CHEMISTRY
JEE-MAIN (February-Attempt) 24
February (Shift-1) Paper

SECTION - A

1. The gas released during anaerobic degradation of vegetation may lead to:

(1) Global warming and cancer (2) Acid rain

(3) Corrosion of metals (4) Ozone hole

Ans. **(1)**

Sol. Biogas is the mixtrue of gases produced by the breakdown of organic matter in the absence of oxygen (anaerobically), primary consisting of methane and carbondioxide. Biogas can be produced from raw material such as agricultural waste, manure, municiple waste, plant material, sewage, green waste or good waste. Due to release of CH_4 gas during anaerobic vegetative degradstion which caueses globle warming and cancer.

2. Out of the following, which type of interaction is responsible for the stabilisation α–helix structure of proteins ?

(1) Ionic bonding (2) Hydrogen bonding

(3) vander Waals forces (4) Covalent bonding

Ans. **(2)**

Sol. The α-helix is stabilized by hydrogen bond between the NH and CO group of the main chain.

3. Which of the following are isostructural pairs ?

(A) SO_4^{2-} and CrO_4^{2-}

(B) $SiCl_4$ and $TiCl_4$

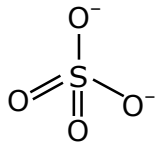
(c) NH_3 and NO_3^-

(D) BCl_3 and $BrCl_3$

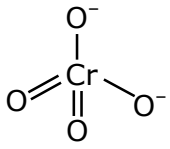
1. A and C only
2. A and B only
3. B and C only
4. C and D only

Ans. **(2)**

Sol. (1) SO_4^{-2} and CrO_4^{2-} both have tetrahedral structure.

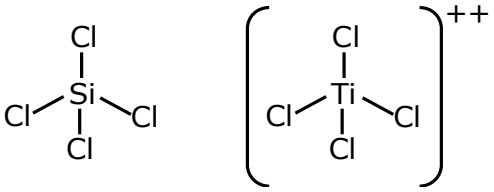


Tetrahedral

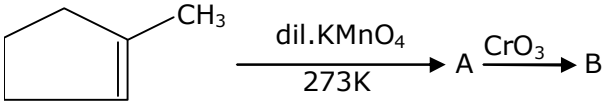


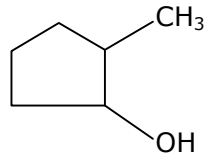
Tetrahedral

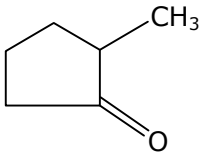
(2) $SiCl_4$ and $TiCl_4$ both have Tetrahedral structure also.

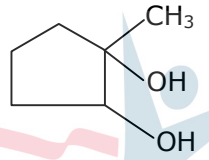


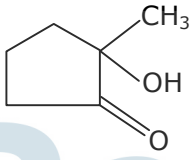
4. Identify products A and B.



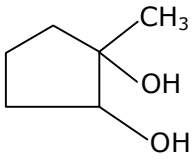
(1) A : 

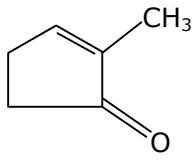
B : 

(2) A : 

B : 

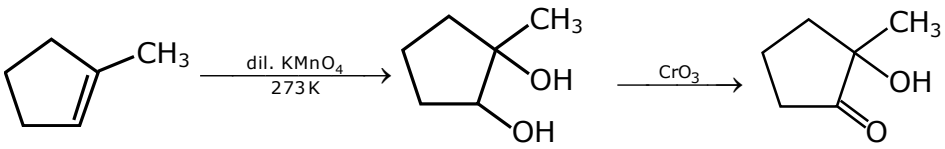
(3) A : OHC $-CH_2CH_2CH_2-\overset{\overset{O}{\|}}{C}-CH_3$ B : HOOC$-CH_2CH_2CH_2-\overset{\overset{O}{\|}}{C}-CH_3$

(4) A : 

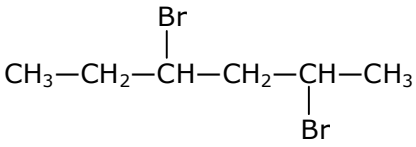
B : 

Ans. (2)

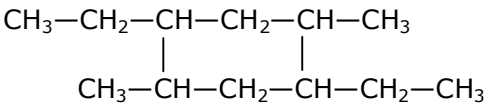
Sol.

