JEE MAIN 2023
Paper with Solution

CHEMISTRY | 25th Jan 2023 _ Shift-1

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Nation's Best SELECTION
Percentage (%) Ratio

Student Qualified in NEET

(2022)
4837/5356 = 90.31%
(2021)
3276/3411 = 93.12%

Student Qualified in JEE ADVANCED

(2022)
1756/4818 = 36.45%
(2021)
1256/2994 = 41.95%

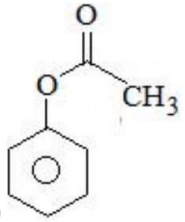
Student Qualified in JEE MAIN

(2022)
4818/6653 = 72.41%
(2021)
2994/4087 = 73.25%

NITIN VIIJAY (NV Sir)
Founder & CEO

SECTION - A

31. In the cumene to phenol preparation in presence of air, the intermediate is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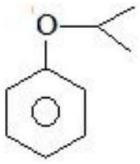
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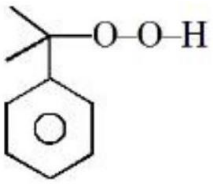
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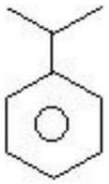
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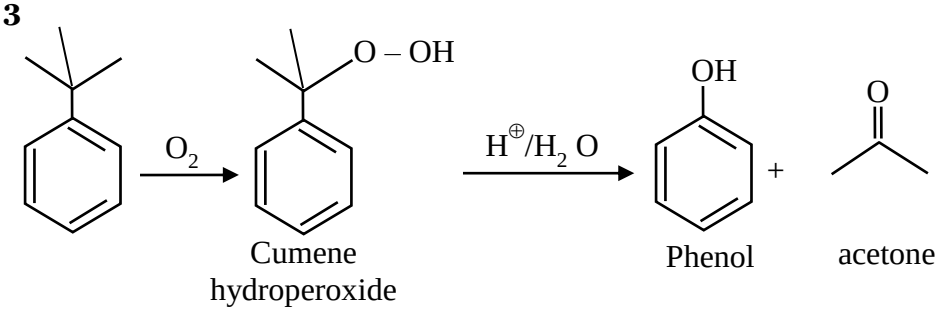
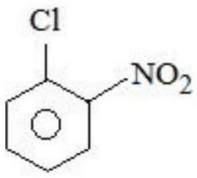
Sol. **3**



32. The compound which will have the lowest rate towards nucleophilic aromatic substitution on treatment with OH^- is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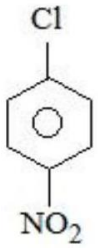
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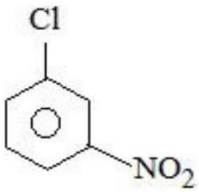
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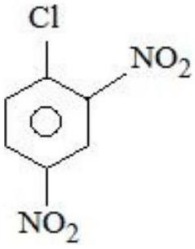
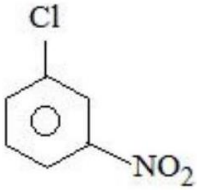

(4)

Sol. **3**

Rate of nucleophilic aromatic substitution decrease by e^- withdrawing group



$-NO_2$ of meta shows –I effect which is less dominating than –M

33. Match List I with List II

LIST I Elements		LIST II Colour imparted to the flame	
A.	K	I.	Brick Red
B.	Ca	II.	Violet
C.	Sr	III	Apple Green
D.	Ba	IV.	Crimson Red

Choose the correct answer from the options given below:

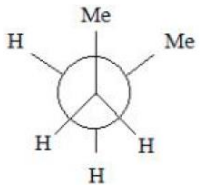
(1) A-II, B-I, C-III, D-IV
(2) A-II, B-I, C-IV, D-III
(3) A-IV, B-III, C-II, D-I
(4) A-II, B-IV, C-I, D-III

Sol. **2**

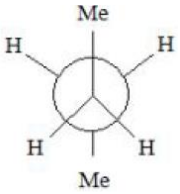
Flame Test.

