CHEMISTRY

SECTION – A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

31. Given below are two statements:

    Statement I : Noradrenaline is a neurotransmitter.

    Statement II : Low level of noradrenaline is not the cause of depression in human.

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

    (1) Statement I is correct but Statement II is incorrect

    (2) Statement I is incorrect but Statement II is correct

    (3) Both statement I and Statement II are incorrect

    (4) Both statement I and Statement II are correct

Answer (1)
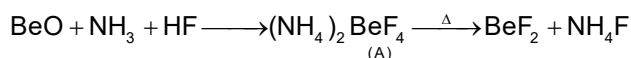
Sol. • Noradrenaline is a neurotransmitter.

    • Low level of noradrenaline is a cause for depression in human.

32. Reaction of BeO with ammonia and hydrogen fluoride gives A which on thermal decomposition gives BeF_2 and NH_4F. What is 'A'?

    (1) H_3NBeF_3 (2) $(NH_4)BeF_3$

    (3) $(NH_4)Be_2F_5$ (4) $(NH_4)_2BeF_4$

Answer (4)

Sol.

$$BeO + NH_3 + HF \longrightarrow \underset{(A)}{(NH_4)_2 BeF_4} \xrightarrow{\Delta} BeF_2 + NH_4F$$

Compound A is $(NH_4)_2BeF_4$

33. **Statement I :** For colloidal particles, the values of colligative properties are of small order as compared to values shown by true solutions at same concentration.

    Statement II : For colloidal particles, the potential difference between the fixed layer and the diffused layer of same charges is called the electrokinetic potential or zeta potential.

    In the light of the above statements, choose the correct answer from the options given below

    (1) Both statement I and Statement II are true

    (2) Both statement I and Statement II are false

    (3) Statement I is true but Statement II is false

    (4) Statement I is false but Statement II is true

Answer (3)

Sol. For colloidal particles value of colligative properties is less as compared to true solutions at same concentration as number of particles are less.
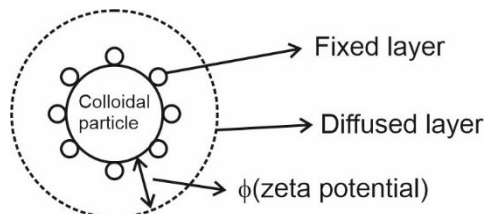
But fixed layer and diffused layer have opposite charges.

34. In the depression of freezing point experiment

    A. Vapour pressure of the solution is less than that of pure solvent

    B. Vapour pressure of the solution is more than that of pure solvent

    C. Only solute molecules solidify at the freezing point

    D. Only solvent molecules solidify at the freezing point

    Choose the most appropriate answer from the options given below:

    (1) A and D only   (2) B and C only
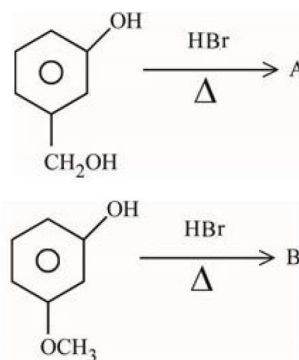
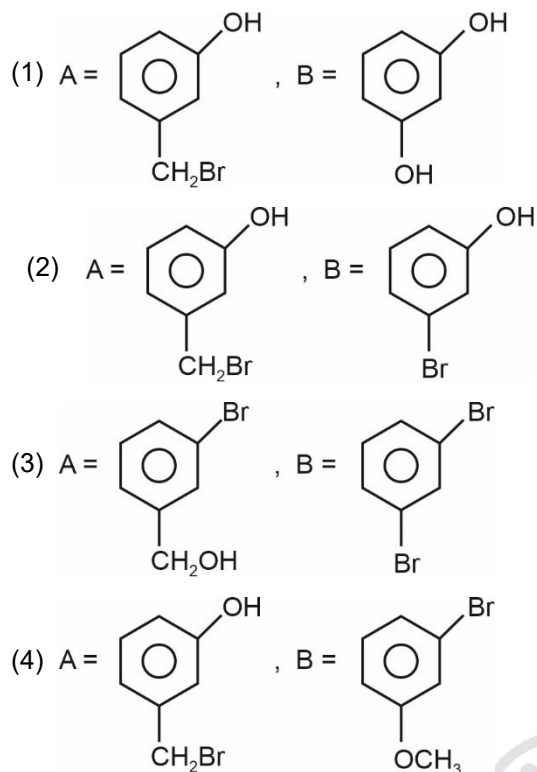   (3) A only   (4) A and C only