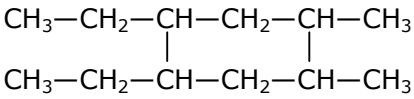


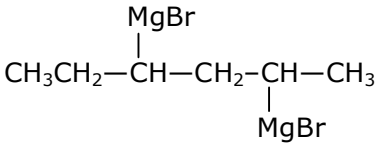
5. The product formed in the first step of the reaction of

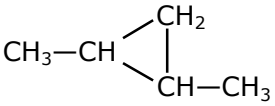


with excess $Mg/Et_2O(Et = C_2H_5)$ is :

(1) 

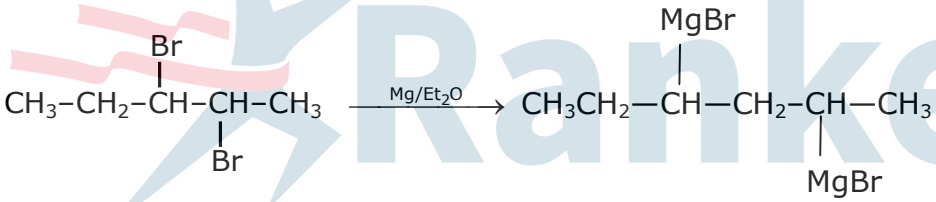
(2) 

(3) 

(4) 

Ans. **(3)**

Sol.



6. The electrode potential of M^{2+}/M of 3d– series elements shows positive value for:

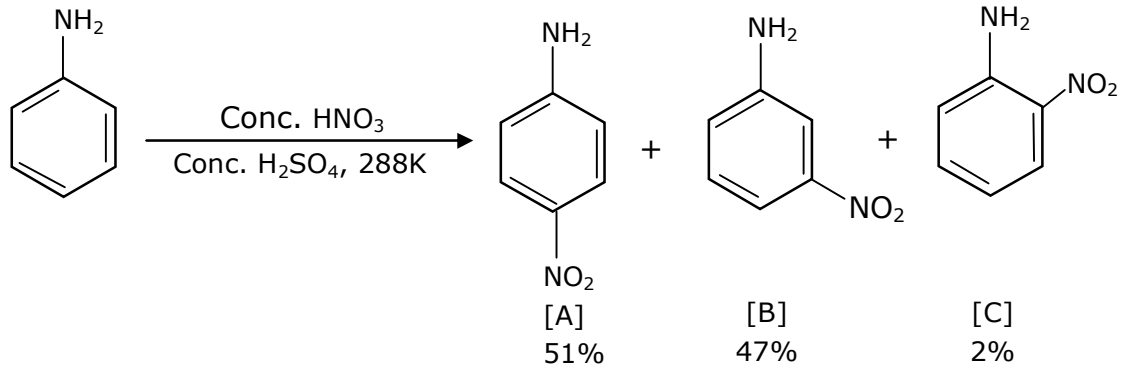
(1) Zn (2) Co (3) Fe (4) Cu

Ans. **(4)**

Sol.

(A) Zn	–0.76
(B) CO	–0.28
(C) Fe	–0.44
(D) Cu	+0.34

7. In the following reaction the reason why meta–nitro product also formed is:



[A] 51% [B] 47% [C] 2%

(1) Formation of anilinium ion

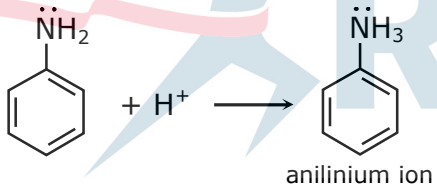
(2) $-NO_2$ substitution always takes place at meta–position

(3) low temperature

(4) $-NH_2$ group is highly meta–directive

Ans. **(1)**

Sol.



anilinium ion

In acidic medium the $-NH_2$ group in aniline converts into anilinium ion which is meta directing.

8. (A) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$

(B) $I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O + O_2$

Choose the correct option.

(1) H_2O_2 act as oxidizing and reducing agent respectively in equations (A) and (B).

(2) H_2O_2 acts as oxidizing agent in equations (A) and (B).

(3) H_2O_2 acts as reducing agent in equations (A) and (B).

(4) H_2O_2 acts as reducing and oxidising agent respectively in equation (A) and (B).

Ans. **(3)**

Sol. When H_2O_2 acts a reducing agent it liberates the O_2.

