ASSOCIATION OF CHEMISTRY TEACHERS

NATIONAL STANDARD EXAMINATION IN CHEMISTRY 2018-2019

Date of Examination : 25th November 2018

Time : 11 : 00 to 13 : 00 Hrs.

[Q. Paper Code : C321]

(Total Marks : 240)

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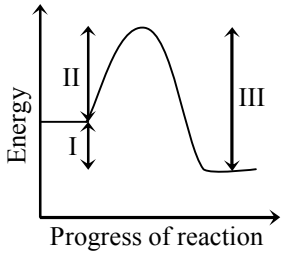
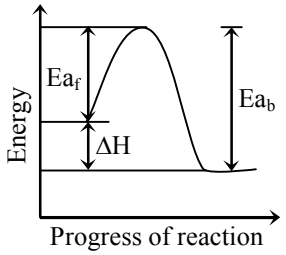
1. Which of the energy values marked as I, II and III in the following diagram, will change by the addition of a suitable catalyst ?



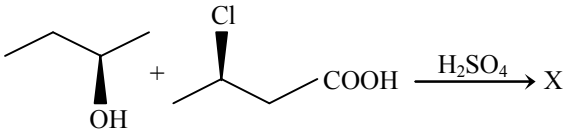
(A) II only (B) I and II (C) II and III (D) III only

Ans. **[C]**

Sol. On addition of catalyst the value of activation energy changes but value of ΔH remain same.



2. The product 'X' in the following reaction is

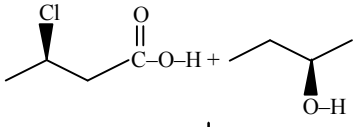


(A) a racemic mixture of ester (B) an optically inactive ester

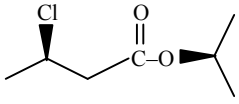
(C) an optically active ester (D) a meso ester

Ans. **[C]**

Sol.



Estrification reaction do not involve reaction at chiral centre so there configuration remain same and only one comp. is formed



optically active ester

(do not have symmetry so optically active)

3. At 298 K, change in internal energy for the complete combustion of fullerene, $C_{60}(s)$, an allotrope of carbon, and the enthalpy of formation of CO_2 (g) are –25970 kJ mol^{-1} and –393 kJ mol^{-1} respectively. The enthalpy of formation of $C_{60}(s)$ at 298 K is -

(A) –2390 kJ (B) 4.95×10^4 kJ (C) 2.60×10^4 kJ (D) 2390 kJ

Ans. **[D]**

Sol. $C_{60} + 60\ O_2 \longrightarrow 60\ CO_2$ – 25970 KJ/mol ...(1)

$60C + 60\ O_2 \longrightarrow 60\ CO_2$ -393×60 KJ/mol ...(2)

eq. (2) – eq. (1)

$60C_{(S)} \longrightarrow C_{60}$ $\Delta U = 25970 - 393 \times 60$

$= 2390$ KJ/mol

4. Which of the following is not paramagnetic ?

(A) S^{2-} (B) N^{2-} (C) O^{2-} (D) NO

Ans. **[A or C]**

Sol. $S^{-2} \rightarrow$  $\rightarrow$ Diamagnetic NO $\rightarrow$ Paramagnetic one unparied electron

$N^{-2} \rightarrow$ $\rightarrow$ Paramagnetic, one unpaired e^-

$O^{-2} \rightarrow$ $\rightarrow$ diamagnetic

5. Solubility product of AgCl is 1.8×10^{-10}. The minimum volume (in L) of water required to dissolve 1 mg of AgCl is close to -

(A) 0.5 (B) 7.5 (C) 50 (D) 0.75

Ans. **[A]**

Sol. $K_{sp} = s^2$

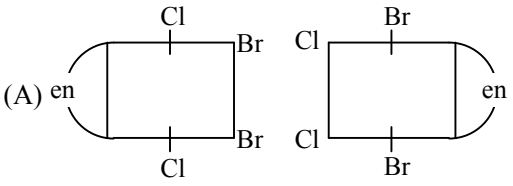
$S^2 = 1.8 \times 10^{-10}$

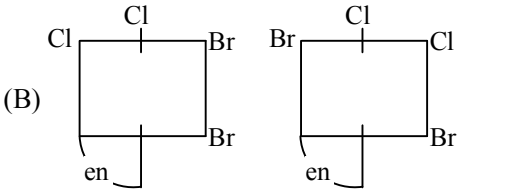
$S = 1.3416 \times 10^{-5}$

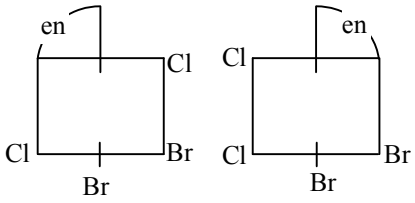
$$1.3416 \times 10^{-5} = \frac{10^{-3}/143.5}{V}$$

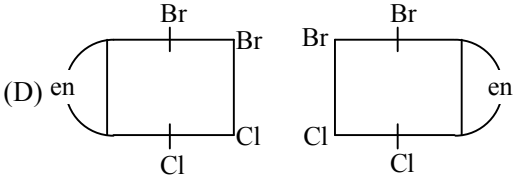
$\therefore V = 0.5$ L

6. The complex $[M(en)(Br)_2(Cl)_2]$ has two optical isomers. Their configuration can be represented as -

(A) 

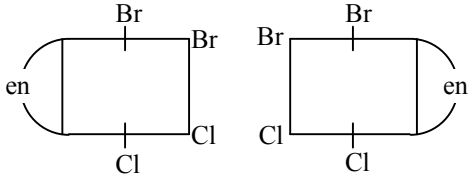
(B) 

(C) 

(D) 

Ans. **[D]**

Sol.



7. A sample of water from a river was analyzed for the presence of metal ions and the observations were recorded as given below

Reagent added	Observation
Dil. HCl	No change
Aq. Na_2CO_3	White precipitate
Aq. Na_2SO_4	No change

The water sample is likely to contain -

(A) Ba^{2+} (B) Cu^{2+} (C) Li^{+} (D) Mg^{2+}

Ans. **[D]**

Sol. $MgCO_3$ – white ppt & $MgCl_2$ and $MgSO_4$ are soluble in water.

8. The lattice enthalpy and enthalpy of solution in water for solid NaCl are 753 kJ mol^{-1} and 5 kJ mol^{-1} respectively(Fig. above). If the solution enthalpies of Na^{+} and Cl^{-} are in the ratio 6 : 5, the enthalpy of hydration of Na^{+} ion is -

(A) 408 kJ mol^{-1} (B) –412 kJ mol^{-1} (C) –408 kJ mol^{-1} (D) –412 kJ mol^{-1}

Ans. **[C]**

Sol. Let hydration energy of Na^{+} = x

$\therefore$ hydration energy of $Cl^{-} = \frac{5}{6}$ x

$x + \frac{5}{6}x = 748$

$x = -408$ kJ/mol

9. The gaseous product obtained on reaction of BF_3 with LiH is -

(A) HF (B) H_2 (C) B_2H_6 (D) F_2

Ans. **[C]**

Sol. $BF_3 + LiH \longrightarrow B_2H_6 + LiF$.

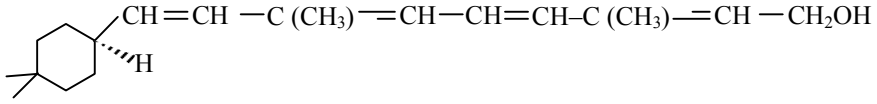
10. The equilibrium constant K for the reversible reaction A = B is 2×10^3 at 350 K. The rate constant of the forward reaction is the presence and absence of a suitable catalyst of the same temperature are 5×10^4 s^{-1} and 4×10^{-6} s^{-1}. respectively. The rate constant of the reverse reaction in the absence of the catalyst is -

(A) 2×10^{-3} s^{-1} (B) 2.5×10^{-1} s^{-1} (C) 1.6×10^{-7} s^{-1} (D) 1.25×10^{-2} s^{-1}

Ans. **[Bonus]**

Sol. No correct Match.

11. The number of stereoisomers possible for the following compound

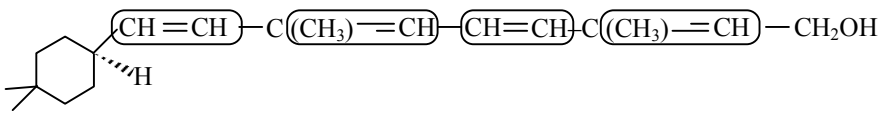


(A) 4 (B) 2 (C) 16 (D) 32

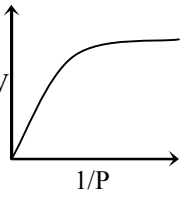
Ans. **[C]**

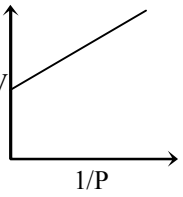
Sol. Molecule is having four double bond along which geometric isomerism is possible and does not contain chiral centre.