Answer (1)

Sol. A and D are correct

    as $(vp)_{solution} < (vp)_{solvent}$
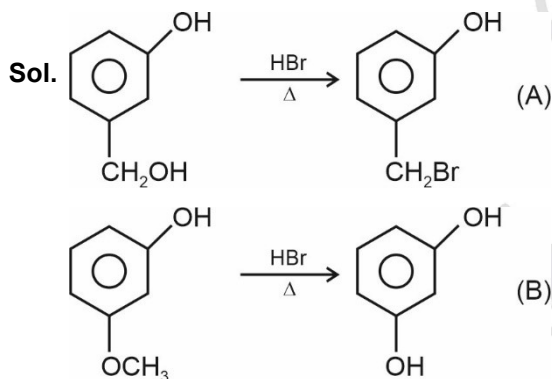
    and only solvent particles undergoes solidification.

35. 'A' and 'B' formed in the following set of reactions are:

(1) A = [structure: benzene with OH, CH₂Br] , B = [structure: benzene with OH, OH, OH]

(2) A = [structure: benzene with OH, CH₂Br] , B = [structure: benzene with OH, Br]

(3) A = [structure: benzene with Br, CH₂OH] , B = [structure: benzene with Br, Br, Br]

(4) A = [structure: benzene with OH, CH₂Br] , B = [structure: benzene with Br, OCH₃]

Answer (1)

Sol.

[structure: benzene with OH, CH₂OH] $\xrightarrow[\Delta]{HBr}$ [structure: benzene with OH, CH₂Br] (A)

[structure: benzene with OH, OCH₃] $\xrightarrow[\Delta]{HBr}$ [structure: benzene with OH, OH] (B)

36. The primary and secondary valencies of cobalt respectively in $[Co(NH_3)_5Cl]Cl_2$ are :

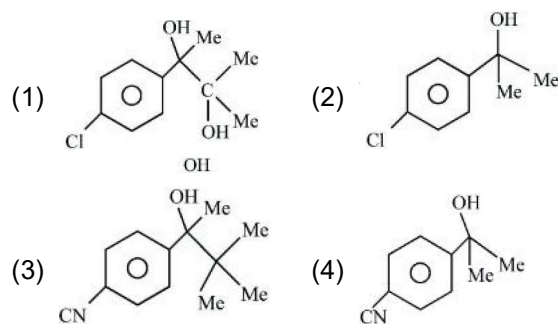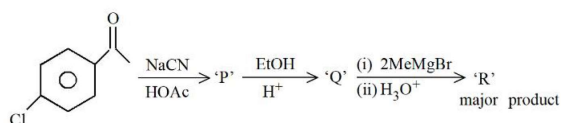(1) 3 and 5   (2) 2 and 6

(3) 2 and 8   (4) 3 and 6

Answer (4)

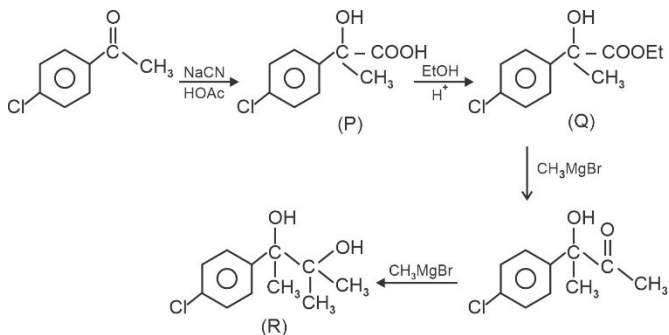**Sol.** $[Co(NH_3)_5Cl]Cl_2$

Oxidation no. = primary valencies = 3

Co-ordination no. = secondary valencies = 6

37. 'R' formed in the following sequence of reactions is

[structure: 4-chloroacetophenone] $\xrightarrow[HOAc]{NaCN}$ 'P' $\xrightarrow[H^+]{EtOH}$ 'Q' $\xrightarrow[\text{(ii) } H_3O^+]{\text{(i) 2MeMgBr}}$ 'R' major product

(1) [structure with OH, Me, C, OH Me, Cl]

(2) [structure with OH, Me, Me, Cl]

(3) [structure with OH Me, Me, Me, CN]

(4) [structure with OH, Me Me, CN]

Answer (1)

Sol.