$H_2O_2 \rightleftharpoons 2H^+ + O_2 + 2e^-$

9. Which of the following ore is concentrated using group 1 cyanide salt ?

(1) Sphalerite (2) Siderite

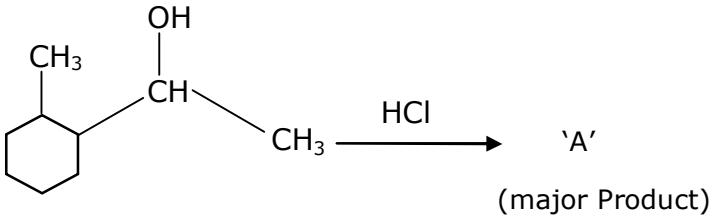
(3) Malachite (4) Calamine

Ans. **(1)**

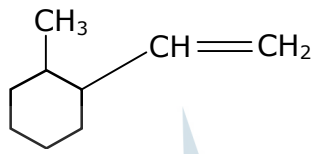
Sol. Conc. of sphalerite, first by cyanide salt as a depressant to remove the impurity of galena

$$Zns + Pbs + \underset{\text{excess}}{NaCN} \longrightarrow \underset{\text{solution}}{Na_2[Zn(CN)_4]} + PbS\uparrow$$

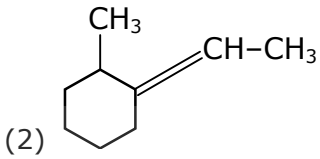
10. Which is the final product (major) 'A' in the given reaction?



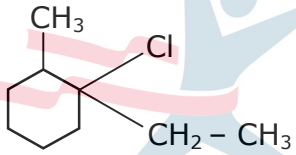
(1)



(2)



(3)



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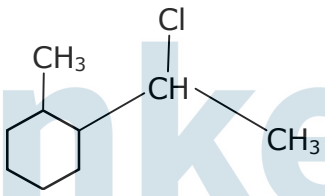
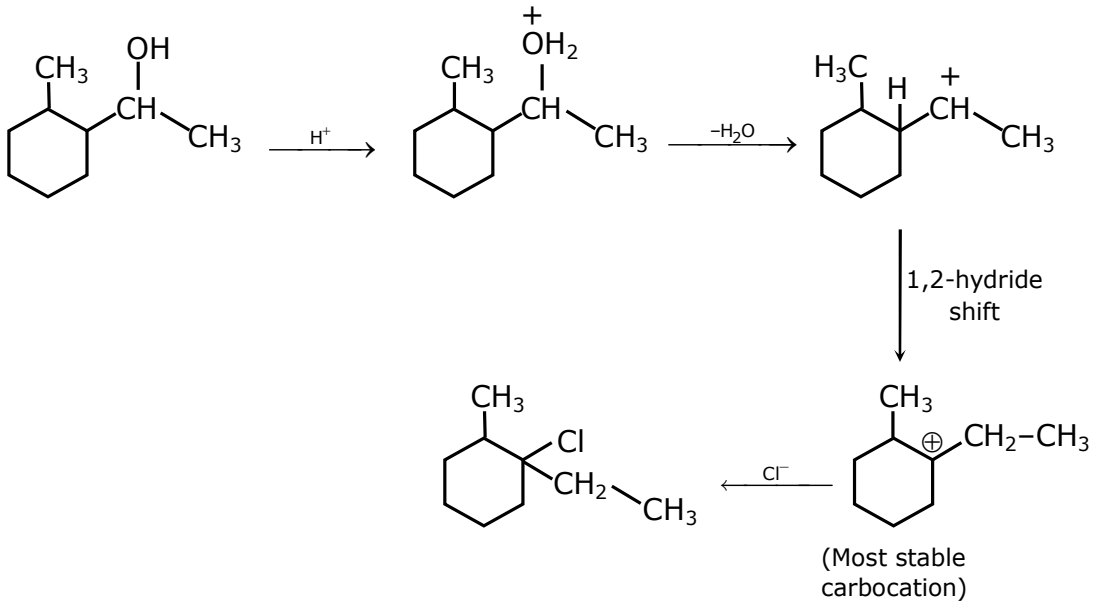
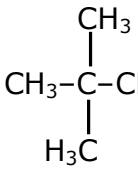
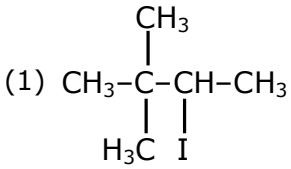


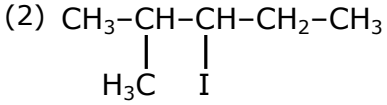
Ans. **(3)**

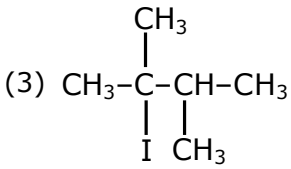
Sol.