Metals	**Colour of flame test**
K	Violet
Ca	Brick Red
Sr	Crimson Red
Ba	Apple Green

34. Which of the following conformations will be the most stable ?



(1)



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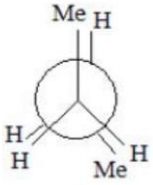

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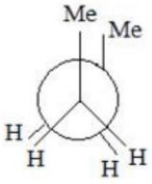
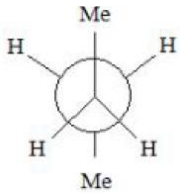


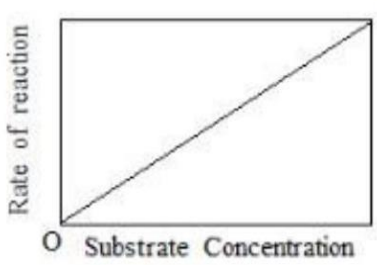
(4)

Sol. **2**

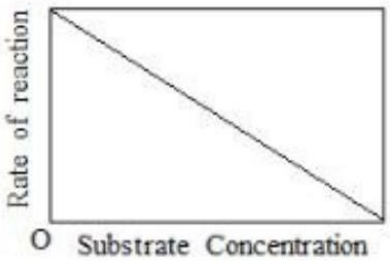


Anti position highly stable (bulky group maximum distance)

35. The variation of the rate of an enzyme catalyzed reaction with substrate concentration is correctly represented by graph



(a)



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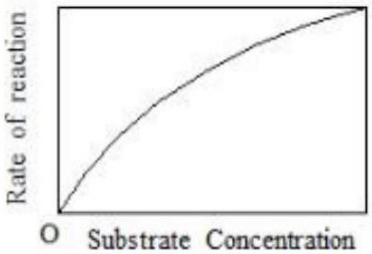

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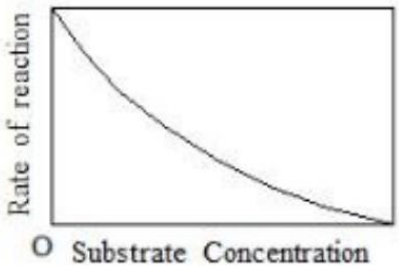


(d)

(1) (b) (2) (a) (3) (d) (4) (c)

Sol. **4**

Fact base.

36. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason **R** :

Assertion A : Acetal / Ketal is stable in basic medium.

Reason R : The high leaving tendency of alkoxide ion gives the stability to acetal/ ketal in basic medium.

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

(1) A is true but R is false

(2) A is false but R is true

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

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

Sol. **1**

Acetal and ketals are basically ether hence they must be stable in basic medium but should break down in acidic medium.

Hence assertion is correct.

Alkoxide ion (RO^-) is not considered a good leaving group hence reason must be false.

37. A cubic solid is made up of two elements X and Y. Atoms of X are present on every alternate corner and one at the center of cube. *Y* is at $\frac{1}{3}$ rd of the total faces. The empirical formula of the compound is

(1) $XY_{2.5}$ (2) $X_2Y_{1.5}$ (3) $X_{2.5}Y$ (4) $X_{1.5}Y_2$

Sol. **4**

Number of X-atom per unit cell = $1+4\times\frac{1}{8}=\frac{3}{2}$

Number of Y-atoms per unit cell = $2\times\frac{1}{2}=1$

$\therefore$ Empirical formula of the solid is X_3Y_2.

38. Match the List-I with List-II

List-I	List-II
Cations	Group reagents
A → Pb^{2+}, Cu^{2+}	i) H_2S gas in presence of dilute HCl
B → Al^{3+}, Fe^{3+}	ii) $(NH_4)_2CO_3$ in presence of NH_4OH
C → Co^{2+}, Ni^{2+}	iii) NH_4OH in presence of NH_4Cl
D → Ba^{2+}, Ca^{2+}	iv) H_2S in presence of NH_4OH

Correct match is -

(1) A → iii, B → i, C → iv, D → ii

(2) A → i, B → iii, C → ii, D → iv

(3) A → iv, B → ii, C → iii, D → i

(4) A → i, B → iii, C → iv, D → ii

Sol. **4**

Cations	Group No.	Group reagents
Pb^{2+}, Cu^{2+}	II	H_2S + HCl
Al^{3+}, Fe^{3+}	III	NH_4Cl + NH_4OH
Co^{2+}, Ni^{2+}	IV	NH_4OH + H_2S
Ba^{2+}, Ca^{2+}	V	NH_4OH , Na_2CO_3

39. Which of the following statements is incorrect for antibiotics?
(1) An antibiotic must be a product of metabolism.
(2) An antibiotic should promote the growth or survival of microorganisms.
(3) An antibiotic is a synthetic substance produced as a structural analogue of naturally occurring antibiotic.
(4) An antibiotic should be effective in low concentrations.

