, then the ratio of activities of $A$ : $B$ the intial mixture was:
A. $4: 6$
B. 6: 4
C. 3:4
D. 3:1

## Answer: D

21. In order to determine the volume of blood in an animal, a 1.0 mL sample of solution of $10^{3} \mathrm{dpm}$ of $\cdot{ }_{1}^{3} \mathrm{H}$ is injected into the animal blood stream. After sufficient time for circulatory equilibrium to be established, 2 mL of blood is found to have activity to 10 dpm . The volume of blood in animal is :
A. 199 mL
B. 198 mL
C. 200 mL
D. 20 mL

## Answer: A

## - Watch Video Solution

## Level 2 Q 33 To Q 35

1. Find the age of an ancient Egyptian wooden article (in years) from the given information.
(i) Activity of 1 g of carbon obtained from ancient wooden article $=7$ counts/min/g
(ii) Activity of 1 g carbon obtained from fresh wooden sample $=15.4$ counts per min/g
(iii) Precentage increases in level of $C^{14}$ due to nuclear explosions in past 100 years is $10 \%$
(iv) $t_{1 / 2}$ of ${ }_{6}^{14} C=5770$ years
A. $5.770 \times 10^{3}$
B. $16.87 \times 10^{3}$
C. 2488
D. none of these

## Answer: A

2. The isotopes. ${ }^{238} U$ and. ${ }^{235} U$ occur in nature in the mass ratio $140: 1$. it is assumed that intially they were found in equal mass. If half life $\left(t_{1 / 2}\right)$ of . ${ }^{238} U=4.5 \times 10^{9}$ and $t_{1 / 2}$ of $.{ }^{235} U=7.13 \times 10^{8}$ years respectively then the age of earth is $(\log 7=0.846, \log 2=0.3)$
A. $6.04 \times 10^{9}$ year
B. $2.01 \times 10^{9}$ year
C. $8.72 \times 10^{9}$ year
D. none of these

## Answer: A

## - Watch Video Solution

## Level 3 Passage

1. Two consecutive irreversible fierst order reactions can be represented by
$A \xrightarrow{k_{1}} B \xrightarrow{k_{2}} C$
The rate equation for $A$ is readily interated to obtain
$[A]_{t}=[A]_{0} \cdot e^{-k_{1} t}$, and $[B]_{t}=\frac{k_{1}[A]_{0}}{k_{2}-k_{1}}\left[e^{-k_{1}^{t}}-e^{-k_{2}^{t}}\right]$
If $k_{1}$ and $k_{2}$ both are almost same then which graph is most suitable ?
A. graph A
B. graph B
C. graph C
D. graph D

## Answer: A

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Level 3 One Or More Answers Are Correct

1. Select the correct statement(s) :
A. When $T \rightarrow \infty$ or $E_{a} \rightarrow O$ then $\mathrm{K}=\mathrm{A}$
B. A positive catalyst can change $\Delta H$ of the reaction
C. A mixture catalyst may be thermodynamically unstable by kinetically stable
D. A negative catalyst increases the activation energy of the reaction

## Answer: A::C::D

## - Watch Video Solution

2. Consider a reaction $A+B \rightarrow C$, in which boht reactants are in the same phase, may be
A. unimolecular elementary reaction
B. Exothermic
C. Heterogeneous
D. Photochemical

## Answer: B::C::D

3. In the following gaseous phase first order reaction
$A(g) \rightarrow 2 B(g)+C(g)$
initial pressure was found to be 400 mm of Hg and it changed to 1000 mm of Hg after 20min. Then
A. half life for $A$ is 10 min
B. rate constant is $0.0693 \mathrm{~min}^{-1}$
C. partial pressure of C at 30 min is 350 mm of Hg
D. total pressure after 30 min is 1100 mm of Hg

## Answer: A::B::C::D

## - Watch Video Solution

4. Indentify the true statement(s)
A. A catalyst is chemically unchanged at the end of a reaction
B. A catalyst may appear in the kinetic rate equation of the reaction
C. A catalyst will not affect the composition of an equilibrium mixture
D. A catalyst cannot cause a non-spontaneous $(\Delta G>0)$ reaction to proceed

## Answer: A::B::C::D

## - Watch Video Solution

5. For the reaction $A \underset{k_{2} \sec ^{-1}}{\stackrel{K_{1} \sec ^{-1}}{\rightleftharpoons}} B$ following graph is given, $k_{1}=4 \times 10^{-2} \sec ^{-1}$. Which is/are correct statement (s) (ln 2=0.7, In 8/7
$=0.14)$

A. equilibrium constant is 4.0
B. Time taken for the completion fo $50 \%$ fo equilibrium conc. Of B is 14 sec.
C. Time taken for the completion of $10 \%$ of initial conc. Of A is 2.8 sec .
D. Rate constant of backward reaction is $10^{-2} \mathrm{sec}^{-1}$