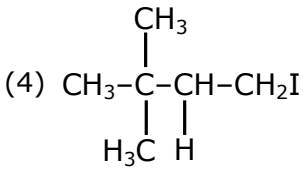


11. What is the major product formed by HI on reaction with  ?

(1) 

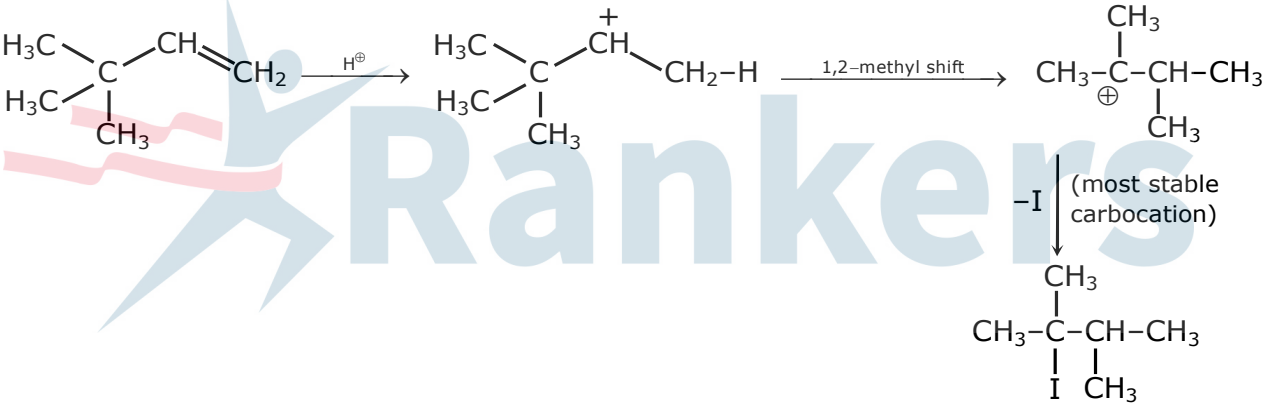
(2) 

(3) 

(4) 

Ans. **(3)**

Sol.



12. Which of the following reagent is used for the following reaction ?

$CH_3CH_2CH_3 \xrightarrow{?} CH_3CH_2CHO$

(1) Potassium permanganate

(2) Molybdenum oxide

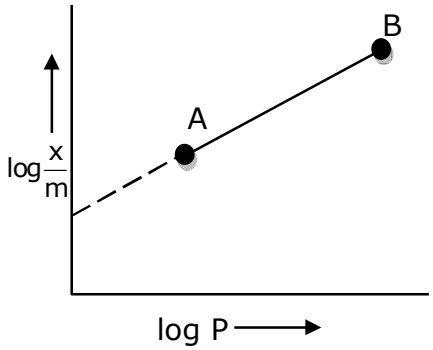
(3) Copper at high temperature and pressure

(4) Manganese acetate

Ans. **(2)**

Sol. $CH_3–CH_2–CH_3 \xrightarrow{MO_2O_3} CH_3–CH_2–CH=0$

13. In Freundlich adsorption isotherm, slope of AB line is :



(1) $\frac{1}{n}$ with $\left(\frac{1}{n} = 0 \text{ to } 1\right)$

(2) log $\frac{1}{n}$ with (n<1)

(3) log n with (n>1)

(4) n with (n, 0.1 to 0.5)

Ans. **(1)**

Sol. Freundlich adsorption isotherm is :

$\frac{x}{m} = kp^{1/n}$

x = mass of adsorbate

m = mass of adsorbent

P = eq. pressure

$k_1 n = \frac{1}{n}$ log p + log k

y = mx + c

compairing

$m = \frac{1}{n}$ = slope $\left[\frac{1}{n} = 0 \text{ to } 1\right]$

n > 1

14. The major components in "Gun Metal" are:

(1) Al, Cu, Mg and Mn

(2) Cu, Sn and Zn

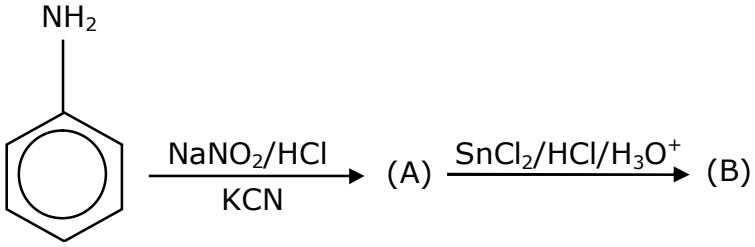
(3) Cu, Zn and Ni

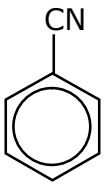
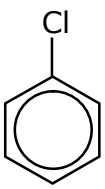
(4) Cu, Ni and Fe