[4-chloroacetophenone] $\xrightarrow[HOAc]{NaCN}$ [structure with OH, C–COOH, CH₃, Cl] (P) $\xrightarrow[H^+]{EtOH}$ [structure with OH, C–COOEt, CH₃, Cl] (Q)

$\downarrow CH_3MgBr$

[structure (R) with OH, C, C–OH, CH₃ CH₃, CH₃, Cl] $\xleftarrow{CH_3MgBr}$ [structure with OH, C, C=O, CH₃, CH₃, Cl]

38. It is observed that characteristic X-ray spectra of elements show regularity. When frequency to the power "n" i.e. ν^n of X-rays emitted is plotted against atomic number "Z", following graph is obtained.

[graph: ν^n vs Z, straight line]
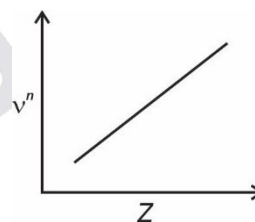
(1) 1   (2) 2

(3) 3   (4) $\dfrac{1}{2}$

Answer (4)

Sol. $h\nu = \Delta E = 13.6 \times Z^2 \left(\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2} \right)$

$\Rightarrow \nu \propto Z^2$

$\Rightarrow (\nu)^{1/2} \propto Z \quad \left(n = \dfrac{1}{2} \right)$

39. The magnetic moment of a transition metal compound has been calculated to be 3.87 B.M. The metal ion is

(1) Ti^{2+} (2) Mn^{2+}

(3) Cr^{2+} (4) V^{2+}

Answer (4)

Sol. $\mu = 3.87$

n = 3

$V_{23} = 4s^2 3d^3$

$V^{2+} = 4s^0 3d^3$ (n = 3)

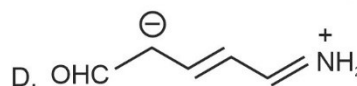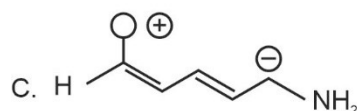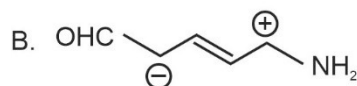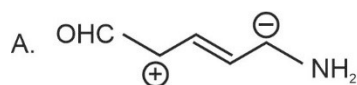40. Which of the following is true about freons?

(1) These are chemicals causing skin cancer

(2) These are radicals of chlorine and chlorine monoxide

(3) All radicals are called freons

(4) These are chlorofluorocarbon compounds

Answer (4)

Sol. Freons are chlorofluorocarbons

41. Increasing order of stability of the resonance structures is:

A.

B.

C.

D.

Choose the correct answer from the options given below:

(1) C, D, A, B

(2) D, C, B, A

(3) D, C, A, B

(4) C, D, B, A

Answer (Not given in the options)

Sol. Correct stabilising order is

C < A < B < D

(This question should be given bonus)

42. **Assertion A:** Hydrolysis of an alkyl chloride is a slow reaction but in the presence of NaI, the rate of the hydrolysis increases.
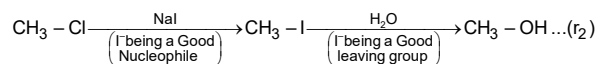
Reason R: I⁻ is a good nucleophile as well as a good leaving group.

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

(1) Both **A** and **R** are true and **R** is the correct explanation of **A**

(2) **A** is false but **R** is true

(3) **A** is true but **R** is false

(4) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**

Answer (1)

Sol. $CH_3 - Cl \xrightarrow{H_2O} CH_3OH$ (slow process) ....(r_1)

$CH_3 - Cl \xrightarrow[\left(\begin{smallmatrix} I^- \text{ being a Good} \\ \text{Nucleophile} \end{smallmatrix}\right)]{NaI} CH_3 - I \xrightarrow[\left(\begin{smallmatrix} I^- \text{ being a Good} \\ \text{leaving group} \end{smallmatrix}\right)]{H_2O} CH_3 - OH$ ...(r_2)

$r_2 \gg r_1$

as I⁻ is a good nucleophile as well as good leaving group.