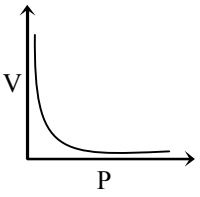
Stereoisomer = $2^4 = 16$

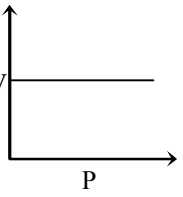


12. An adsorption isotherm equation proposed by Langmuir is fo the form $V = \frac{V_0 bP}{(1\_ bP)}$ where V is the volume of gas adsorbed at pressure P. For a given adsorbate/adsorbent system, V_0 and b are constants. The dependence of V on P can be depicted as -

(A) 

(B) 

(C) 

(D) 

Ans. **[B]**

Sol. Theoretical

13. For the reaction $4NO_2(g) + O_2(g) \rightarrow 2N_2O_5(g)$, $\Delta H_{reaction} = -112$ kJ. If the N_2O_5 is assumed to be formed in the reaction as a solid, $\Delta H_{reaction}$ will be ($\Delta H_{sublimation}$ of N_2O_5 is 54 kJ mol^{-1})

(A) –220 kJ (B) – 4 kJ (C) –166 kJ (D) –332 kJ

Ans. **[A]**

Sol. $4NO_2(g) + O_2(g) \longrightarrow 2N_2O_5(g)$ $\Delta H = -112$ KJ

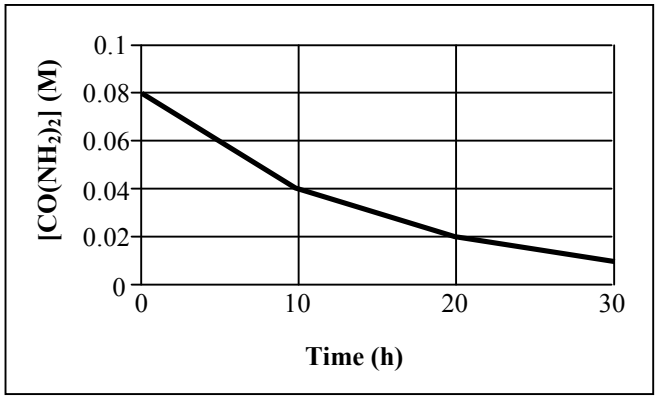
$\downarrow$ $\Delta H = -54 \times 2$ KJ

$2N_2O_5(s)$

$\therefore$ $\Delta H = -112 - 54 \times 2$

$= -220$ KJ

14. Urea, $CO(NH_2)_2$, decomposes at 90ºC as $CO(NH_2)_2$ (aq) $\rightarrow$ NH_4^+ (aq) + OCN^- (aq) Experimental data obtained for the reaction is given in the following plot



From the graph it can be inferred that

(A) Average rate of the reaction is the same for successive time intervals of 10 h

(B) unit of rate constant of the reaction is h^{-1}

(C) rate constant of the reaction is the lowest at 30 h

(D) the reaction is of zero order

Ans. **[B]**

Sol. It is a first order reaction as concentration of urea is making G.P. in regular time internal

$\therefore$ unit of K $\longrightarrow$ h^{-1}

15. If for an aqueous solution of a weak acid, pH = pK_a + 2 at 25º, the approximate fraction of the acid in the dissociated form is -

(A) 1.1 % (B) 0.99 % (C) 99.0 % (D) 9.9 %

Ans. **[C]**

Sol. $P^H = p^{ka} + \log \frac{In^-}{HIn}$ …(1)

$P^H = p^{ka} + \log 2$ ...(2)

From equation (1) & (2) % of acid dissocioted = 99%

16. 2.0 L of N_2 gas kept at 25ºC and 5 atm pressure were expanded isothermally against a constant pressure of 1 atm until the pressure of the gas reaches 1 atm. Assuming ideal behaviour, reversible work of expansion in this process (in J) is close to -

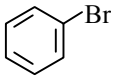
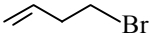
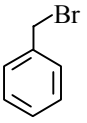
(A) 810 J (B) –194 kJ (C) –810 kJ (D) 3390 kJ

Ans. **[Answer has been removed by IAPT]**

Sol. According to the data given in question there will be no match of the option if we calculate revesible work so it is wrong question.

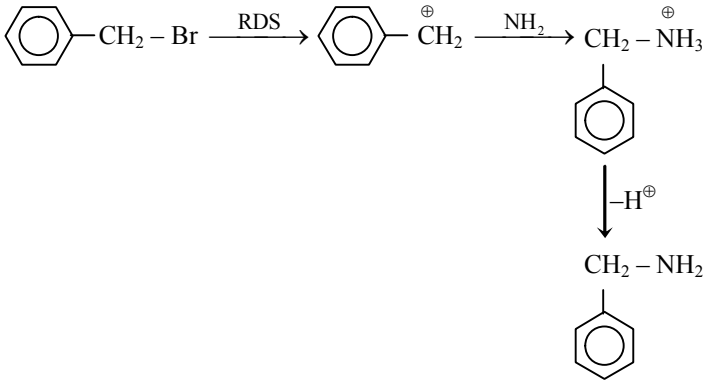
Although the options are given according to irrevasible work calculation.

17. The compound which would undergo a reaction with ammonia by S_N1 mechanism is -

(A)  (B)  (C)  (D) 

Ans. **[D]**

Sol. For SN_1 reaction stable carbocation should be formed which is possible only in D.



18. The daily energy requirement of a teenager is 7800 kJ. As calculated from the data given in the table below, the amount of glucose he has to consume (g) per day assuming that the entire energy he requires comes from the combustion of glucose is -

Molecule	ΔH_f(kJ mol^{-1})
$C_6H_{12}O_6$	–1273
CO_2(g)	–394
H_2O	–286

(A) 262 (B) 500 (C) 131 (D) 250

Ans. **[B]**

Sol. $C_6H_{12}O_6 + O_2 \longrightarrow 6CO_2 + 6H_2O$

$\Delta H = 6 \times (-394) + 6(-286)$

$+ 1273$

$= -2807$ KJ/mol

$\therefore$ moles required per day $= \frac{7800}{2807} = 2.77$

$\therefore$ mass required $= 2.77 \times 180$

$= 500$ gm

19. The pressure inside two gas cylinders of volume 25 m^3 and 50 m^3 are 10 kPa and 20 kPa respectively. The cylinders are kept at the same temperature and separated by a valve. What is the pressure in the combined system when the valve is opened ?

(A) 30 kPa (B) 15 kPa (C) 16.7 kPa (D) 2.5 kPa

Ans. **[C]**

Sol. $\frac{250}{RT} + \frac{1000}{RT} = \frac{P \times 75}{RT}$

$\therefore \quad P = 16.7$ K Pa

20. Aluminium and copper are extracted from their oxide and sulphide ores respectively. Which of the following is correct ?

I. Copper is extracted by the auto reduction of copper oxide by copper sulphide.

II. Aluminium cannot be obtained by chemical reduction due to its strong affinity for oxygen.

III. In electromethallurgy of Al, graphite is used as cathode to avoid reoxidation of Al into Al_2O_3 by preventing formation of O_2.

IV. Sulphide ores of copper are difficult to be reduced that the oxide ores.

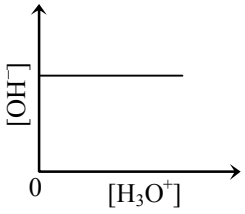
(A) I, II, IV (B) II and III (C) II and III (D) II and IV

Ans. **[A]**

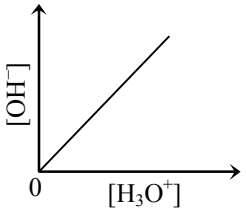
Sol. Theoretical

21. Which of the following graphs describes the relationship between $[H_3O^+]$ and $[OH^-]$ in an aqueous solution at a constant temperature ?

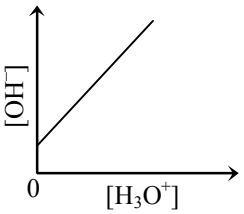
(A)



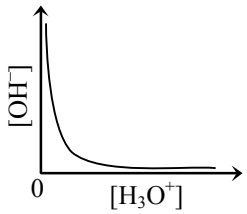
(B)



(C)



(D)



Ans. **[D]**

Sol. $K_w = [H^+]\,[OH^-]$

22. From the given standard electrode potentials

$Sn^{4+}(aq) + 2e^- \rightarrow 2e^- \rightarrow Sn^{2+}(aq)$ $E^o = 0.15$ V

$Br_2(l) + 2e^- \rightarrow 2Br^-(aq)$ $E^o = 1.07$ V

The approximate free energy change for the process

$2Br^-(aq) + Sn^{4+}(aq) \rightarrow Br_2(l) + Sn^{2+}(aq)$ is

(A) 177.6 kJ (B) 355 kJ (C) –177.6 kJ (D) –355 kJ

Ans. **[A]**

Sol. $2Br^-_{(aq)} + Sn^{4+}_{(aq)} \longrightarrow Br_{2(\ell)} + Sn^{2+}_{(aq)}$

$E^o = -1.07 + 0.15 = -0.92$

$\Delta G^o = -nFE^o$

$= -2 \times 96500 \times 0.92$

$= 177.6$ kJ

23. Number of moles of $KClO_3$ that have to be heated to produce 1.0 L of $O_2(g)$ at STP can be expressed as -

(A) $\frac{1}{3}$ (1/22.4) (B) $\frac{1}{2}$ (1/22.4) (C) $\frac{2}{3}$(1/22.4) (D) $\frac{3}{2}$(22.4)

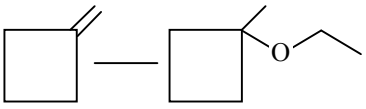
Ans. **[C]**

Sol. $KClO_3 \xrightarrow{\Delta} KCl + \frac{3}{2}O_2(g)$

Moles of $O_2 = \frac{1}{22.4}$

$\therefore$ moles of $KClO_3 = \frac{2}{3 \times 22.4}$

24. The sequence of reagents required for the following conversation is

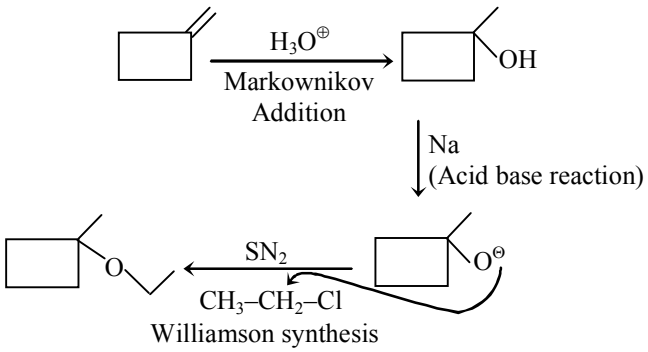


(A) (i) $B_2H_6/H_2O_2/OH^-$ (ii) Na (iii) C_2H_5I (B) (i) HCl (ii) C_2H_5ONa

(C) (i) H_3O^+ (ii) Na (iii) C_2H_5OH (D) (i) H_3O^+ (ii) Na (iii) C_2H_5Cl

Ans. **[D]**

Sol.