Sol. **2**
Antibiotic kill or inhibit the growth of microorganism

40. The correct order in aqueous medium of basic strength in case of methyl substituted amines is :
(1) $Me_3N > Me_2NH > MeNH_2 > NH_3$
(2) $Me_2NH > MeNH_2 > Me_3N > NH_3$
(3) $Me_2NH > Me_3N > MeNH_2 > NH_3$
(4) $NH_3 > Me_3N > MeNH_2 > Me_2NH$

Sol. **2**
In aqueous medium basic strength is dependent on electron density on nitrogen as well as solvation of cation formed after accepting H^+.After considering all these factors overall basic strength order is $Me_2NH > MeNH_2 > Me_3N > NH_3$

41. '25 volume' hydrogen peroxide means
(1) 1 L marketed solution contains 25 g of H_2O_2.
(2) 1 L marketed solution contains 75 g of H_2O_2.
(3) 1 L marketed solution contains 250 g of H_2O_2.
(4) 100 mL marketed solution contains 25 g of H_2O_2.

Sol. **2**
$25V\,H_2O_2$ means : 1 lit of H_2O_2 on decomposition give 25 lit of $O_2(g)$ at STP.

$$2H_2O_2(\ell) \rightarrow 2H_2O(\ell) + O_2(g)$$

$$2\left[\frac{25}{22.4}\right]\text{mole} \qquad \left[\frac{25}{22.4}\right]\text{mole}$$

Mass of $H_2O_2 = \frac{2\times 25}{22.4}\times 34 = 75.89\,\text{gram}$.

42. The radius of the 2nd orbit of Li^{2+} is x. The expected radius of the 3rd orbit of Be^{3+} is
(1) $\frac{27}{16}x$ (2) $\frac{4}{9}x$ (3) $\frac{9}{4}x$ (4) $\frac{16}{27}x$

Sol. **1**

$$R = 0.529\times\frac{n^2}{Z}$$

$$r_{Li^{2+}\ n-2} = 0.529\times\frac{(2)^2}{3} = x$$

$$r_{Be^{3+}\ n-3} = 0.529\times\frac{(3)^2}{4}$$

$$\frac{r_{Li^{2+}\ n-2}}{r_{Be^{3+}\ n-3}} = \frac{\frac{r_0\times(2)^2}{3}}{\frac{r_0\times(3)^2}{4}}$$

$$\frac{x}{r_{Be^{3+}\ n-3}} = \frac{16}{27}$$

$$\therefore \quad (r_{Be^{3+}})_{n=3} = \frac{27x}{16}$$

43. Reaction of thionyl chloride with white phosphorus forms a compound [A], which on hydrolysis gives [B], a dibasic acid. [A] and [B] are respectively
(1) P_4O_6 and H_3PO_3 (2) PCl_5 and H_3PO_4 (3) $POCl_3$ and H_3PO_4 (4) PCl_3 and H_3PO_3

Sol. **4**

$$P_4 + 8SOCl_2 \longrightarrow \underset{(A)}{4PCl_3} + 4SO_2 + 2S_2Cl_2$$

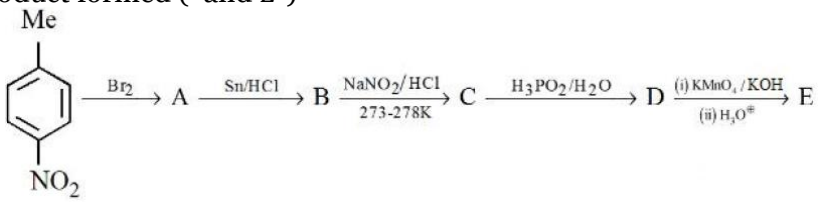
$$PCl_3 + 3H_2O \longrightarrow \underset{(B)}{H_3PO_3} + 3HCl$$

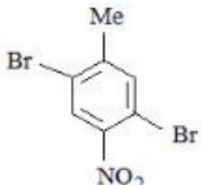
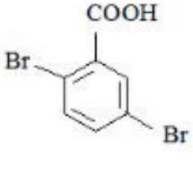
44. Inert gases have positive electron gain enthalpy. Its correct order is
(1) He < Kr < Xe < Ne (2) He < Xe < Kr < Ne
(3) He < Ne < Kr < Xe (4) Xe < Kr < Ne < He