43. Match List I with List II

	LIST I		LIST II
A.	Chlorophyll	I.	Na_2CO_3
B.	Soda ash	II.	$CaSO_4$
C.	Dentistry, Ornamental work	III.	Mg^{2+}
D.	Used in white washing	IV.	$Ca(OH)_2$

Choose the correct answer from the options given below:

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

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

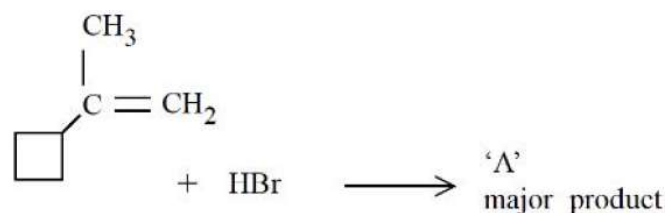(3) A-II, B-III, C-IV, D-I

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

Answer (4)

Sol. Chlorophyll contains Mg^{2+} Ions (A – III)

Soda ash is Na_2Co_3 (B – I)

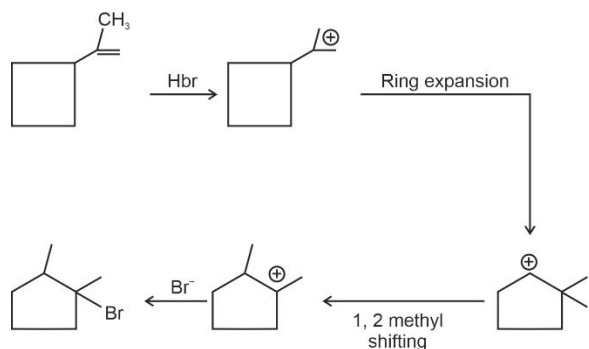Dentistry; ornamental work – $CaSO_4$ (C – II)

Used in white washing – $Ca(OH)_2$ (D – IV)

44. In the following given reaction, 'A' is

(1)

(2)

(3)

(4)

Answer (4)

Sol.

45. Match List I with List II

	LIST I		LIST II
A.	Reverberatory furnace	I.	Pig Iron
B.	Electrolytic cell	II.	Aluminum
C.	Blast furnace	III.	Silicon
D.	Zone refining furnace	IV.	Copper

Choose the correct answer from the options given below:

(1) A-I, B-IV, C-II, D-III (2) A-I, B-III, C-II, D-IV

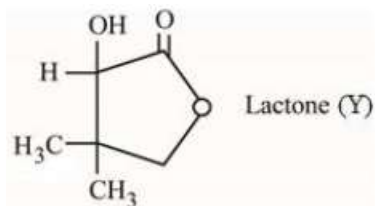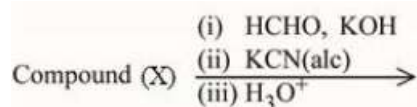(3) A-IV, B-II, C-I, D-III (4) A-III, B-IV, C-I, D-II

Answer (3)

Sol. (A) Reverberatory furnace is used for extraction of copper.

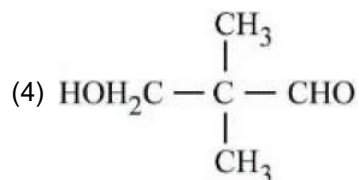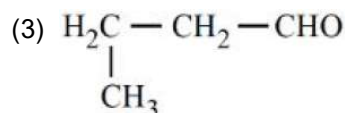(B) Electrolytic cell is used for obtaining highly reactive metals like aluminium.
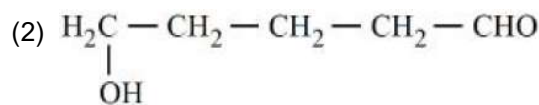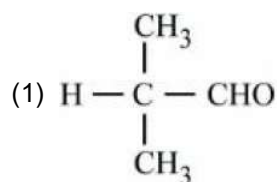
(C) Blast furnace is used for extraction of Iron.

(D) Zone refining furnace is used for silicon.