25. Among the following, number of oxygen atoms present is the maximum in

(A) 1.0 g of C_2 molecules (B) 4.0 g of O atoms

(C) 1.0 g of O_3 (D) 1.7 g of H_2O

Ans. **[B]**

Sol. No. of atoms = $\frac{4}{16} = \frac{1}{4} = 0.25$

26. Which of the following elements will exhibit photoelectric effect with light of the longest wavelength ?

(A) K (B) Rb (C) Mg (D) Ca

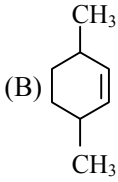
Ans. **[B]**

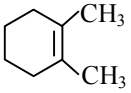
Sol. Rb has least value of work function.

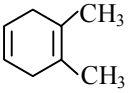
27. Compound 'X' in the following reaction is

$$X \xrightarrow[\text{(iii) } Cl_2/NaOH]{\text{(i) } O_3 \\ \text{(ii) } Zn/H_2O \\ \text{(iv) } H_3O^+} \underset{\text{Adipic Acid}}{COOH-((CH_2)_4)-COOH}$$

(A) 

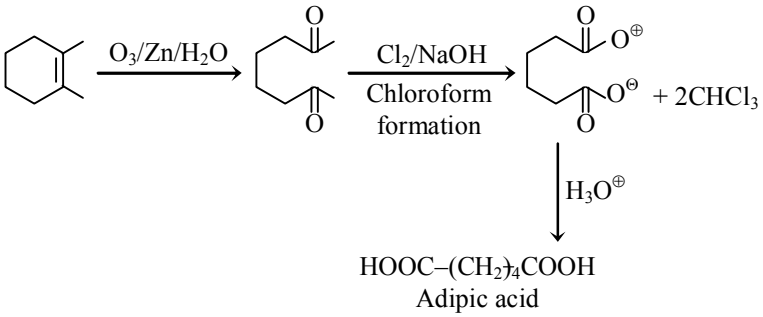
(B) 

(C) 

(D) 

Ans. **[C]**

Sol.



28. The standard molar entropies of $H_2(g)$, $N_2(g)$ and $NH_3(g)$ are 130, 190 and 193 J mol^{-1} K^{-1} respectively. For the reaction $N_2(g) + 3/2H_2(g) \rightleftharpoons NH_3(g)$

($\Delta H_{reaction}$ = –45 kJ) to be inequilibrium, the temperature must be equal to -

(A) 465 K (B) 928 K (C) 737 K (D) 354 K

Ans. **[A]**

Sol. $\frac{1}{2} N_2 + \frac{3}{2} H_2 \rightleftharpoons NH_3(g)$

$\Delta S = 193 - \frac{3}{2} \times 130 - \frac{1}{2}\ 190\ \text{Jmol}^{-1}\ \text{k}^{-1}$

$= 193 - 195 - 95$

$= -97\ \text{J mol}^{-1}\ \text{K}^{-1}$

$\therefore\ T = \frac{\Delta H}{\Delta S} = \frac{-45000}{-97} = 465\text{K}$

29. Density of CO_2 gas at 0ºC and 2.00 atm pressure can be expressed as -

(A) 2g m^{-3} (B) 4g m^{-3} (C) 4×10^3 kg m^{-3} (D) 8 g L^{-1}

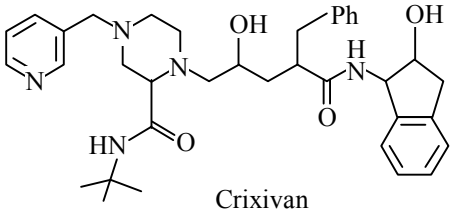
Ans. **[Bonus]**

Sol. None of these

PM = dRT

$$d = \frac{2 \times 44}{0.0821 \times 273} = 3.926 \text{ gm/L} = 4 \text{ kg/m}^3$$

30. The maximum number of moles of CH_3I consumed by one mole of crixivan, a drug used against AIDS is –



Crixivan

(A) 2 (B) 3 (C) 5 (D) 7

Ans. **[D]**

31. Concentration of K^+ ions inside a biological cell was found to be 25 times higher than that outside. The magnitude of the potential difference between the two sides of the cell is close to (2.303 RT/F can be taken as 59 mV; difference in concentrations of other ions can be taken as negligible.)

(A) 4.2 mV (B) 195 mV (C) 82 mV (D) –82 mV

Ans. **[C]**

Sol. $E_{cell} = E°_{cell} - \frac{2.303RT}{nF} \log \frac{[P]}{[R]}$

$= 0 - 59 \times \log 25 = -82$ mV

$\therefore$ magnitude = 82 mV

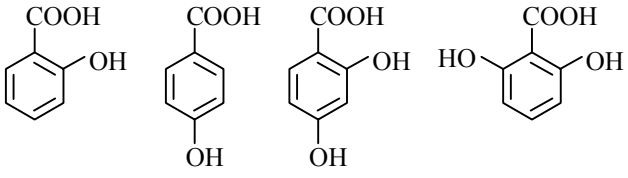
32. The standard redox potential for the reaction $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$ is –1.23 V. If the same reaction is carried out at 25ºC and at pH = 7, the potential will be -

(A) –0.82 V (B) – 3.28 V (C) 0.82 V (D) –1.18 V

Ans. **[A]**

Sol. $\text{R.P.} = -1.23 - \frac{0.0591}{4} \log [10^{-7}] = -0.82$

33. The order of pK_a values of the following acids is -



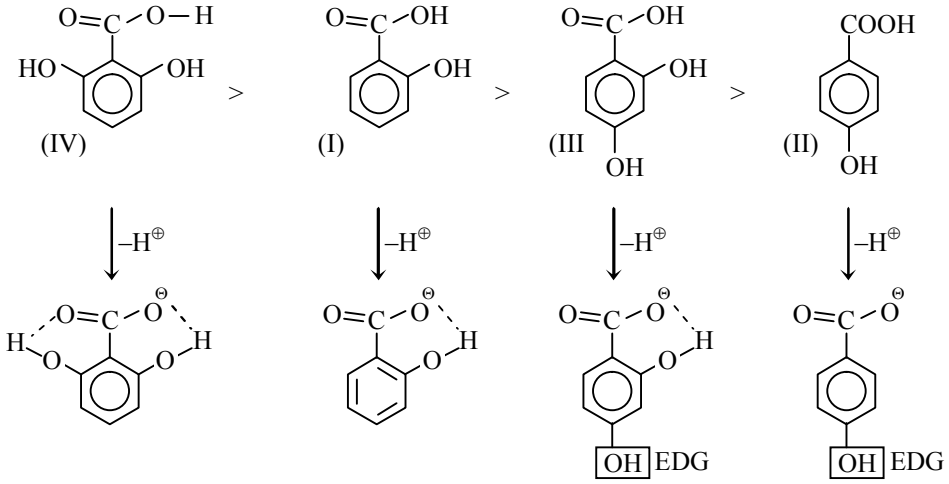
I II III IV

(A) IV > I > III > II (B) III > IV > I > II (C) II > I > III > IV (D) II > III > I > IV

Ans. **[D]**

Sol. Acidic strength (Ka) $\propto \frac{1}{pKa}$

Acidic strength order



34. If the radius of the hydrogen atom is 53 pm, the radius of the He^+ ions is close to -

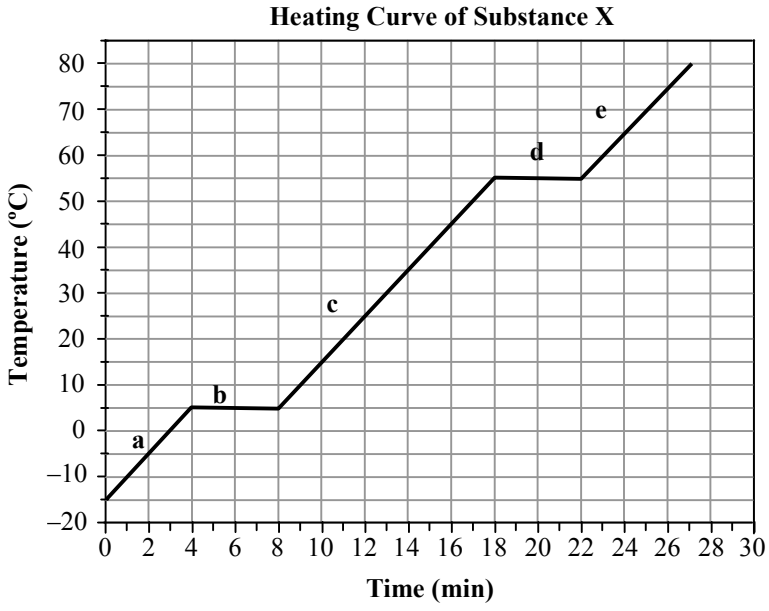
(A) 75 pm (B) 38 pm (C) 106 m (D) 27 pm

Ans. **[D]**

Sol. $r_{He+} = \frac{r_H}{2}$

53 /2 = 27 pm

35. A substance X was heated at constant pressure and the temperature observed at various times of heating was plotted as given below –



Which of the following is/are correct ?