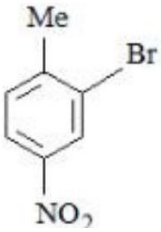
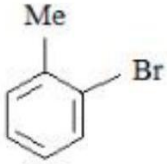
Sol. **2**

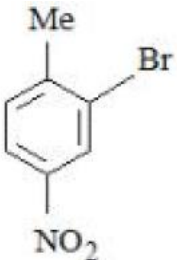
Positive electron gain enthalpy. of inert gas is in order of
Ne > Ar = Kr > Xe > He

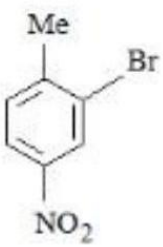
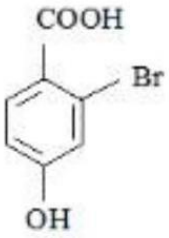
45. Identify the product formed (and *E*)



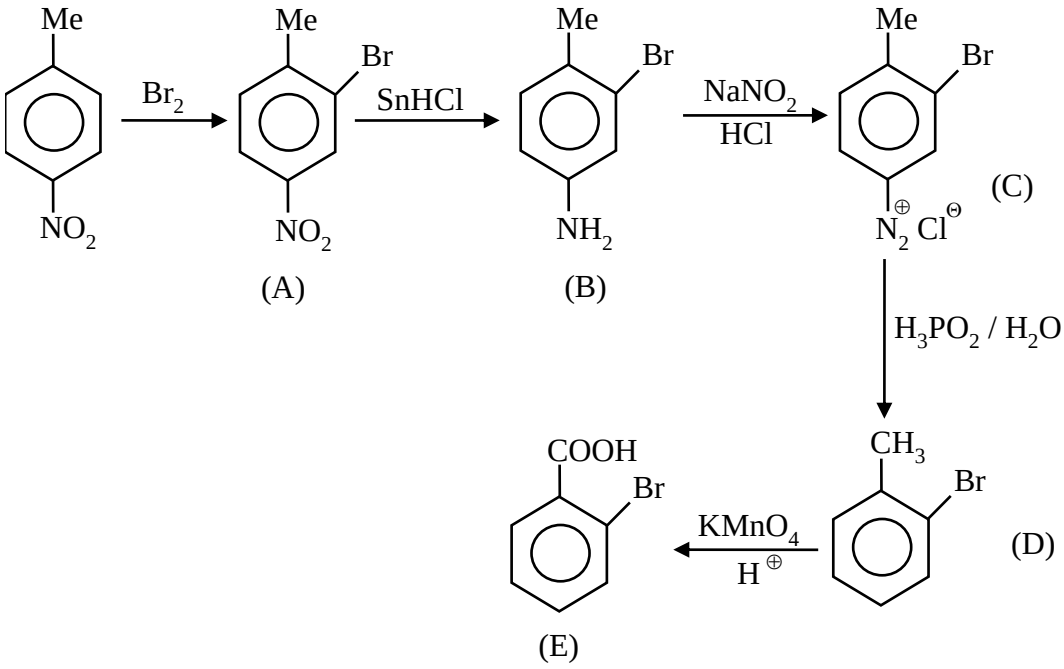
(1) A =  , E = 

(2)  , E = 

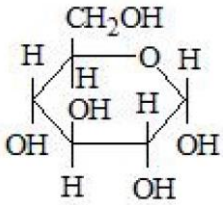
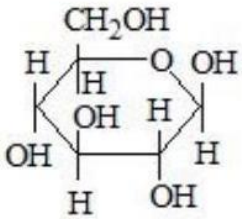
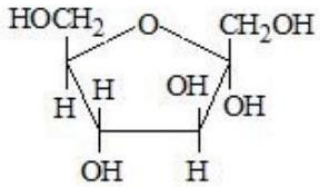
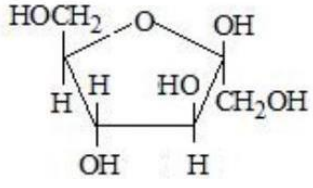
(3)  , E =

(4)  , E = 

Sol. **3**



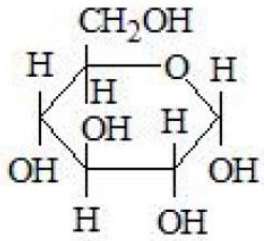
46. Match items of Row I with those of Row II.