46. Compound (X) undergoes following sequence of reactions to give the Lactone (Y).

Compound (X) is

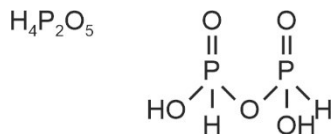(1) $H - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}} - CHO$

(2) $H_2C - CH_2 - CH_2 - CH_2 - CHO$ with OH on first carbon

$H_2\overset{}{\underset{\underset{\displaystyle OH}{|}}{C}} - CH_2 - CH_2 - CH_2 - CHO$

(3) $H_2\overset{}{\underset{\underset{\displaystyle CH_3}{|}}{C}} - CH_2 - CHO$

(4) $HOH_2C - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}} - CHO$

Answer (1)

Sol.
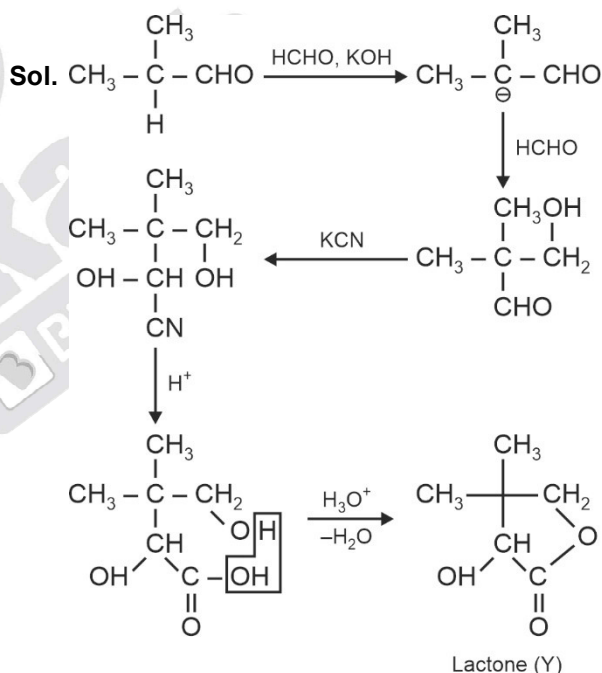
47. Which of the phosphorus oxoacid can create silver mirror from $AgNO_3$ solution?

(1) $H_4P_2O_5$

(2) $(HPO_3)_n$

(3) $H_4P_2O_7$

(4) $H_4P_2O_6$

Answer (1)

Sol. $H_4P_2O_5$ can act as a reducing agent due to (P – H) bond.

$H_4P_2O_5$

48. Decreasing order of the hydrogen bonding in following forms of water is correctly represented by

  A. Liquid water

  B. Ice

  C. Impure water

  Choose the correct answer from the options given below:

  (1) A > B > C

  (2) B > A > C

  (3) A = B > C

  (4) C > B > A

Answer (2)

Sol. Extent of hydrogen bonding :
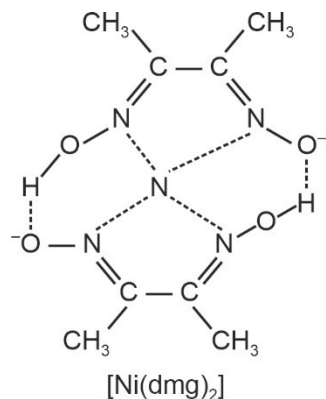
Ice > liquid water > impure water

- In ice, 4 molecules of H_2O are connected to H_2O molecule.

- Impure water will have less hydrogen bonding.

49. An ammoniacal metal salt solution gives a brilliant red precipitate on addition of dimethylglyoxime. The metal ion is

  (1) Ni^{2+}

  (2) Cu^{2+}

  (3) Fe^{2+}

  (4) Co^{2+}

Answer (1)

Sol. Ni^{2+} forms cherry red ppt with dmg

[Ni(dmg)$_2$]

50. Order of covalent bond :

  A. KF > KI; LiF > KF

  B. KF < KI; LiF > KF

  C. SnCl4 > SnCl2; CuCl > NaCl

  D. LiF > KF; CuCl < NaCl

  E. KF < KI; CuCl > NaCl

  Choose the correct answer from the options given below:

  (1) B, C only   (2) C, E only

  (3) B, C, E only   (4) A, B only

Answer (3)

Sol. B is correct   KF < KI; LiF > KF

  C is correct $\underset{+4}{SnCl_4} > \underset{+2}{SnCl_2}$; CuCl > NaCl

  E is correct   KF < KI; CuCl > NaCl

SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

51. The d-electronic configuration of $[CoCl_4]^{2-}$ in tetrahedral crystal field is $e^m t_2{}^n$. Sum of "m" and "number of unpaired electrons" is _____.

