FINAL JEE–MAIN EXAMINATION – APRIL, 2023
Held On Saturday 15th April, 2023
TIME : 09:00 AM to 12:00 PM

SECTION - A

61. Which one of the following is not an example of calcination?

(1) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$

(2) $2PbS + 3O_2 \xrightarrow{\Delta} 2PbO + 2SO_2$

(3) $CaCO_3.MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$

(4) $Fe_2O_3.xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$

Sol. **2**

Calcination is the process in which the ore of the metal is heated to high temperature in the absence or limited supple of air or oxygen. Anhydrous iron is formed during iron calcination.

$Fe_2O_3.xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$

62. During water–gas shift reaction

(1) Water is evaporated in presence of catalyst.

(2) Carbon monoxide is oxidized to carbon dioxide

(3) Carbon is oxidized to carbon monoxide.

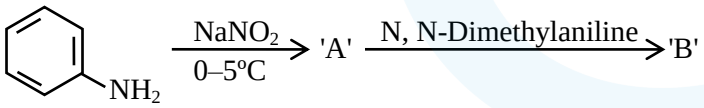
(4) Carbon dioxide is reduced to carbon monoxide.

Sol. **2**

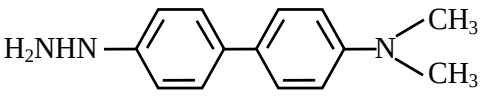
Water gas shift reaction

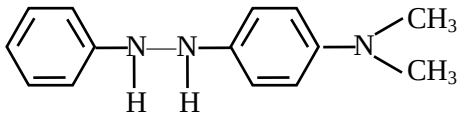
$CO + H_2O \longrightarrow CO_2 + H_2$

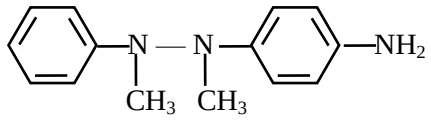
63. Consider the following sequence of reaction :

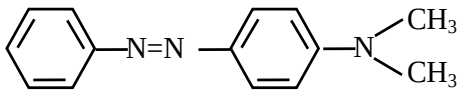


The product 'B' is :

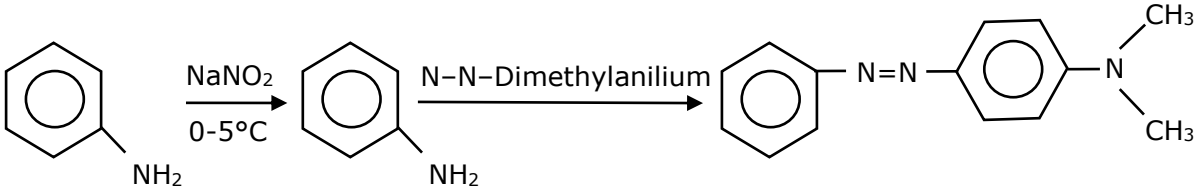
(1) 

(2) 

(3) 

(4) 

Sol. **4**



64. Given below are two statements: One is labeled as Assertion A and the other is labelled as Reason R:

Assertion (A) : $BeCl_2$ and $MgCl_2$ Produce characteristic flame

Reason (R) : The excitation energy is high in $BeCl_2$ and $MgCl_2$

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

(1) (A) is False but (R) is true

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

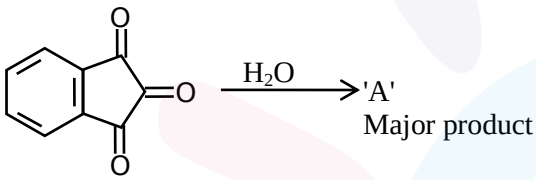
(3) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

(4) (A) is true but (R) is fasle

Sol. **1**

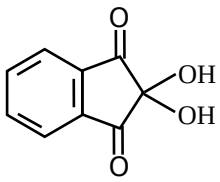
Be and mg have abnormally small size when compared to other alkali metals. Due to this, electrons in the atom are tightly hold and thus, they have high Ionisation energy. Hence, Be and mg donot undergo transition and don't impart characteristic colour to the flame.

65.