I. Melting point of X is –5ºC.

II. Solid and liquid forms of X coexist in the region b.

III. Boiling point of X is 55ºC.

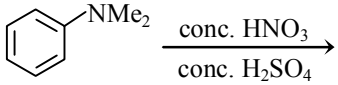
IV. Solid and liquid forms of X coexist I the region d.

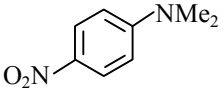
(A) I and IV (B) II and III (C) III only (D) I, II and III

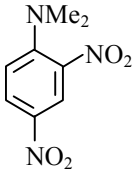
Ans. **[B]**

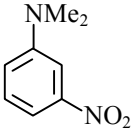
Sol. Theoretical

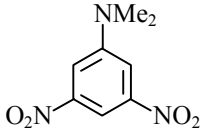
36. The major product of the following reaction is –



(A) 

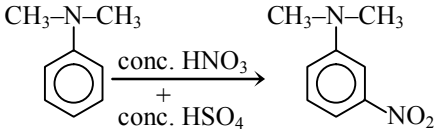
(B) 

(C) 

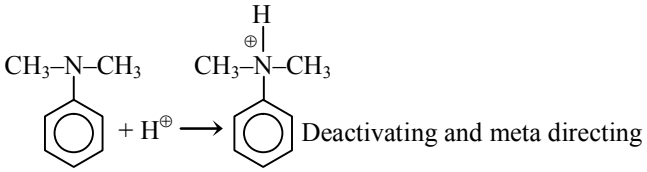
(D) 

Ans. **[C]**

Sol.



Protonation of N, N Dimethyl aniline occur and it become meta directing in strong acidic medium



37. In which of the following, all the bond lengths are not the same ?

I. IF_4^+ II. BF_4^- III. SF_4 IV. $TeCl_4$

(A) I, II, IV (B) II, III, IV (C) I, III, IV (D) I, II, III

Ans. **[C]**

Sol. IF_4^+, SF_4, $TeCl_4$ → In all these molecules hybridisation is sp^3d so all bond length are not equal.

38. Among the following, the reaction/s that can be classified as oxidation-reduction is/are –

I. $Cr_2O_7^{2-}(aq) + 2OH^-(aq) \rightarrow 2CrO_4^{2-} + H_2O(l)$

II. $SiCl_4(l) + 2Mg(s) \rightarrow 2MgCl_2(l) + Si(s)$

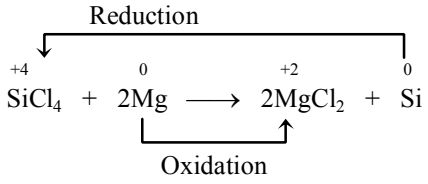
III. $6Cl_2(l) + 12KOH(l) \rightarrow 2KClO_3(s)\ \ 10\ KCl + 6H_2O(l)$

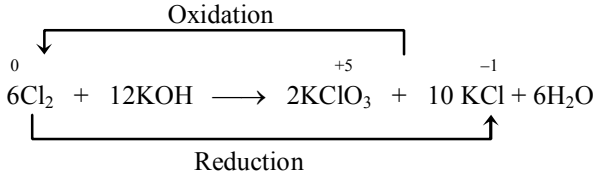
IV. $2H_2O_2 \rightarrow 2H_2O(l) + O_2(g)$

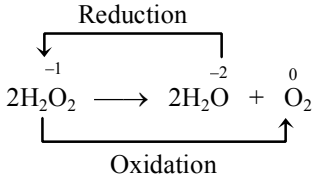
(A) I and IV (B) I, II and III (C) II, III and IV (D) IV only

Ans. **[C]**

Sol.

(II) 

(III) 

(IV) 

$\therefore$ (II, III, IV)

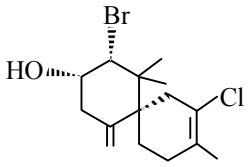
39. Among the following pairs, the one is which both the compounds as pure liquids can show significant auto ionization is -

(A) H_2O and H_2S (B) BrF_3 and ICl_3 (C) PF_5 and PCl_5 (D) HF and HCl

Ans. **[B]**

Sol. BrF_3 & ICl_3 shows significant auto ionization in liquid state.

40. The number of quaternary and chiral carbon atoms present in elatol, isolated from an algae are respectively.

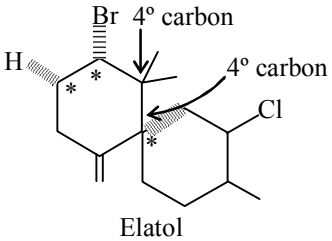


Elatol

(A) 2, 3 (B) 4, 2 (C) 3, 2 (D) 1, 3

Ans. **[A]**

Sol.



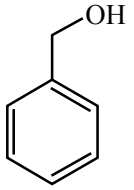
Elatol

2 Quatesnary carbon

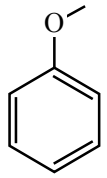
3 chiral centre

2, 3

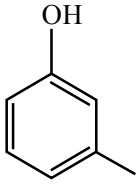
41. Compounds X ($pK_a \sim 15$) and Y ($pK_a \sim 10$), both produce H_2 on treatment with sodium metal and both yield a mixture of isomers on monoitration. X and Y respectively are



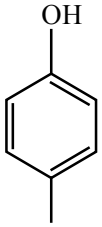
(I)



(II)



(III)



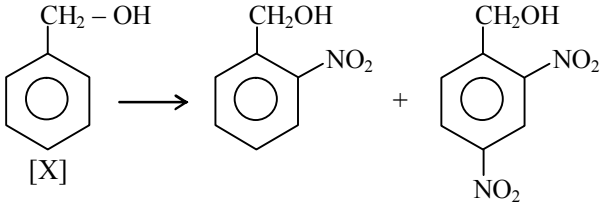
(IV)

(A) IV, I (B) III, II (C) III, I (D) I, III

Ans. **[D]**

Sol. pKa = 15 for X is range of Alcohol so it is (I)

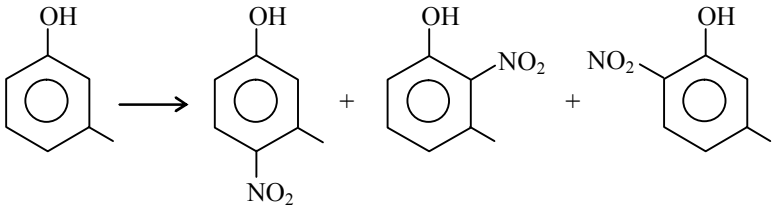
pKa = 10 for y is phenol



Y can be III or IV but IV give only ortho product because para is blocked wheras III can give ortho & para substituted product both.

So, x = I

y = III



42. A crystal of KCl containing a small amount of $CaCl_2$ will have

(A) vacant Cl^- sites

(B) vacant K^+ sites and a higher density as compared to pure KCl

(C) vacant K^+ sites and a lower density as compared to pure KCl

(D) K^+ ions in the interstitial sites

Ans. **[C]**

Sol. If one K^+ is replace by one Ca^{+2} ion it will create one cation vaccency & density will decreases.

43. In the following reaction, the values of a, b and c respectively are

a $F_2(g)$ + **b** $OH^-(aq) \rightarrow$ **c** $F^-(aq)$ + **d** $OF_2(g)$ + **e** $H_2O(1)$

(A) 3, 2, 4 (B) 3, 4, 2

(C) 2, 2, 4 (D) 2, 2, 2

Ans. **[D]**

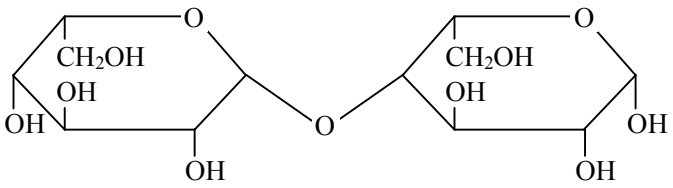
Sol. Reduction half reaction : $4e^- + 2F_2 \longrightarrow OF_2 + 2F^-$

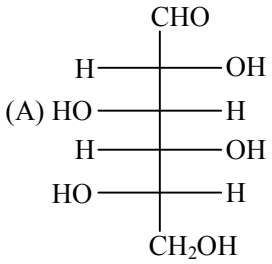
Oxidation Half reaction : $OH^- \longrightarrow OF_2 + 2F^- + 4e^-$

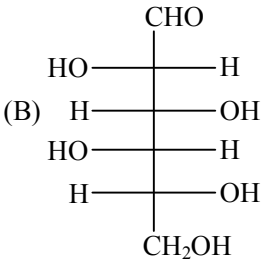
$$2F_2 + 2OH^- \longrightarrow OF_2 + 2F^- + H_2O$$

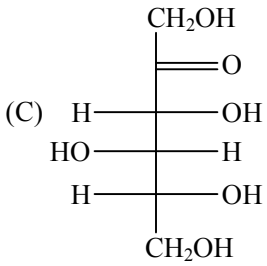
$\therefore$ a, b, c is 2, 2, 2.