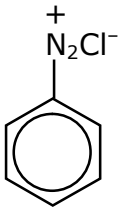
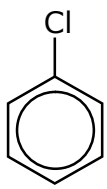
Ans. **(2)**

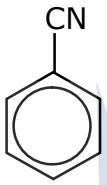
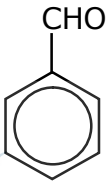
Sol. "Gun metal" is alloy of copper with tin and zinc.

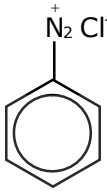
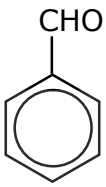
15. 'A' and 'B' in the following reactions are :



(1) (A) :  (B) : 

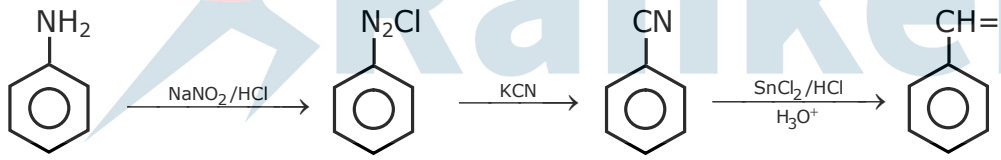
(2) (A) :  (B) : 

(3) (A) :  (B) : 

(4) (A) :  (B) : 

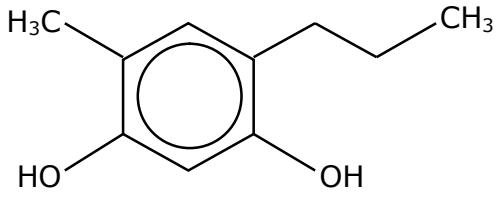
Ans. (3)

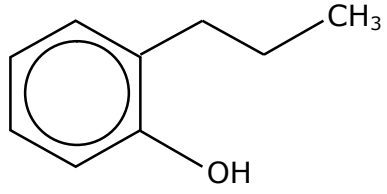
Sol.

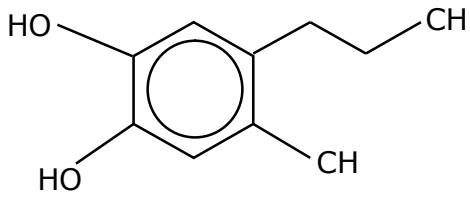


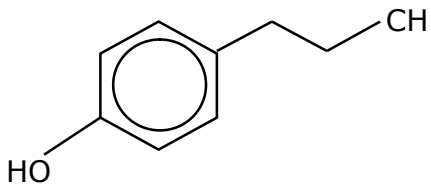
(A) (Stephen's rexn) (B)

16. Which of the following compound gives pink colour on reaction with phthalic anhydride in conc.H_2SO_4 followed by treatment with NaOH ?

(1) 

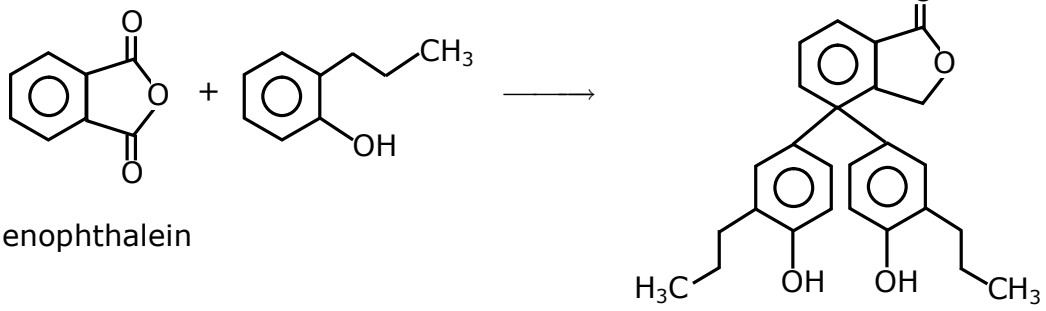
(2) 

(3) 

(4) 

Ans. **(2)**

Sol.