## Answer: A::B::C::D

## - Watch Video Solution

6. Select the correct statement(s) :
A. $\alpha$-particles are simply helium atoms
B. $\gamma$-rays travel with higher speed as compared to $\alpha$-particle and have higher ionization power as compare to $\beta$-particle
C. Loss of $\beta$-particles resuluts in the production of isobars
D. $\beta$-particle are considered as the best bombarding particles

## Answer: C

## - Watch Video Solution

7. Select the correct statement(s) :
A. SI unit of radioactivity is becquerel (Bq)
B. $1 C i=3.7 \times 10^{7} \mathrm{~Bq}$
C. . ${ }_{3}^{7} L i+{ }_{1}^{1} H \rightarrow{ }_{2}^{4} H e i s(P, \alpha)$ type reaction
D. The half -time of a particular radioactive isotope is a characteristics constant of that isotope

## Answer: A::C::D

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8. Select the correct statement(s) :
A. On bombarding ${ }_{7}^{14} N$ nuclei with $\alpha$-particle, the nuclie of the product formed after release of proton would be.${ }_{8}^{17} \mathrm{O}$
B. Decay constant does not depend upon temperature
C. Nuclide and its decay product after $\alpha$-emission are called isodiaphers
D. Half-life of radium is 1580 years . Its average life will be 1097.22 years

## Answer: A::B::C

9. In electron capture (radioactive process):
A. a neutron is formed
B. a proton is consumed
C. $\gamma$-ray emission take place
D. X-ray emission takes place

## Answer: A::B::D

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10. Select the correct statement(s) for positron emission by unstable nucleus.
A. X-ray emission takes place
B. a neutron is formed
C. $\frac{n}{p}$ of daughter nucleus increases
D. A neutron is consumed

## Answer: B::C

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11. Select the correct statement(s)
A. Mass number remains constant when positron emission takes place
B. One neutron converts into proton in $\beta\left({ }^{0}{ }_{-1} e\right)$ emission process
C. Activity of a radioactive substance double when temp. increases from 300 K to 310 K
D. Isodiaphers formed when one alpha particle emitted and isotopes formed when 2 beta particles emitted

## Answer: A: B

Column-I
Linear plots (with non zero slope)
(A) $\ln \left[-\frac{d[A]}{d t}\right]$ vs. $\ln [\mathrm{A}]$
(P) 2
(B) $\log _{e} k$ vs. $\frac{1}{T}$
(C) $\log t_{1 / 2}$ vs. $\log [A]_{0}$
(D) $\frac{-d[A]}{d t}$ vs. $[A]^{2}$
(Q) $\frac{1}{3}$
(R) 0
(S) 1

Column-II
(Order)
13.

## Match

## Column-I

(A) $\alpha$-emission
(B) $\beta$-emission
(C) $\gamma$-emission
(D) $\beta^{+}$(Positron) emission
the
following
columns

## Column-II

(P) Change in mass ne
(0) No change in atomic no, and mass no.
(R) Atomic no. decteases
(S) Atomic no. increases

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1. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENTS-1: Acid catalysed hydrolysis of esters is pseudo first order reaction.

STATEMETNT-2:Water is present in excess in given reaction.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: A

2. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: For each $10^{\circ} \mathrm{C}$ rise of temperature the k is nearly double.
STATEMENT -2: Energy wise distribution of molecules in a gas sample is an exponential function of temperature so $e^{-E_{a} / R T}$ is doubled.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: A

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3. Each question contains STATEMENTS-1 (Assertion) and STATEMENT -2 (Reason).

Examine the statements carefully and mark the correct answer according to the instructions given below:

STATEMENT-1: Nuclide $\cdot{ }_{13}^{30} A l$ is less stable than ${ }_{20}^{40} C a$.
STATEMENT-2: Nuclide having odd number of protons and neutrons are generally unstable.
A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1
B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

## Answer: B

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1.5A $\rightarrow$ Product

In above reaction, half-life period is directly proportional to initial concentration of reactant. The initial rate of reaction is 400 mol lit ${ }^{-1} \min ^{-1}$. Calculate the half - life period (in sec) when initial concentration of reactant is $200 \mathrm{~mol} \mathrm{lit}^{-1} \min ^{-1}$.

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2. For a reaction, $A \Leftrightarrow B$ equilibrium constant is 1.66 and $k_{\text {forward }}=0.166 h r^{-1}$.

Calculate the time (in hour) when concentration of B is $80 \%$ of its equilibrium concentration. (Given : In 25=3.20)

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3.
, At time
$t=0$, intial mole of $A$ is 1 .

Overall half time of the reaction is 15 days. Then calculate the number of mole of C after 45 days if the raio of $k_{1}: k_{2}: k_{3}$ is $4: 2: 1$

## O <br> Watch Video Solution