Answer (7)

Sol. $[CoCl_4]^{2-}$

  $Co^{2+} = 4s^0 3d^7$

  m = 4

  $= e_g^4 t_{2g}^3$

  Number of unpaired electrons = 3

52. The dissociation constant of acetic acid is $x \times 10^{-5}$. When 25 mL of 0.2 M CH_3COONa solution is mixed with 25 mL of 0.02 M CH_3COOH solution, the pH of the resultant solution is found to be equal to 5. The value of x is _____.
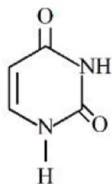
Answer (10)

Sol. $pH = pK_a + \log\left(\dfrac{25 \times 0.2}{25 \times 0.02}\right)$

$5 = pK_a + \log 10$

$pK_a = 4 \Rightarrow K_a = 10^{-4} = 10 \times 10^{-5}$

$x = 10$

53. Uracil is a base present in RNA with the following structure. % of N in uracil is _____.

Given :

Molar mass N = 14 g mol^{-1}

O = 16 g mol^{-1}

C = 12 g mol^{-1}

H = 1 g mol^{-1}

Answer (25)

Sol. Uracil is $C_4H_4N_2O_2$

% by mass of N $= \dfrac{14 \times 2}{112} \times 100$

$= 25\%$

54. The number of correct statement/s from the following is _____.

A. Larger the activation energy, smaller is the value of the rate constant.

B. The higher is the activation energy, higher is the value of the temperature coefficient.

C. At lower temperatures, increase in temperature causes more change in the value of k than at higher temperature.

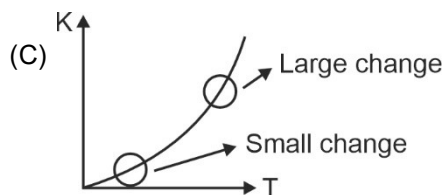D. A plot of ln k vs $\dfrac{1}{T}$ is a straight line with slope equal to $-\dfrac{E_a}{R}$.

Answer (3)

Sol. (A) $k = Ae^{-\frac{E_a}{RT}} \ (E_a \uparrow \ k \downarrow)$

(B) $\ln k = \ln A - \dfrac{E_a}{RT}$

$\dfrac{1}{k} \cdot \dfrac{dk}{dT} = \dfrac{+E_a}{RT^2}$

$E_a \uparrow$ temp. coefficient $\uparrow$

(C)

(D) $\ln k = \ln A - \dfrac{E_a}{RT}$

Slope of ln k vs $\dfrac{1}{T}$ is $\left(\dfrac{-E_a}{R}\right)$

55. At 298 K, a 1 litre solution containing 10 mmol of $Cr_2O_7^{2-}$ and 100 mmol of Cr^{3+} shows a pH of 3.0.
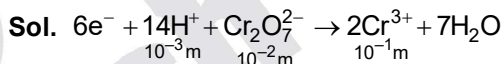
Given : $Cr_2O_7^{2-} \rightarrow Cr^{3+}$; $E° = 1.330V$

and $\dfrac{2.303 \ RT}{F} = 0.059$ V

The potential for the half cell reaction is $x \times 10^{-3}$ V. The value of x is _____.