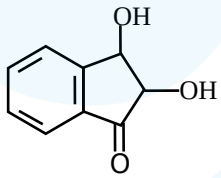


'A' formed in the above reaction is :

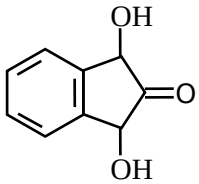
(1)



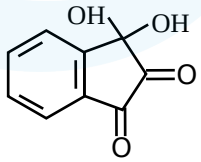
(2)



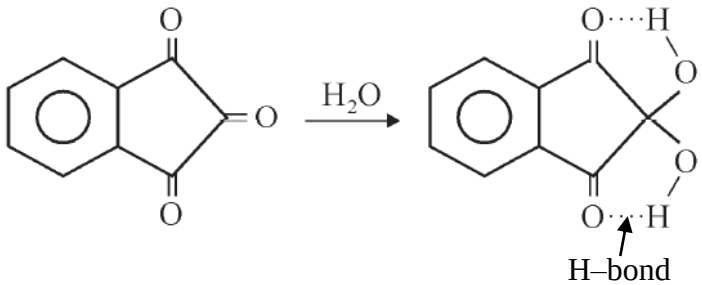
(3)



(4)



Sol. **1**



66. For a good quality cement, the ratio of silica to alumina is found to be

(1) 2 (2) 3 (3) 4.5 (4) 1.5

Sol. 2

The ratio should be between 2.5 to 4: 1

so ans $\rightarrow$ 3

67. Which of the following expressions is correct in case of a CaCl unit cell (edge length 'a')?

(1) $r_{Cs^+} + r_{Cl^-} = \frac{a}{\sqrt{2}}$

(2) $r_{Cs^+} + r_{Cl^-} = a$

(3) $r_{Cs^+} + r_{Cl^-} = \frac{\sqrt{3}}{2}a$

(4) $r_{Cs^+} + r_{Cl^-} = \frac{a}{2}$

Sol. **3**

For CaCl, $Cs^{\oplus}$ is present at Body center and

Cl^{Θ} at all corner. $\frac{\sqrt{3a}}{2} = r_{cs^{\oplus}} + r_{Cl^{\Theta}}$

68. Given below are two statements

Statement I : According to Bohr's model of hydrogen atom, the angular momentum of an electron in a given stationary state is quantised.

Statement II : The concept of electron in Bohr's orbit. violates the Heisenberg uncertainty principle.

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

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

(2) Both Statement I and Statement II are incorrect

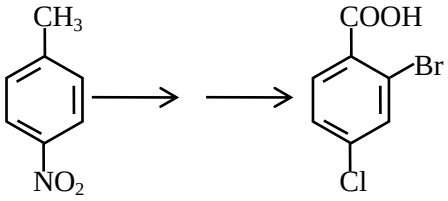
(3) Statement I is incorrect but Statement II is correct

(4) Both Statement I and Statement II are correct

Sol. **1**

According to Bohr's model the angular momentum is quantised and equal to $\frac{nh}{2\pi}$. Heisenberg uncertainty principle explains orbital concept, which is based on probability of finding electron.

69.



In the above conversion the correct sequence of reagents to be added is :

Options :

(1) (i) Br_2/Fe, (ii) Fe/H^+, (iii) $KMnO_4$, (iv) Cl_2

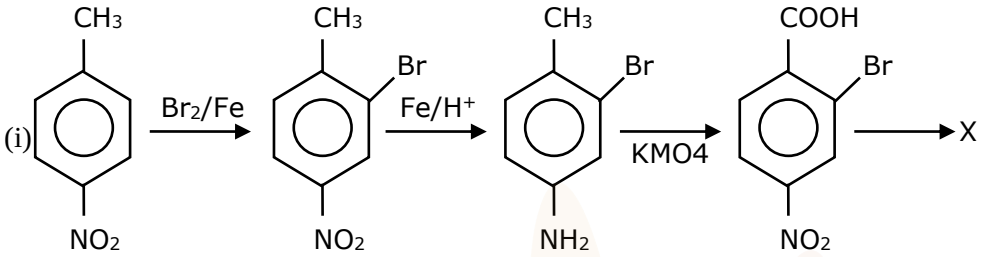
(2) (i) Br_2/Fe, (ii) Fe/H^+, (iii) HONO, (iv) CuCl, (v) $KMnO_4$