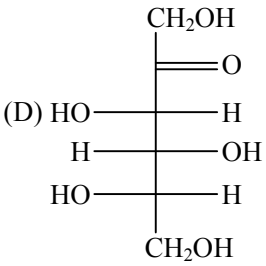
44. The monosaccharide present in the following disaccharide is



(A)


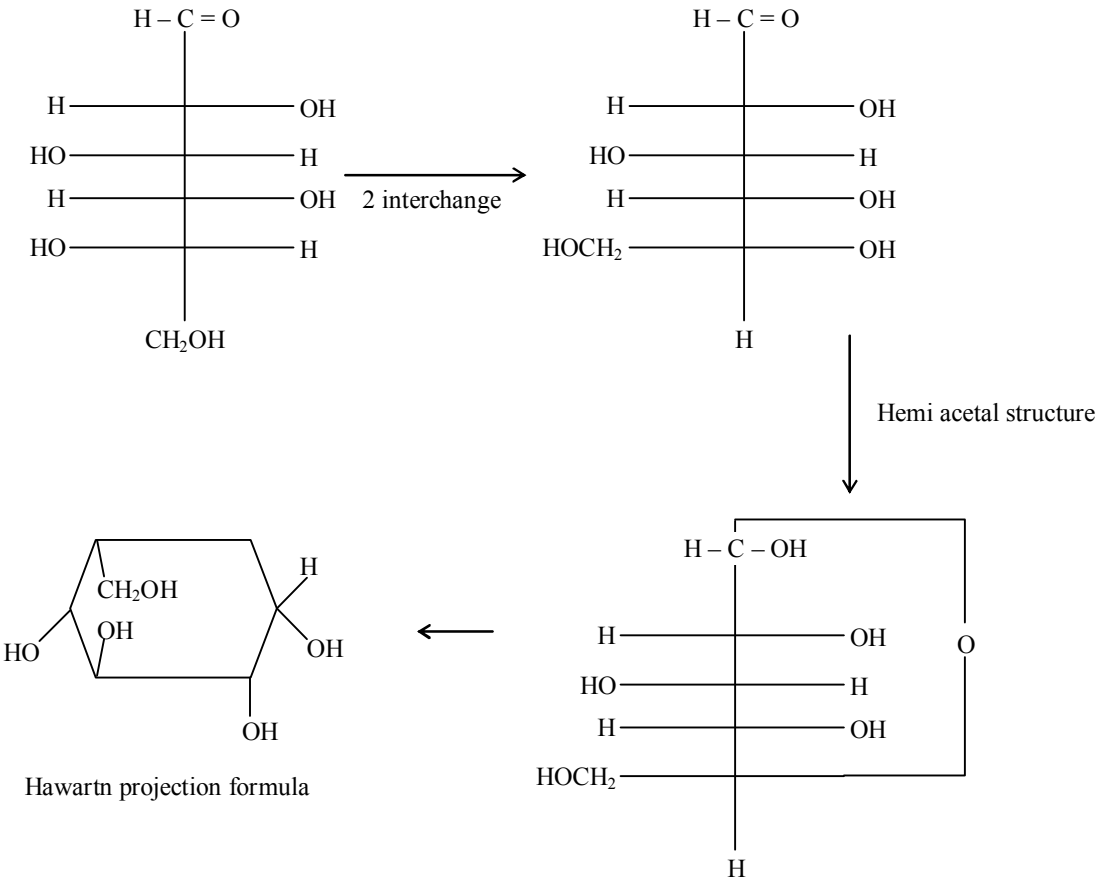
(B)


(C)


(D)


Ans. **[A]**

Sol. This disaccharide uses.

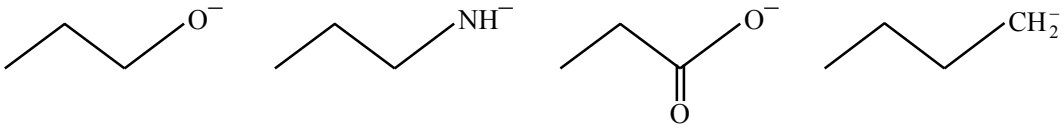


45. The IUPAC name of the complex $[Pt(en)(NH_3)(Cl)_2(ONO)][Ag(CN)_2]$ is
(A) monoamminedichlorido(ethane-1,2-diammine)nitritoplatinum(IV)dicyanoargentate(I)
(B) monoaminebischlorido(ethane-1,2-diamine)nitroplatinate(IV)dicyanosilver(I)
(C) monoaminebischlorido(ethane-1,2-diammine)nitritoplatinate(IV)dicyanoargentate(I)
(D) monoamminedichlorido(ethane-1,2-diamine)nitritoplatinum(IV)dicyanoargentate(I)

Ans. **[D]**

Sol. Theoritical

46. The correct order of basicity of the following species is

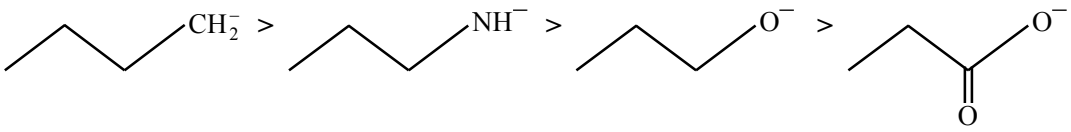


(I) (II) (III) (IV)

(A) III < IV < II < I (B) III < I < II < IV (C) III < II < I < IV (D) IV < I < II < III

Ans. **[B]**

Sol. Basic strength $\propto \frac{1}{\text{Stability of anion}} \propto \frac{1}{\text{E.N}}$



(IV) (II) (I) (III)

Resonance Stabilize

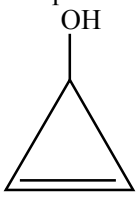
47. Which among the following is nonlinear ?

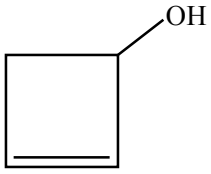
(A) N_3^- (B) ClF_2^- (C) Br_3^- (D) $BrCl_2^+$

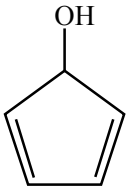
Ans. **[D]**

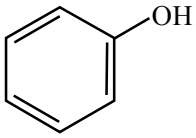
Sol. In $BrCl_2^+$, hybridisation of Br is sp^3 so the molecule is nonlinear

48. The compound most likely to lose water on protonation is

(A) 

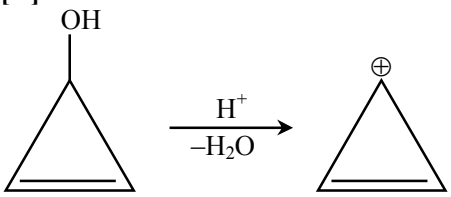
(B) 

(C) 

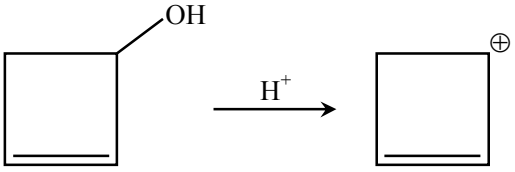
(D) 

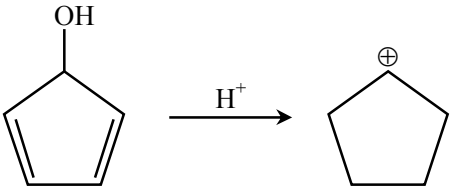
Ans. **[A]**

Sol.

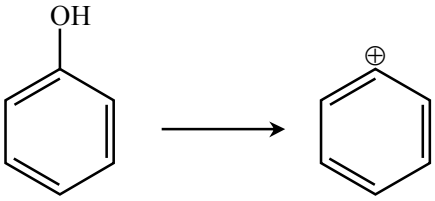


Aromatic most stable ion



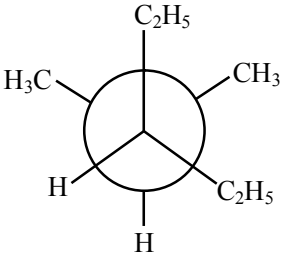


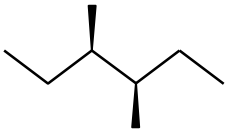
Antiaromatic Highly Unstable

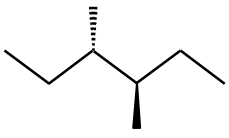


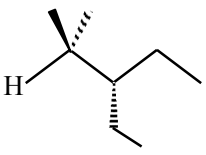
Highly Unstable

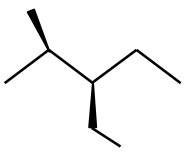
49. The Newman projection shown is the same as



(I) 

(II) 

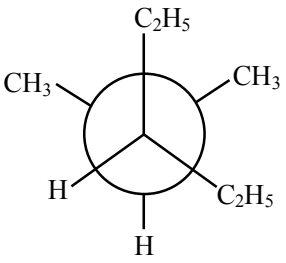
(III) 

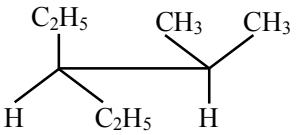
(IV) 

(A) I and IV (B) II and III (C) III and IV (D) I and II

Ans. **[C]**

Sol.





It can be III or IV

50. Which one of the following is not used as a monomer for the synthesis of a high molecular weight silicone polymer ?

(A) $MeSiCl_3$ (B) Me_2SiCl_2 (C) Me_3SiCl (D) $PbSiCl_3$

Ans. **[C or D]**

Sol. Option C and Option D both do not give high molecular weight polymeric silicons.

51. In $YBa_2Cu_3O_{7-x}$, a superconducting oxide that got George Bednorz and Karl Muller the Nobel prize in 1986, Cu can exist in both +2 and +3 oxidation states and their proportion depends on the value of 'x'. In $YBa_2Cu_3O_{7-0.5}$.