Phenophthalein

(Pink colour)

17. Consider the elements Mg, Al, S, P and Si, the correct increasing order of their first ionization enthalpy is:

(1) Al < Mg < Si < S < P (2) Al < Mg < S < Si < P

(3) Mg < Al < Si < S < P (4) Mg < Al < Si < P < S

Ans. **(1)**

Sol. Order of IE, in 3rd period is

Na < Mg > Al < Si < P > S < Cl < Ar

Na < Al < Mg < Si < S < P < Cl < Ar

due to stable full filed 3s-orbital and more penetrating power

due to half filed $3p^3$-orbital of phosphorous

18. Given below are two statements :

Statement I : Colourless cupric metaborate is reduced to cuprous metaborate in a luminous flame.

Statement II : Cuprous metaborate is obtained by heating boric anhydride and copper sulphate in a non-luminous flame.

In the light of the above statements, choose the most appropriate answer from the options given below.

(1) Statement I is false but statement II is true.

(2) Statement I is true but Statement II is false.

(3) Both Statement I and Statement II are true.

(4) Both Statement I and Statement II are false.

Ans. **(4)**

Sol. Both are False

(1) Copper sulphate form copper meta boric with beric an hydride

$CuSO_4 \longrightarrow CuO + SO_3$

$CuO + B_2O_3 \longrightarrow Cu(BO_2)_2$

blue in cold oxidising flame (non luminous flame)

(2) Blue coloured metal borate is reduced to copper in a luminous flame.

19. Al_2O_3 was leached with alkali to get X. The solution of X on passing of gas Y, forms Z. X, Y and Z respectively are :

(1) X = $Na[Al(OH)_4]$, Y=CO_2, Z = $Al_2O_3.xH_2O$

(2) X=$Na[Al(OH)_4]$, Y=SO_2, Z = Al_2O_3

(3) X=$Al(OH)_3$, Y=SO_2, Z = $Al_2O_3.xH_2O$

(4) X = $Al(OH)_3$, Y=CO_2, Z= Al_2O_3

Ans. **(1)**

Sol. (1) $Al_2O_3 + NaOH \longrightarrow \underset{\text{"X"}}{Na[Al(OH)_4]}$

(2) $Na[Al(OH)_4] \xrightarrow[\text{"Y"}]{CO_2} \underset{\text{"Z"}}{Al(OH)_3 \text{ or } Al_2O_3 . xH_2O}$

20. Match List I with List II.

List I (Monomer Unit)	**List II** (Polymer)
(a) Caprolactum	(i) Natural rubber
(b) 2-Chloro-1,3-butadiene	(ii) Buna-N
(c) Isoprene	(iii) Nylon 6
(d) Acrylonitrile	(iv) Neoprene

Choose the correct answer from the options given below :

(1) (a) → (iii), (b) → (iv), (c) → (i), (d) → (ii)

(2) (a) → (i), (b) → (ii), (c) → (iii), (d) → (iv)

(3) (a) → (ii), (b) → (i), (c) → (iv), (d) → (iii)

(4) (a) → (iv), (b) → (iii), (c) → (ii), (d) → (i)

Ans. **(1)**

Sol. (1) Polymer of caprolactum is nylon-6

(2) Polymer of 2-chloro-1,3-butadiene is neoprene.

(3) Polymer of isoprene is natureal rubber

(4) Polymer of acrylonitrile and 1,3-butadiene is buna-N

SECTION – B

1. The stepwise formation of $[Cu(NH_3]^{2+}$ is given below:

$$Cu^{2+} + NH_3 \xrightleftharpoons{K_1} \left[Cu\left(NH_3\right)_4\right]^{2+}$$

$$\left[Cu\left(NH_3\right)_2\right]^{2+} + NH_3 \xrightleftharpoons{K_2} \left[Cu\left(NH_3\right)_2\right]^{2+}$$

$$\left[Cu\left(NH_3\right)_2\right]^{2+} + NH_3 \xrightleftharpoons{K_3} \left[Cu\left(NH_3\right)_3\right]^{2+}$$

$$\left[Cu\left(NH_3\right)_3\right]^{2+} + NH_3 \xrightleftharpoons{K_4} \left[Cu\left(NH_3\right)_4\right]^{2+}$$

The value of stability constants K_1, K_2, K_3 and K_4 are 10^4, 1.58×10^2 , 5×10^2 and 10^2 respectively. The overall equilibrium constants for dissociation of $[Cu(NH_3)_4]^{2+}$ is $x \times 10^{-12}$. The value of x is _____. (Rounded off to the nearest integer)