(3) (i) Fe/H^+, (ii) HONO, (iii) CuCl, (iv) $KMnO_4$, (v) Br_2

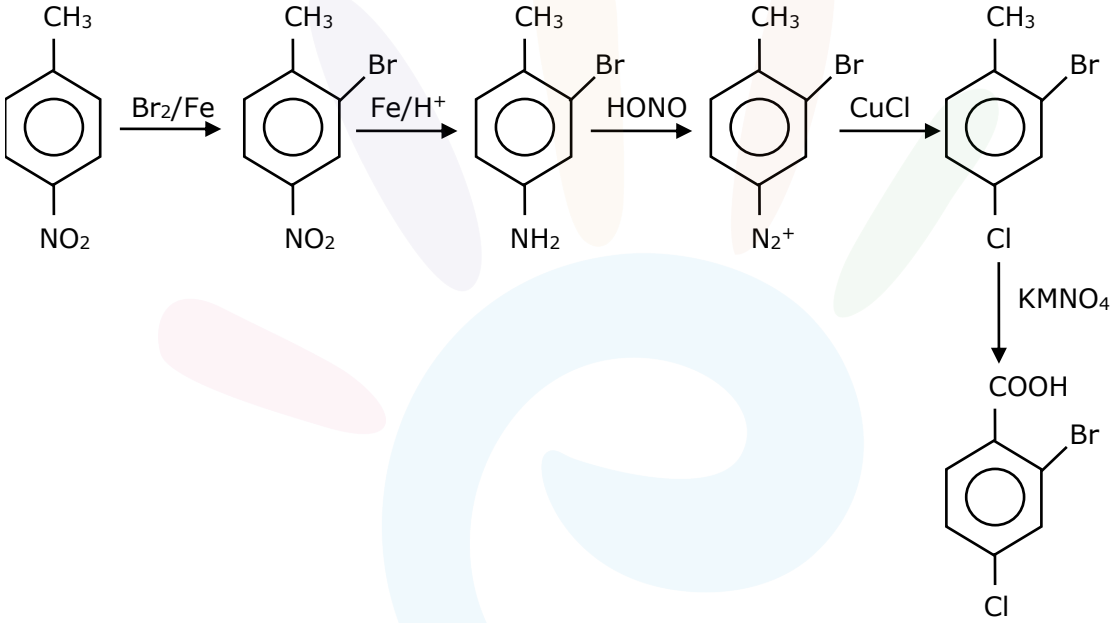
(4) (i) $KMnO_4$, (ii) Br_2/Fe, (iii) Fe/H^+, (iv) Cl_2 ,

Sol. **2**

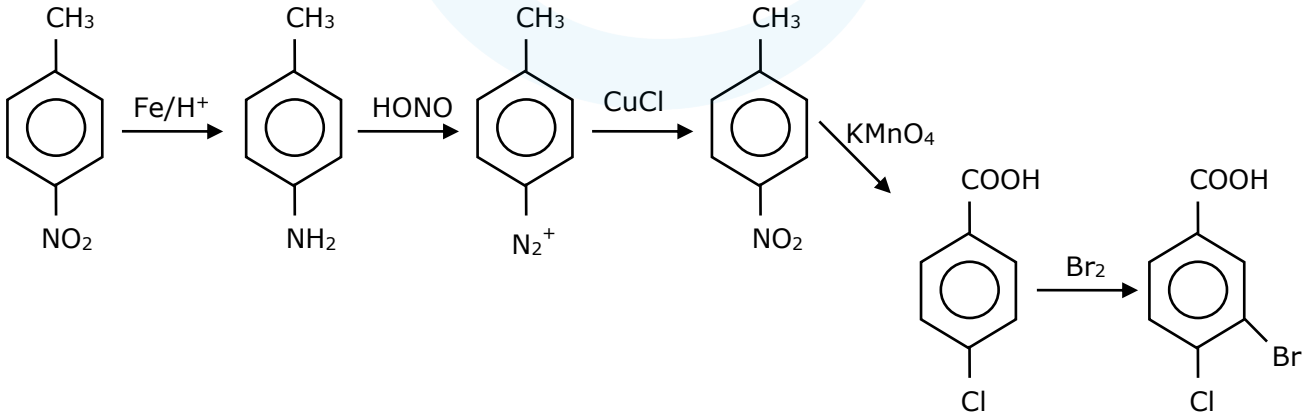
(i)