Row I	Row II
(A) 	(i) α – D – (–)-Fructofuranose,
(B) 	(ii) β – D – (–) – Fructofuranose
(C) 	(iii) α – D – (–) Glucopyranose,
(D) 	(iv) β – D – (–)-Glucopyranose

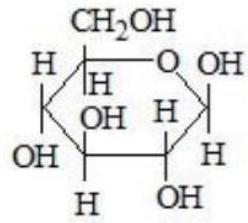
Correct match is

(1) A → i, B → ii, C → ii, D → iv
(2) A → iv, B → iii, C → i, D → ii
(3) A → iii, B → iv, C → ii, D → I
(4) A → iii, B → iV, C → i, D → ii

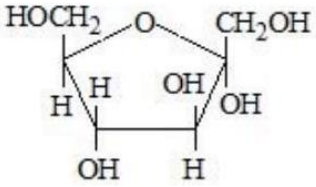
Sol. **4**



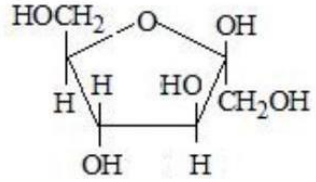
$\alpha - D - (-)$ Glucopyranose



$\beta - D - (-)$-Glucopyranose



$\alpha - D - (-)$-Fructofuranose



$\beta - D - (-) -$ Fructofuranose

47. Which one of the following reactions does not occur during extraction of copper ?
(1) $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$
(2) $FeO + SiO_2 \rightarrow FeSiO_3$
(3) $2FeS + 3O_2 \rightarrow 2FeO + 2SO_2$
(4) $CaO + SiO_2 \rightarrow CaSiO_3$

Sol. **4**

$\underset{\text{Impmily}}{CaO} + \underset{\text{Flux}}{SiO_2} \rightarrow \underset{\text{Slog}}{CaSiO_3}$

In metallurgy iron will occur not in metallurgy of Cu.

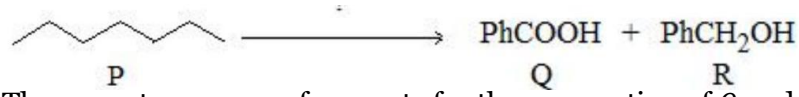
48. Some reactions of NO_2 relevant to photochemical smog formation are

$$NO_2 \xrightarrow{\text{sunlight}} X + Y$$
$$\downarrow A$$
$$B$$

Identify A, B, X and Y
(1) $X = \frac{1}{2}O_2, Y = NO_2, A = O_3, B = O_2$
(2) $X = [O], Y = NO, A = O_2, B = O_3$
(3) $X = N_2O, Y = [O], A = O_3, B = NO$
(4) $X = NO, Y = [O], A = O_2, B = N_2O_3$