Ans. **(1)**

Sol. $\left[Cu\left(NH_3\right)_4\right]^{+2} \xrightleftharpoons{k} cu^{+2} + 4NH_3$ .....(A)

For this :

$$Cu^{+2} + NH_3 \xrightleftharpoons{k1} \left[Cu\left(NH_3\right)\right]^{+2} \text{.....(1)}$$

$$\left[Cu\left(NH_3\right)\right]^{+2} + NH_3 \xrightleftharpoons{k_2} \left[cu\left(NH_3\right)_2\right]^{+2} \text{.....(2)}$$

$$\left[Cu\left(NH_3\right)\right]^{+2} + NH_3 \xrightleftharpoons{k_3} \left[cu\left(NH_3\right)_3\right]^{+2} \text{.....(3)}$$

$$\left[Cu\left(NH_3\right)_3\right]^{+2} + NH_3 \xrightleftharpoons{k_4} \left[Cu\left(NH_3\right)_4\right]^{+2} \text{.....(4)}$$

(1) + (2) + (3) + (4)

$$Cu^{+2} + 4NH_3 \xrightleftharpoons{k_1.k_2.k_3.k_4} \left[C_4\left(NH_3\right)_4\right]^{+4} \text{.....(B)}$$

So for (A)

$$K = \frac{1}{k_1.K_2.K_3.K_4}$$

Putting the value of k_1,k_2,k_3 and k_4.

$$K = \frac{1}{(10)^4.\left(1.58\times10^3\right)\left(5\times10^2\right)(10)^2} = 1.26\times10^{-12}$$

x = 1.

2. At 1990 K and 1 atrm pressure, there are equal number of Cl_2 molecules and Cl atoms in the reaction mixture. The value of K_p for the reaction $Cl_{2(g)} \rightleftharpoons 2Cl_{(g)}$ under the above conditions is x $\times 10^{-1}$. The value of x is _____. (Rounded off to the nearest integer)

Ans. **(5)**

Sol. $Cl_2 \rightleftharpoons 2Cl^-$

Lets mole of eq. x x

P.P. at eq. $\frac{x}{2x} \times 1$ $\frac{x}{2x} \times 1$

$\frac{1}{2}$ $\frac{1}{2}$

$$K_p = \frac{[P_{c1}]^2}{[P_{Cl_2}]} = \frac{\left[\frac{1}{2}\right]^2}{\frac{1}{2}} = \frac{1}{2} = 0.5 = 5 \times 10^{-1}$$

X = 5.

3. 4.5 g of compound A (MW = 90) was used to make 250 mL of its aqueous solution. The molarity of the solution in M is x $\times 10^{-1}$. The value of x is _____. (Rounded off to the nearest integer)

Ans. **(2)**

Sol. Moles of A = $\frac{\text{Weight}}{\text{M.w}}$

$= \frac{4.5}{90} = \frac{1}{20} = 0.05$

Volume (Lit) = $= \frac{250}{1000} = 0.250$ lit lit

Moles of A = $\frac{\text{Weight}}{\text{M.w}}$

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Volume (Lit) = $= \frac{250}{1000} = 0.250$ lit lit

Molarity (M) = $\frac{\text{Mole}}{\text{(Lit)volume}} = \frac{0.05}{0.250} = 0.2$

$= 2 \times 10^{-1} \frac{\text{mol}}{\text{Lit}}$

x = 2

Molarity (M) = $\frac{\text{Mole}}{\text{(Lit)volume}} = \frac{0.05}{0.250} = 0.2$

$= 2 \times 10^{-1} \frac{\text{mol}}{\text{Lit}}$ x = 2

4. The coordination number of an atom in a body-centered cubic structure is _____.
[Assume that the lattice is made up of atoms]

Ans. **(4)**

Sol. Fact

5. Number of amphoteric compounds among the following is _____.
(A) BeO (B) BaO (C) $Be(OH)_2$ (D) $Sr(OH)_2$

Ans. **(2)**

Sol. BeO and $Be(OH)_2$ are amphoteric in nature

6. When 9.45g of $ClCH_2COOH$ is added to 500 mL of water, its freezing point drops by 0.5°C. The dissociation constant of $ClCH_2COOH$ is $x \times 10^{-3}$. The value of x is _____. (Rounded off to the nearest integer)
$[K_{f(H_2O)} = 1.86\,K\,kg\,mol^{-1}]$

Ans. **(35)**

Sol.