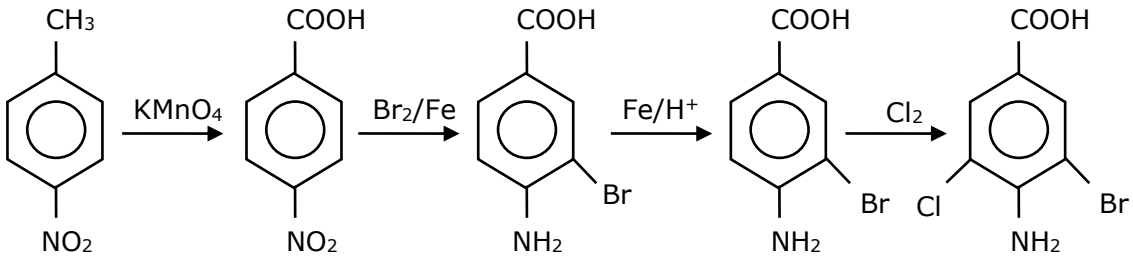
(ii)



(iii)



(iv)



70. The product formed in the following multistep reaction is:

$$CH_3 - CH = CH_2 \xrightarrow[(iii)PCC\ (iv)CH_3MgBr]{(i)B_2H_6\ (ii)H_2O_2,NaOH} \rightarrow$$

(1) $CH_3–CH_2–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_3$

(2) $CH_3–CH_2–CH_2–CH_2–OH$

(3) $CH_3–CH_2–\overset{\displaystyle O}{\overset{\|}{C}}–OCH_3$

(4) $CH_3–\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle OH}{\overset{|}{C}}}}–CH_3$

Sol. **1**

$$CH_3 - CH = CH_2 \xrightarrow[ii)\ H_2O_2,NaOH]{i)\ B_2H_6} CH_3 - CH_2 - \underset{\displaystyle OH}{\underset{|}{CH_2}}$$

$$\downarrow P.C.C$$

$$CH_3 - CH_2 - \overset{\displaystyle O}{\overset{\|}{C}} - H$$

$$\downarrow CH_3MgBr$$

$$CH_3 - CH_2 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$$

71. The possibility of photochemical smog formation will be minimum at

(1) Srinagar, Jammu and Kashmir in January

(2) New-Delhi in August (Summer)

(3) Kolkata in October

(4) Mumbai in May

Sol. 1

Srinage, Jammu & Kashmir in January photo chemical smog is produced when sunlight reacts with nitrogen oxides.

$$NO_2(g) \xrightarrow{h\upsilon} NO(g) + O(g)$$

$$O(g) + O_2 \longrightarrow O_3(g)$$

$$NO + O_3 \longrightarrow NO_2 + O_2$$

Chemical Bonding **Medium**

72. Consider the following statements:

(A) NF_3 molecule has a trigonal planar structure.

(B) Bond length of N_2 is shorter than O_2

(C) Isoelectronic molecules or ions have identical bond order

(D) Dipole moment of HS is higher than that of water molecule.

Choose the correct answer from the options given below:

(1) (A) and (B) are correct

(2) (C) and (D) are correct

(3) (B) and (C) are correct

(4) (A) and (D) are correct

Sol. **3**

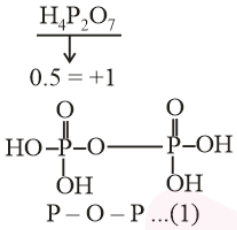
	Isoelectronic have
$N_2 + O_2$	Identical bond order
$N \equiv N \; O = O$	
B.O. – 3 > 2	
B.L.3 < 2	

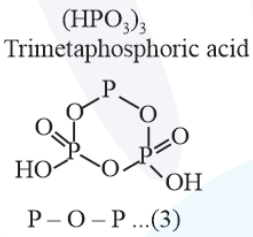
P-Block Medium

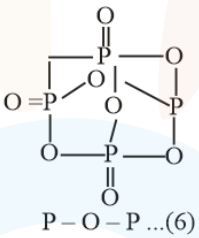
73. The number of P–O–P bonds in $H_4P_2O_7$, $(HPO_3)_3$ and P_4O_{10} are respectively

(1) 1, 3, 6 (2) 0, 3, 6 (3) 0, 3, 4 (4) 1, 2, 4

Sol. **1**





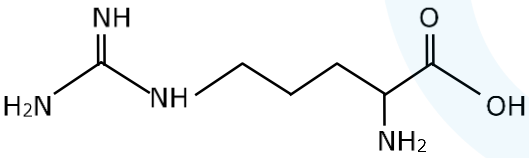


74. Which is not true for arginine?

(1) It has high solubility in benzene (2) It is associated with more than one pK_a values.