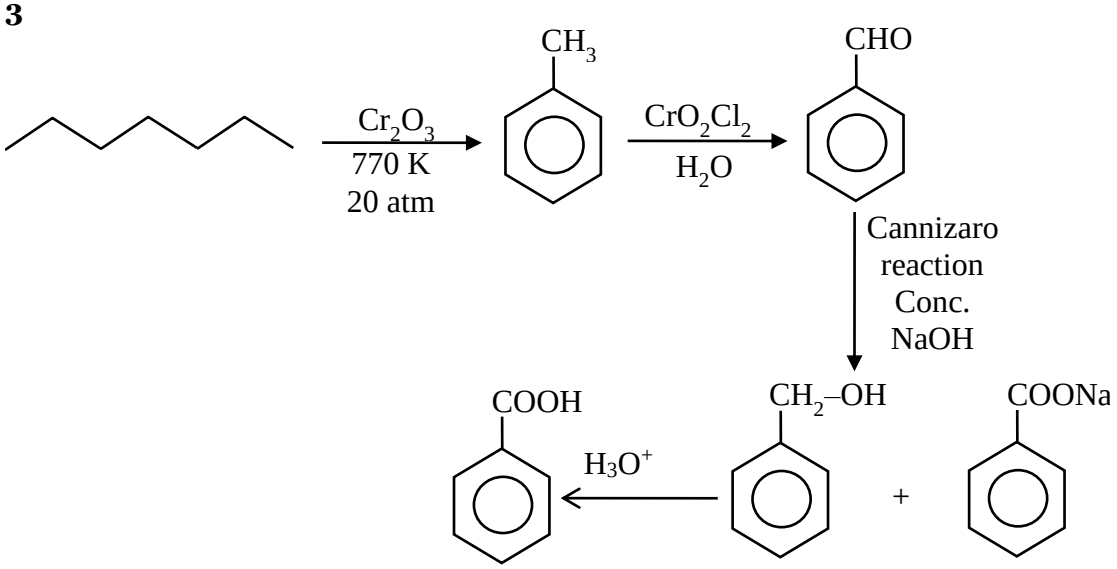
Sol. **2**

$$NO_2 \xrightarrow{hv} \underset{(x)}{O} + \underset{(y)}{NO}$$
$$\downarrow O_2\,(A)$$
$$O_3\,(B)$$

49. 

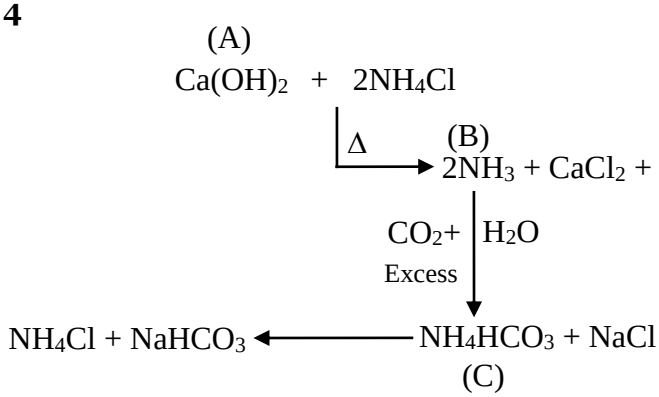
The correct sequence of reagents for the preparation of Q and R is :
(1) (i) CrO_2Cl_2, H_3O^+; (ii) Cr_2O_3, 770 K, 20 atm; (iii) NaOH; (iv) H_3O^+
(2) (i) $KMnO_4, OH^-$; (ii) Mo_2O_3, Δ; (iii) NaOH; (iv) H_3O^+
(3) (i) Cr_2O_3, 770 K, 20 atm; (ii) CrO_2Cl_2, H_3O^+; (iii) NaOH; (iv) H_3O^+
(4) (i) Mo_2O_3, Δ; (ii) CrO_2Cl_2, H_3O^+; (iii) NaOH; (iv) H_3O^+

Sol. **3**



50. Compound A reacts with NH_4Cl and forms a compound B. Compound B reacts with H_2O and excess of CO_2 to form compound C which on passing through or reaction with saturated NaCl solution forms sodium hydrogen carbonate.
Compound A, B and C, are respectively.
(1) $CaCl_2, NH_3, NH_4HCO_3$ (2) $Ca(OH)_2, NH_4^{\oplus}, (NH_4)_2CO_3$
(3) $CaCl_2, NH_4^{\oplus}, (NH_4)_2CO_3$ (4) $Ca(OH)_2, NH_3, NH_4HCO_3$

Sol. **4**



SECTION - B

51. For the first order reaction A → B, the half life is 30 min. The time taken for 75% completion of the reaction is_____min. (Nearest integer)

Given : $\log 2 = 0.3010$
$\log 3 = 0.4771$
$\log 5 = 0.6989$

Sol. **60**

$t_{75\%} = 2t_{1/2}$ [For 1st order reaction]

$t_{75\%} = 2 \times 30 = 60\,\text{min}$.