(A) 0.5 moles of Cu are in +3 oxidation state (B) 5% of Cu is in +3 oxidation state

(C) All the Cu is in +3 oxidation state (D) All Cu is in +2 oxidation state

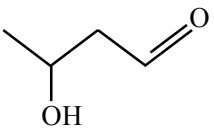
Ans. **[D]**

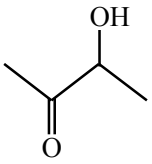
Sol. $YBa_2Cu_3O_{7-0.5}$

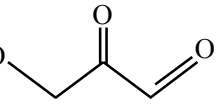
$3 + 2(2) + 3(x) - 13 = 0$

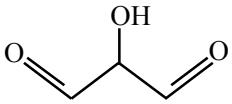
$x = +2$

52. Compound 'Y' (molar mass = 88.12 g mol^{-1}) containing 54.52 % carbon, 9.17% hydrogen and 36.31 % oxygen gives a reddish-brown precipitate in Fehling's test. 'Y' is

(A) 

(B) 

(C) HO 

(D) 

Ans. **[A]**

Sol. Mass of C = $88.12 \times \frac{54.52}{100} \approx 48$

No. of C atom = 48/4 = 12

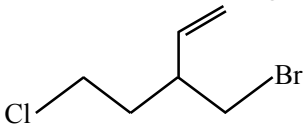
$C_4H_8O_2$

Mass of H or No. of H atom = 88.12 × 9.17 = 8

Mass of oxygen $= 88.12 \times \frac{36.31}{2} = 32$ means two atom

This gives fehling's solution so it is aldehyde.

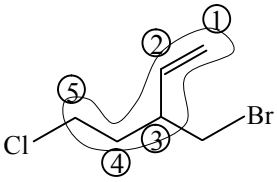
53. The IUPAC name of the following compound is



(A) 1-Bromo-4-chloro-3-ethenylbutane (B) 4-Bromo-1-chloro-3-ethenylbutane
(C) 3-(Bromomethyl)-5-chloropent-1-ene (D) 3-(Bromomethyl)-1-chloropent-4-ene

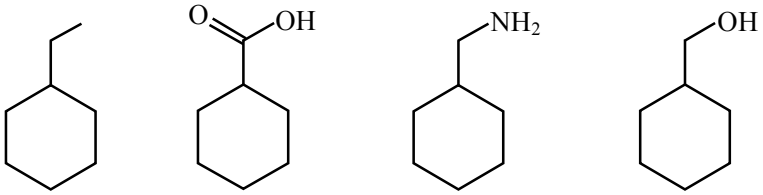
Ans. **[C]**

Sol.



3(Bromodetnyl)
5untrropent-1 eno

54. The correct order of boiling points of the following compounds is

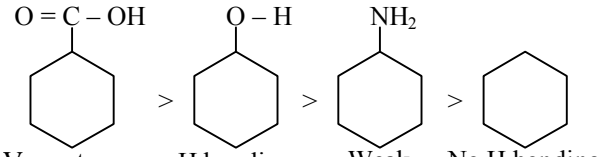


(I) **(II)** **(III)** **(IV)**

(A) III < IV < II < I (B) I < III < IV < II (C) I < II < III < IV (D) IV < III < I < II

Ans. **[B]**

Sol. B.Pt. ∝ Intermolecules atraction force



Very strong H bonding > H bonding > Weak H bonding > No H bonding only weak vanderwaal att force

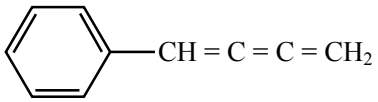
55. Which of the following is a strong oxidising agent ?

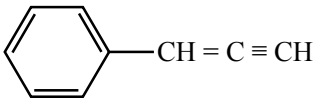
(A) $AlCl_3$ (B) $TlCl_3$ (C) NF_3 (D) PCl_3

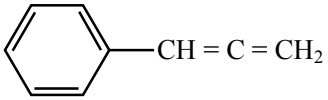
Ans. **[B]**

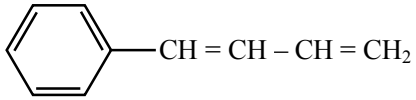
Sol. Due to inert pair effect $TlCl_3$ act as strong oxidising agent

56. The molecule in which all atoms are not coplanar is

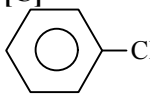
(A) 

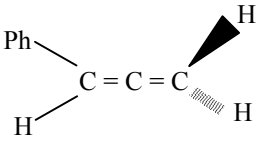
(B) 

(C) 

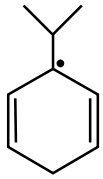
(D) 

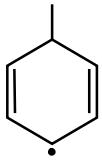
Ans. **[C]**

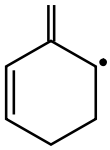
Sol.  $CH = C = CH_2$ is Allene type molecule is not planar it can be represented as

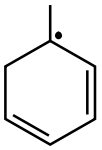


57. The most stable radical among the following is

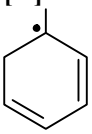
(A) 

(B) 

(C) 

(D) 

Ans. **[D]**

Sol.  Most stable free radial it has extended resonance and most no. Of α-H

58. During World War II, soldiers posted at high altitudes experienced crumbling of the tin buttons of their uniforms into a grey powder. This can be attributed to

(A) oxidation of tin

(B) interaction with nitrogen in the air at low pressure

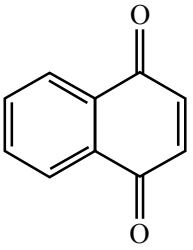
(C) change in the crystal structure of tin

(D) reaction of tin with water vapour in the air

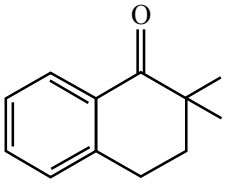
Ans. **[C]**

Sol. Due to change in crystalline structure of tin, it gets converted into grey powder

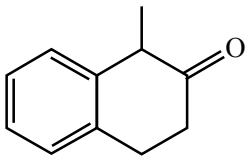
59. The molecules that can exhibit tautomerism are



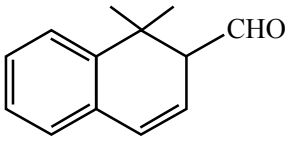
(I)



(II)



(III)

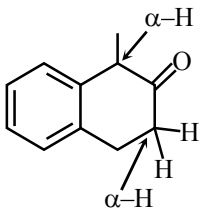


(IV)

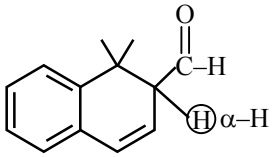
(A) I, IV (B) II, III (C) III, IV (D) I, II

Ans. **[C]**

Sol. Tautomerism is possible when molecule contain α–H



(III)



(IV)

60. A scientist attempts to replace a few carbon atoms in 1.0 g of diamond with boron atoms or nitrogen atoms in separate experiments. Which of the following is correct ?

(A) The resulting material with B doping will be an n-type semiconductor

(B) The resulting material with B doping will be a p-type semiconductor

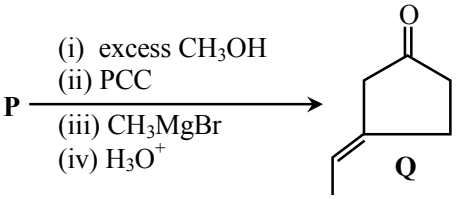
(C) B doping is NOT possible as B cannot form multiple bonds

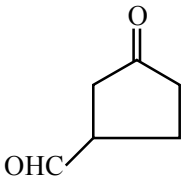
(D) The resulting material with N doping will be a p-type semiconductor

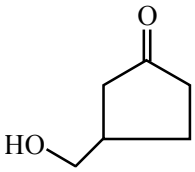
Ans. **[B]**

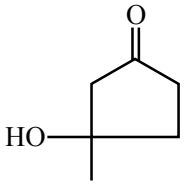
Sol. If doping is done by the atom of lower group number then it results in formation of p-type semiconductor.

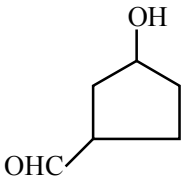
61. Compound 'P' that undergoes the sequence of reactions given below to give the product Q is



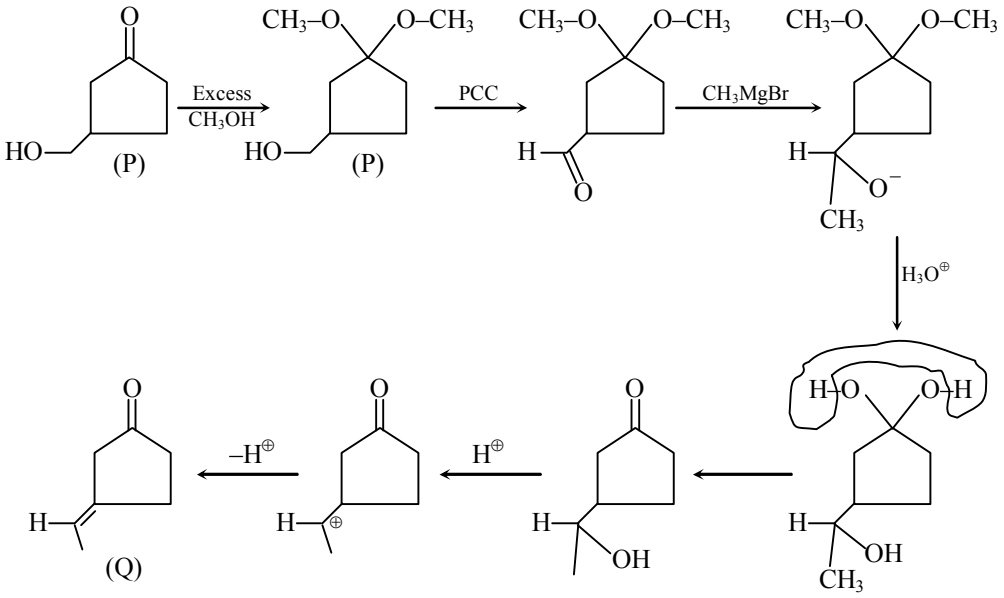
(A) 

(B) 

(C) 

(D) 

Ans. **[B]**

Sol. 