Answer (917)

Sol. $\underset{10^{-3}m}{6e^-} + \underset{}{14H^+} + \underset{10^{-2}m}{Cr_2O_7^{2-}} \rightarrow \underset{10^{-1}m}{2Cr^{3+}} + 7H_2O$

$E_{cell} = 1.330 - \dfrac{0.059}{6}\log\dfrac{10^{-2}}{(10^{-2})(10^{-42})}$

$= 1.330 - \dfrac{0.059}{6}(42)$

$= 1.330 - 0.413$

$= 0.917 = 917 \times 10^{-3}$

$x = 917$

56. 5 g of NaOH was dissolved in deionized water to prepare a 450 mL stock solution. What volume (in mL) of this solution would be required to prepare 500 mL of 0.1 M solution?_____

Given : Molar Mass of Na, O and H is 23, 16 and 1 g mol^{-1} respectively

Answer (180)

Sol. Molarity of solution $= \dfrac{5}{(40)}\dfrac{(1000)}{(450)}$

$\Rightarrow M \times V = 500 \times .1$

$\Rightarrow \dfrac{5}{450} \times \dfrac{1000}{450} \times V = 500 \times .1$

$\boxed{V = 180 \text{ mL}}$

57. For independent processes at 300 K

Process	$\Delta H/kJ\ mol^{-1}$	$\Delta S/J\ K^{-1}$
A	−25	−80
B	−22	40
C	25	−50
D	22	20

The number of non-spontaneous processes from the following is_____

Answer (2)

Sol. − C is non − spontaneous as $(\Delta H > 0, \Delta S < 0)$

D is Non - spontaneous

For D,

$\Delta G = \Delta H - T\Delta S$

$= 22{,}000 - (300)\ (20)$

$= (22{,}000 - 6000) > 0$

Non-spontaneous as $(\Delta G > 0)$

58. When $Fe_{0.93}O$ is heated in presence of oxygen, it converts to Fe_2O_3. The number of **correct** statement/s from the following is_____

A. The equivalent weight of $Fe_{0.93}O$ is $\dfrac{\text{Molecular weight}}{0.79}$

B. The number of moles of Fe^{2+} and Fe^{3+} in 1 mole of $Fe_{0.93}O$ is 0.79 and 0.14 respectively.

C. $Fe_{0.93}O$ is metal deficient with lattice comprising of cubic closed packed arrangement of O^{2-} ions.

D. The % composition of Fe^{2+} and Fe^{3+} in $Fe_{0.93}O$ is 85% and 15% respectively.

Answer (4)

Sol. A : $Fe_{0.93}O \longrightarrow Fe_2O_3$

$nF = \left(3 - \dfrac{200}{93}\right) \times .93$

$= .79$

$\boxed{\text{eq. wt} = \dfrac{mw}{.79}}$

B : $Fe_{0.93}O$ $\qquad Fe_{93}O_{100}$

$\qquad\qquad Fe_x^{+2}\ Fe_{(93-x)}^{+3}O_{100}$

$2x + 3(93 - x) = 200$

$x = 79$

% of Fe^{2+} = $\dfrac{79}{93} \times 100 = 85\%$

% of Fe^{3+} = $\dfrac{14}{93} \times 100 = 15\%$

= $Fe_{0.93}O$ is metal deficient compound

A, B, C, D are correct.

59. If wavelength of the first line of the Paschen series of hydrogen atom is 720 nm, then the wavelength of the second line of this series is_____ nm. (Nearest integer)

Answer (492)

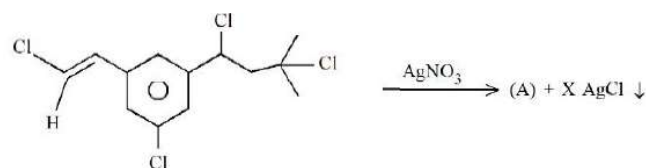**Sol.** $\dfrac{1}{720} = R \times \left(\dfrac{1}{9} - \dfrac{1}{16}\right)$

$\Rightarrow R = \dfrac{9 \times 16}{720 \times 7}$

$\dfrac{1}{\lambda'} = \dfrac{9 \times 16}{720 \times 7} \times \left(\dfrac{1}{9} - \dfrac{1}{25}\right)$
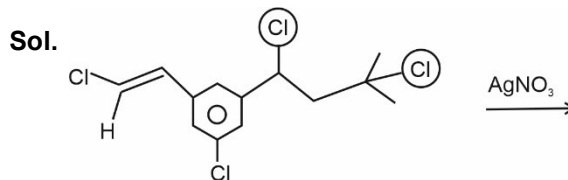
$\lambda' = 492.18$ nm

$\boxed{\lambda' = 492\ nm}$ (nearest integer)

60. Number of moles of AgCl formed in the following reaction is_____

Answer (2)

Sol.

Circled Cl will get precipitated