52. How many of the following metal ions have similar value of spin only magnetic moment in gaseous state?

(Given: Atomic number : V, 23; Cr, 24; Fe, 26; Ni, 28)

$V^{3+}, Cr^{3+}, Fe^{2+}, Ni^{3+}$

Sol. **2 (Cr^{+3} & Ni^{+3})**

V^{3+} = 3d: [↑][↑][ ][ ][ ] 4s: [ ]

Cr^{3+} = 3d: [↑][↑][↑][ ][ ] 4s: [ ]

Fe^{2+} = 3d: [↑↓][↑][↑][↑][↑] 4s: [ ]

Ni^{3+} = 3d: [↑↓][↑↓][↑][↑][↑] 4s: [ ]

53. In sulphur estimation, 0.471 g of an organic compound gave 1.4439 g of barium sulphate. The percentage of sulphur in the compound is_____(Nearest Integer)

(Given: Atomic mass Ba: 137u, S: 32u, O: 16u)

Sol. **42**

Organic compound $\rightarrow$ $BaSO_4$

Weight = 0.417 g Weight = 1.44 g

Moles $BaSO_4 = \frac{1.44}{233}$ = moles of Sulphur

Weight Sulphur = $\frac{1.44}{233} \times 32\,\text{gram}$

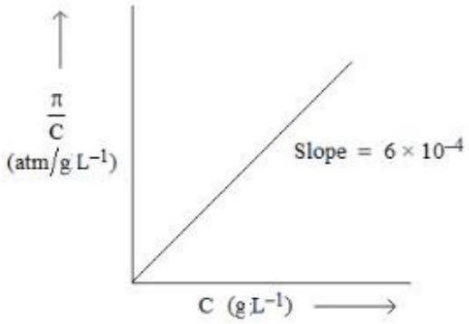
$$\%\,S = \frac{\text{weight of sulphur}}{\text{weight of organic}} \times 100$$

$$\Rightarrow \frac{1.44 \times 32}{233 \times 0.471} \times 100$$

$$\Rightarrow \frac{46.08}{109.743} \times 100$$

$$\Rightarrow 41.98 \simeq 42$$

54. The osmotic pressure of solutions of PVC in cyclohexanone at 300 K are plotted on the graph. The molar mass of PVC is_____$gmol^{-1}$ (Nearest integer)



(Given : R = 0.083 L atm K^{-1} mol^{-1})

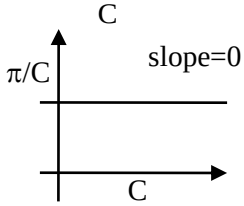
Sol. 41500

$$\pi = M'RT = \left(\frac{W/M}{V}\right)RT$$

$$\Rightarrow \pi = \left(\frac{W}{V}\right)\left(\frac{1}{M}\right)RT = C\left(\frac{RT}{M}\right)$$

$$\Rightarrow \frac{\pi}{C} = \frac{RT}{M} \neq f(c)$$

If we assume graph between $\frac{\pi}{C}$ and C



Assuming π vs C graph

$$\text{Slope} = \frac{RT}{M} = \frac{0.083\times 300}{M} = 6\times 10^{-4}$$

$$\therefore M = \frac{0.083\times 300}{6\times 10^{-4}} = \frac{830\times 300}{6}$$

= 41,500

55. The density of a monobasic strong acid (Molar mass 24.2 g/mol) is 1.21 kg/L. The volume of its solution required for the complete neutralization of 25 mL of 0.24MNaOH is____$\times 10^{-2}$ mL (Nearest integer)

Sol. **12**

$$\text{Molarity of acid} = \frac{1.2\times 10^3}{24.2} = \frac{1000}{20} = 50\,M$$

Neutralization reaction :

$$HA + NaOH \rightarrow NaA + H_2O$$

$$M_1V_1 = M_2V_2$$

$$[50]\times V = [0.24\times 25]$$

V = 00. 12 ml

56. An athlete is given 100 g of glucose ($C_6H_{12}O_6$) for energy. This is equivalent to 1800 kJ of energy. The 50% of this energy gained is utilized by the athlete for sports activities at the event. In order to avoid storage of energy, the weight of extra water he would need to perspire is_____g (Nearest integer)
Assume that there is no other way of consuming stored energy.
Given : The enthalpy of evaporation of water is 45 kJ mol^{-1}
Molar mass of C, H&O are 12,1 and 16 g mol^{-1}

Sol. **360**

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O(\ell)$

$n = \frac{100}{180}$

Energy needed to perspire water = $1800 \times \frac{1}{2}$

Moles of water evaporated = $\frac{900}{45} = 20\,\text{moles}$

Weight of water evaporated $\Rightarrow$ 20×18

$\Rightarrow$ 360 gram

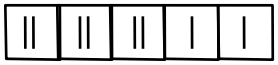
57. The number of paramagnetic species from the following is