62. The most stable Lewis structure of N_2O is

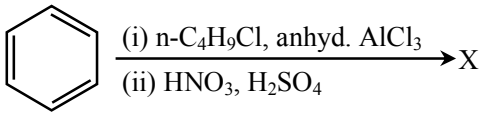
(A) $:\ddot{O}=N=\ddot{N}:$ (B) $:N=O=\ddot{N}:$

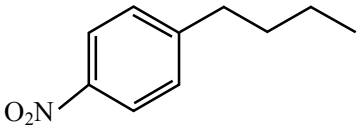
(C) $:\ddot{\underset{\cdot\cdot}{N}}-N\equiv O:$ (D) $:\ddot{\underset{\cdot\cdot}{O}}-N\equiv N:$

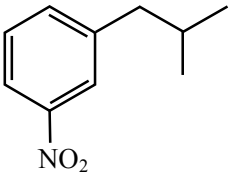
Ans. **[D]**

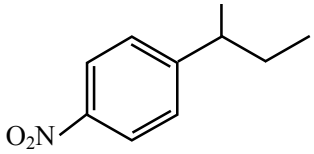
Sol. The structure in which –ve charge is present on more E.N. atom is most stable structure.

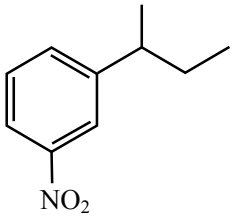
63. The major product 'X' formed in the following reaction is



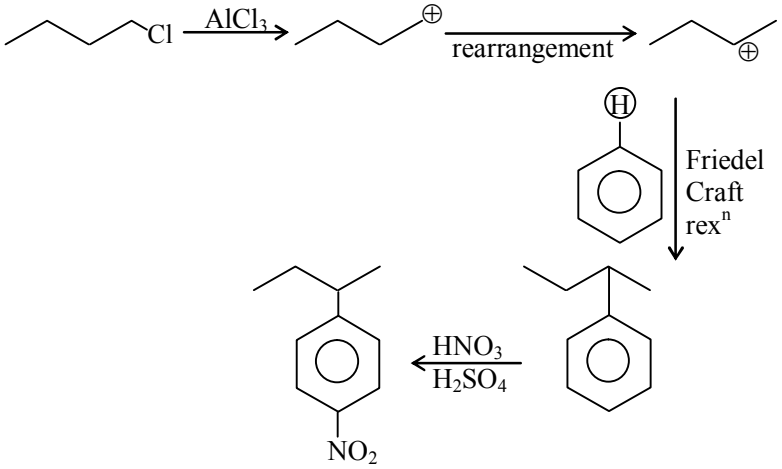
(A) 

(B) 

(C) 

(D) 

Ans. **[C]**

Sol. 

64. Which of the following accounts best for the fact that F^- is smaller than O^{2-} ?

(A) F^- has a larger nuclear mass than O^{2-}

(B) F^- has a larger nuclear charge than O^{2-}

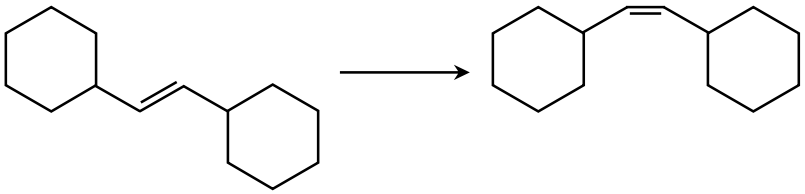
(C) F^- is more polarizable than O^{2-}

(D) F is more electronegative than O

Ans. **[B]**

Sol. $\because Z_{eff} \propto \frac{1}{\text{size}}$; as the –ve charge increases on the atom the size of atom increases therefore distance of outer most electron from nucleus increases and Z_{eff} decreases.

65. The correct sequence of reagents from those listed below for the following conversion is

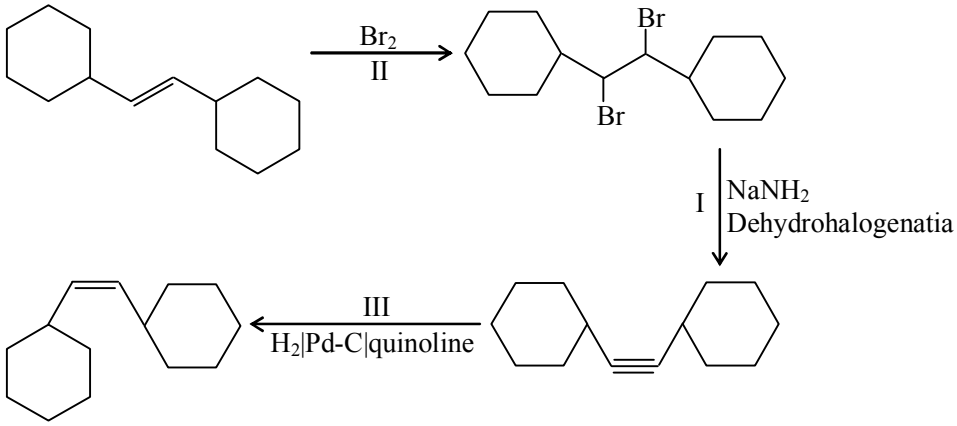


I. $NaNH_2$ II. Br_2 III. H_2/Pd-C, quinoline IV. H_3O^+

(A) IV – I – III (B) III – IV – I (C) II – I – III (D) I – II – III

Ans. **[C]**

Sol.



66. An orbital among the following that has two radial nodes and two angular nodes is

(A) 3d (B) 4p (C) 4f (D) 5d

Ans. **[D]**

Sol. Radial node (R.N) = $n - \ell - 1$

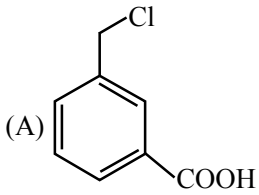
Angular node (A.N.) = ℓ.

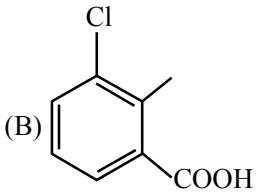
For 5d ordbital R.N. = 5 – 2 – 1 = 2

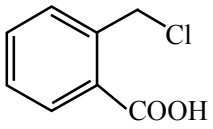
A.N. = ℓ = 2

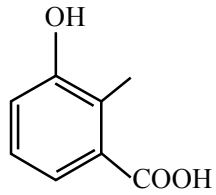
67. The compound 'X' undergoing the following reaction is

$$\mathbf{X} \xrightarrow[\text{(iii) acid } K_2Cr_2O_7 \\ \text{(iv) Heat}]{\text{(i) dil aq NaOH} \\ \text{(ii) } H^+} C_8O_4O_3$$

(A) 

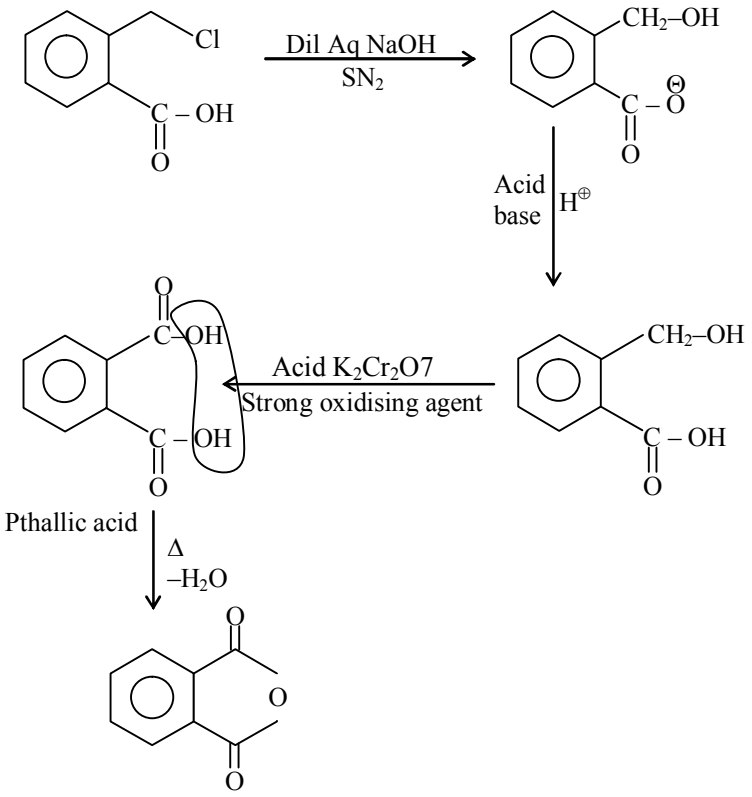
(B) 

(C) 

(D) 

Ans. **[C]**

Sol.