	$ClCH_2COOH \longrightarrow$	$ClCH_2COO^{\ominus}$	+ $H^{\oplus}$
t = 0	C	O	O
t = t	C–cα	cα	cα

Total no. of moles = c+ cα = c(1+ α)

$$i = \frac{\text{observed}}{\text{calculate}} = \frac{c(1+\alpha)}{c} = (1+\alpha)$$

M.W. = 94.5

$\Delta T_f = i \times k_f \times m$ $\Delta T_f = 0.5°C$

$i = 1 + \alpha$

$$0.5 = (1+\alpha) \times 1.86 \times \frac{\frac{9.45}{94.5}}{\frac{500}{1000}}$$

$$m = \frac{\text{mole}}{\text{k.g(Solvent)}}$$

$k_t = 1.86k$ kg/mol

$$(1+\alpha) = \frac{2.5}{1.86}$$

$$\alpha = \frac{0.64}{1.86} = \frac{32}{93}$$

$$K_a = \frac{C\alpha^2}{1-\alpha} = \frac{0.2 \times 1024}{93 \times 93 \times \frac{61}{93}}$$

$K_a = 0.0351 = 35.1 \times 10^{-3}$

7. A proton and a Li^{3+} nucleus are accelerated by the same potential. If λ_{Li} and λ_p denote the de Broglie wavelengths of Li^{3+} and proton respectively, then the value of $\frac{\lambda_{Li}}{\lambda_p}$ is $x \times 10^{-1}$. The value of x is _____. [Rounded off to the nearest integer]
[Mass of Li^{3+} = 8.3 mass of proton]

Ans. **(2)**

Sol. De Brogir Davelength

$$\lambda = \frac{h}{\sqrt{2m\ k.E.}}$$

$$\frac{\lambda_{Li^{+3}}}{\lambda_p} = \sqrt{\frac{m_p \times (e^- v)_p}{m_{Li^{+3}} \times 3e_p v}}$$

$m_{Li^{+3}}$ = 8.3 mp

$$\frac{\lambda_{Li^{+3}}}{\lambda_p} = \sqrt{\frac{m_p}{3 \times 8.3 m_p}} = \sqrt{\frac{1}{25}}$$

$$= \frac{1}{5} = 0.2 = 2 \times 10^{-1}$$

x = 2.

8. Gaseous cyclobutene isomerizes to butadiene in a first order process which has a 'k' value of $3.3 \times 10^{-4}\ s^{-1}$ at 153°C. The time in minutes it takes for the isomerization to proceed 40% to completion at this temperature is _____. (Rounded off to the nearest integer)

Ans. **(26)**

Sol. For firdst order Rxn :-

$$t = \frac{2.303}{k} \log\left[\frac{100}{100 - x}\right]$$

X = 40, k = 3.3×10^{-4}

$$t = \frac{2.303}{3.3 \times 10^{-4}} \log\left[\frac{100}{60}\right]$$

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$$t = \frac{2.303}{3.3 \times 10^{-4}} \log\left[\frac{100}{60}\right]$$

$$t = \frac{2.303}{3.3 \times 10^{-4}} \times 0.22$$

t = $0.1535.3 \times 10^4$

t = 1535 sec.

t = $0.1535.3 \times 10^4$

t = 1535 sec = 25.6 Min.

9. For the reaction $A_{(g)} \rightarrow B_{(g)}$, the value of the equilibrium constant at 300 K and 1 atm is equal to 100.0. The value of $\Delta_r G$ for the reaction at 300 K and 1 atm in J mol^{-1} is $-xR$, where x is _____. (Rounded off to the nearest integer)
[R = 8.31 J $mol^{-1}K^{-1}$ and ln 10 = 2.3]

Ans. **(1380)**

Sol. $\Delta G° = -RT \ln Keq.$
$= -R \times 300 \times \ln(10^2)$
$= 300 \times 2 \times 2.3 \times (-R)$
$= -1380R$
x = 1380 ans.

10. The reaction of sulphur in alkaline medium is given below:

$$S_{8(s)} + a\ OH^-_{(aq)} \longrightarrow b\ S^{2-}_{(aq)} + c\ S_2O_3^{2-}{}_{(aq)} + d\ H_2O_{(\ell)}$$

The values of 'a' is _____. (Integer answer)

Ans. **(12)**

Sol. $S_8 + aOH^- \longrightarrow bs^{-2} + CdS_2O_3^{-2} + dH_2O$
$S_8 + bOH^- \longrightarrow 4S^{-2} + 2S_2O_3^{-2} + dH_2O$
$S_8 + 12OH^- \longrightarrow 4S^{-2} + 2S_2O_3^{-2} + 6H_2O$
a = 12