$[Ni(CN)_4]^{2-}, [Ni(CO)_4], [NiCl_4]^{2-}$
$[Fe(CN)_6]^{4-}, [Cu(NH_3)_4]^{2+}$
$[Fe(CN)_6]^{3-}$ and $[Fe(H_2O)_6]^{2+}$

Sol. **4**

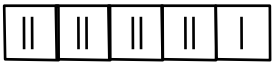
$(NiCl_4)^{-2} \rightarrow Ni^{+2} \rightarrow 3d^8$

$Cl^+ \rightarrow$ weak field layered



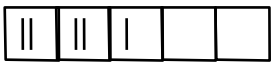
paramagnetic (n-e=2)

$(Cu(NH_3)_4)^{+2} \rightarrow Cu^{+2} \rightarrow 3d^9$



u-e = 1 paramagnetic

$(Fe(CN)_6)^{-3} \rightarrow Fe^{+3} \rightarrow 3d^5$

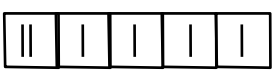


CN^- is strong field ligand so u-e=1

so paramagnetic

$(Fe(H_2O)_6)^{+2} \rightarrow Fe^{+2} \rightarrow 3d^6$

H_2O is weak field ligand



u-e=4 so paramagnetic

58. Consider the cell

$Pt(s) \mid H_2(g)\ (1\ atm) \mid H^+(aq, [H^+] = 1) \parallel Fe^{3+}(aq), Fe^{2+}(aq) \mid Pt(s)$

Given $E^{\circ}_{Fe^{3+}/Fe^{2+}} = 0.771$ V and $E^{\circ}_{H/1/2H_2} = 0$ V, T= 298 K

If the potential of the cell is 0.712 V, the ratio of concentration of Fe^{2+} to Fe^{3+} is (Nearest integer)

Sol. **10**

$$\text{Anode} \Rightarrow \frac{1}{2}H_2(g) \rightarrow H^+(aq) + e^-$$

$$\underline{\text{Cathode} \Rightarrow Fe^{3+} + e^- \rightarrow Fe^{2+}}$$

$$\text{Overall} \frac{1}{2}H_2 + Fe^{3+} \xrightarrow{n-1} H^+ + Fe^{2+}$$

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{1}\log\frac{[Fe^{2+}]}{[Fe^{3+}]} \times \frac{[H^+]}{[P_{H_2}]^{\frac{1}{2}}}$$

$$0.712 = 0.771 - 0.059\log\frac{[Fe^{2+}]}{[Fe^{3+}]}$$

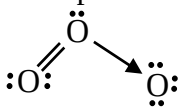
$$\log\frac{[Fe^{2+}]}{[Fe^{3+}]} = 1$$

$$\text{So } \frac{[Fe^{2+}]}{[Fe^{3+}]} = 10$$

59. The total number of lone pairs of electrons on oxygen atoms of ozone is

Sol. **6**

Not l.p. e^- in O_3 is = 6



60. A litre of buffer solution contains 0.1 mole of each of NH_3 and NH_4Cl. On the addition of 0.02 mole of HCl by dissolving gaseous HCl, the pH of the solution is found to be_____$\times 10^{-3}$ (Nearest integer)
[Given : $pK_b(NH_3) = 4.745$
$\log 2 = 0.301$
$\log 3 = 0.477$
$T = 298$ K]

Sol. **9**

NH_3	+	NH_4Cl
0.1mole		0.1mole

NH_3	+	HCl	→	NH_4Cl
0.1mole		0.02		0.1
0.08 mole		–		0.12 mole

$$P_{OH} \Rightarrow P_{Kb} + \log\frac{[NH_4Cl]}{[NH_3]}$$

$$\Rightarrow 4.745 + \log\left(\frac{0.12}{0.08}\right)$$

$$\Rightarrow 4.745 + \log\left(\frac{3}{2}\right)$$

$$\Rightarrow 4.745 + (0.477 - 0.301)$$
$$\Rightarrow 4.745 + 0.176$$
$$\Rightarrow 4.569$$
$$pH \Rightarrow 14 - 4.569$$
$$\Rightarrow 9.431 \simeq 9$$

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Class 10th to 11th Moving

Target: JEE/NEET 2024
Enthuse & प्रयास Batch
Class 11th to 12th Moving

Target: JEE/NEET 2024
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