68. A dilute solution of an alkali metal in liquid ammonia is

I. blue in colour II. conducts electricity

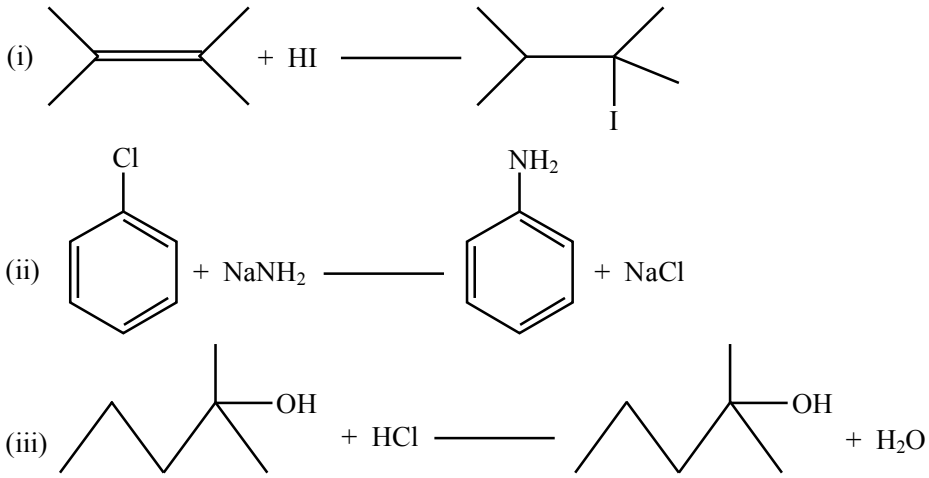
III. paramagnetic IV. an oxidising agnet

(A) I and III (B) II and IV (C) I, II and III (D) I and III

Ans. **[C]**

Sol. Theoritical

69. The reactions from those given below that involve a carbocation intermediate are



(A) i, ii and iii (B) i and ii (C) i and iii (D) ii and iii

Ans. **[This question has been removed by IAPT]**

70. The C–O bond length is the shortest in

(A) $[Cr(CO)_6]$ (B) $[Mo(CO)_6]$ (C) $[Mn(CO)_6]^+$ (D) $[V(CO)_6]^-$

Ans. **[C]**

Sol. If there is +ve charge present on CMA from extent of synergic bonding is less and C–O bond length will be shortest

$\because$ bond order $\propto \frac{1}{\text{bond length}}$

71. The rate of the reaction between two reactants X and Y can be expressed as $R = k[X]^2[Y]$. In an experiment, the initial rate of the reaction was found to be R_1 when the initial concentrations of X and Y are $[X_0]$ and $[Y_0]$. Another experiment was performed in which $[X_0]$ was taken as $\frac{1}{2}[X_0]$. What should be $[Y_0]$ in this experiment to get the initial rate as $0.5R_1$?

(A) $4[Y_0]$ (B) $\frac{1}{2}[Y_0]$ (C) $2[Y_0]$ (D) $[Y_0]$

Ans. **[C]**

Sol. $R = K[X]^2[Y]$

$R_1 = K[X_0]^2[Y_0]$

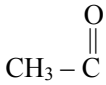
$0.5\ R_1 = K(X_0/2)^2\ Y'_0 \Rightarrow \therefore\ Y_0' = 0.5 \times 4Y_0 = 2Y_0$

72. Among the following, the compound that has the highest dipole moment is

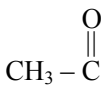
(A) CH_3COOCH_3 (B) CH_3CONH_2 (C) $CH_3COC_2H_5$ (D) CH_3COCl

Ans. **[B]**

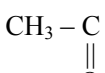
Sol.



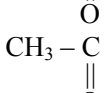
$\mu = 1.72$ D



$\mu = 3.60$ D



$\mu = 2.76$ D



$\mu = 2.45$ D

73. A common method to clean acid spills is to use Na_2CO_3 (Molar mass 106 g). If 50.0 mL of 0.75 M HCl is spilt on a wooden surface, the amount of Na_2CO_3 required is

(A) 3.75 g (B) 7.5 g (C) 2.0 g (D) 4.0 g

Ans. **[C]**

Sol. Eq. Na_2CO_3 = Eq. HCl

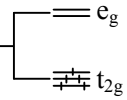
$\frac{50 \times 0.75}{1000} = \frac{w}{106/2} \Rightarrow \therefore\ w = 2$ gm

74. The spin-only magnetic moments of $[Fe(NH_3)_6]^{3+}$ and $[FeF_6]^{3-}$ (in unit of BM) respectively are

(A) 1.73 and 1.73 (B) 5.92 and 1.73 (C) 1.73 and 5.92 (D) 5.92 and 5.92

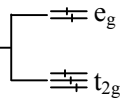
Ans. **[C]**

Sol. $[Fe(NH_3)_6]^{3+}$ has 1 unpaired e^-, since NH_3 is a S.L. —



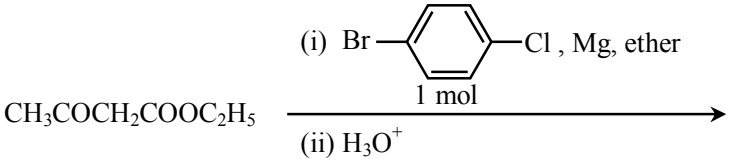
$\therefore$ BM = $\sqrt{n(n+2)}$ = 1.73 BM

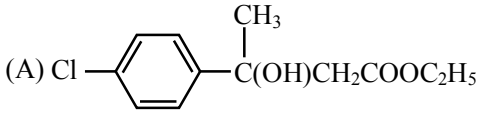
$[FeF_6]^{3-}$ has 5 unpaired $e^- \longrightarrow$ since F^- is a W.L. —

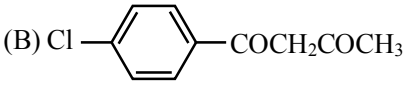


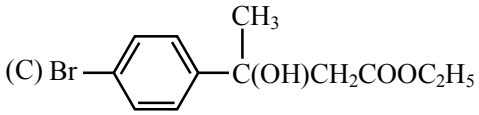
$\therefore$ BM = $\sqrt{5(5+2)}$ = 5.92 BM

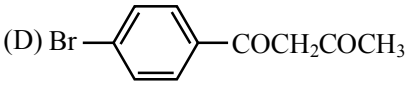
75. The major product of the following reaction is



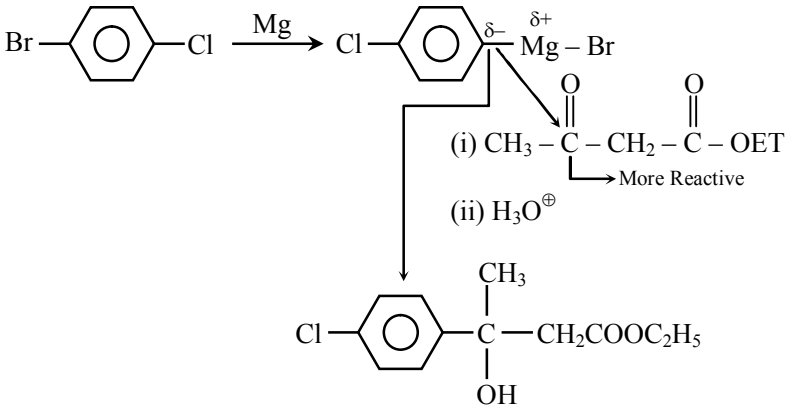
(A) 

(B) 

(C) 

(D) 

Ans. **[A]**

Sol. 

76. The standard electrode potential (E^0) of the Daniel cell is 1.1 V and the overall cell reaction can be represented as $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$.
Under which of the following conditions will the cell potential be higher than 1.1 V ?

(A) 1.0 M Zn^{2+}, 1.0 M Cu^{2+} (B) 1.2 M Zn^{2+}, 1.2 M Cu^{2+}

(C) 0.1 M Zn^{2+}, 1.0 M Cu^{2+} (D) 1.0 M Zn^{2+}, 0.01 M Cu^{2+}

Ans. **[C]**

Sol. $$E_{cell} = E^0_{cell} - \frac{0.0591}{2}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$$

E_{cell} will be higher than E^0_{cell} when $[Zn^{2+}] < [Cu^{2+}]$

77. Penicillamine is used in the treatment of arthritis. One molecule of penicillamine contains a single sulphur atom and the weight percentage of sulphur in penicillamine is 21.49%. Molecular weight of penicillamine in g mol^{-1} is.

(A) 85.40 (B) 68.76 (C) 125.2 (D) 149.2

Ans. **[D]**

Sol. $\because$ Mass of sulphur is 21.4g, then wt. of peniciliamine is 100

$\therefore$ Mass of sulphur is 1 then wt. of peniciliamine is $\frac{100}{21.4}$

$\therefore$ Mass of sulphur is 32gm then wt. of peniciliamine is $\frac{100}{21.4} \times 32 \approx 149.2$

78. An ion exchange resin, RH_2, can replace Ca^{2+} in hard water as

$RH_2 + Ca^{2+} \longrightarrow RCa^{2+} + 2H^+$

When a 1.0 L hard water sample was passed through the resin, all H^+ ions were replaced by Ca^{2+} ions and the pH of eluted water was found to be 2.0. The hardness of water (as ppm of Ca^{2+}) in the sample of water treated is

(A) 50 (B) 100 (C) 125 (D) 200

Ans. **[D]**

Sol. $[Ca^{2+}] = \frac{10^{-2}}{2} \times 40$

$\therefore$ in 1000 ml $\longrightarrow 20 \times 10^{-2}$ m Ca^{2+}

$\therefore$ $10^6 \longrightarrow 200$ ppm

79. The analysis of three different binary oxides of bromine (Br) and oxygen (O) gives the following results :

Compound	Mass of O combined with 1.0 g of Br
X	0.101 g
Y	0.303 g
Z	0.503 g

Which of the following statements is not correct ?

I. Compound Y is Br_2O_3 II. Compound Z is Br_2O_5

III. Compound Z is Br_2O_7 IV. Compound Y is Br_2O_5

(A) I and III (B) II and IV (C) III and IV (D) I and II

Ans. **[C]**

In Br_2O_3

2×80 g Br combine with 48 gm oxygen

$\therefore$ 1 gm Br combine with $\frac{48}{160} = 0.3$ gm oxygen

$\therefore$ Compound B_2O_3 is y

In Br_2O_5

2×80 g Br combine with 16×5 gm oxygen

$\therefore$ 1 gm Br combine with $\frac{16 \times 5}{160} = 0.5$ gm oxygen

80. Which of the following statements/s is/are correct ?

I. Number of significant figures in 2345.100 is three

II. 0.00787 rounded to two significant figures is written as 0.787×10^{-2}

III. 340 rounded to two significant figures is written as 0.34×10^3

IV. The number of significant figures in 0.020 is two

(A) II and III (B) III and IV (C) I, II and IV (D) III only

Ans. **[B]**

Sol. Theoritical