(3) It is a crystalline solid. (4) It has a fairly high melting point.

Sol. **1**



Arginine exist is zwitterion, so solid nature and soluble in polar solvent.

(i) Polar, so not high soluble in benzene (ii) It has 3 pKa values

(iii) True (iv) High molecular mass to high M.P.

75. The complex with highest magnitude of crystal field splitting energy (Δ_0) is

(1) $[Mn(OH_2)_6]^{3+}$ (2) $[Fe(OH_2)_6]^{3+}$ (3) $[Cr(OH_2)_6]^{3+}$ (4) $[Ti(OH_2)_6]^{3+}$

Sol. **3**

	$(Mn(H_2O)_6]^{+3}$	$[Fe(OH_2)_6)^{+3}$	$(Cr(OH_2)_6)^{+3}$	$(Ti(OH_2)_6)^{+3}$
	↓			
	Mn^{+3}	Fe^{+3}	Cr^{+3}	Ti^{+3}
	↓	↓	↓	↓
	$3d^4$	$3d^5$	$3d^3$	$3d^1$
CFSε =	–0.6	0	–1.2	–0.4
			↓	
			Higher	

76. Which of the following statement is correct for paper chromatography?

(1) Water present in the pores of the paper forms the stationary phase.

(2) Water present in the mobile phase gets absorbed by the paper which then forms the stationary phase

(3) Paper sheet forms the stationary phase.

(4) Paper and water present in its pores together form the stationary phase.

Sol. **1**

Fact

77. Which of the following statement(s) is/are correct?

(A) The pH of 1 x 10^{-8} M HCl solution is 8

(B) The conjugate hase of $H_2PH_4^-$ is HPO_4^{2-}

(C) K_w increases with increase in temperature.

(D) When a solution of a weak monoprotic acid is titrated against a strong base at half neutralisation point.

$$pH = \frac{1}{2}pK_a$$

Choose the correct answer from the options given below

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

Sol. **4**

(A) pH of 10^{-8} M HCl in acidic range (6.98).

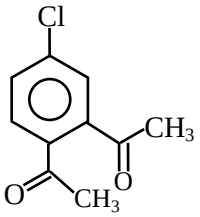
(B) Conjugate Base of $H_2PO_4^-$ is HPO_4^{2-}

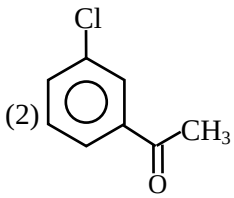
(C) K_w increases with increasing Temperature, as the temperature increases, the dissociation of water increases.

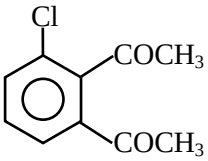
(D) At half neutralization point, half of the acid is present in the from salt.

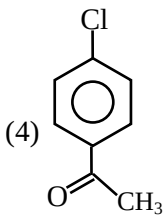
$$pH = Pk_a + \log\frac{1}{1} = Pk_a$$

78. The major product in the Friedel-Craft acylation of chlorobenzene is :

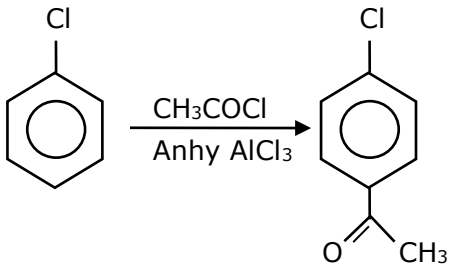
(1) 

(2) 

(3) 

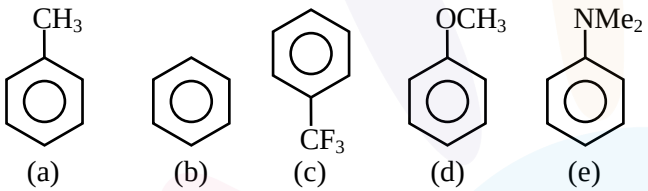
(4) 

Sol. **4**



Chlorine is ortho/para directing, para is major.

79. Decreasing order of reactivity towards electrophilic substitution for the following compounds is :

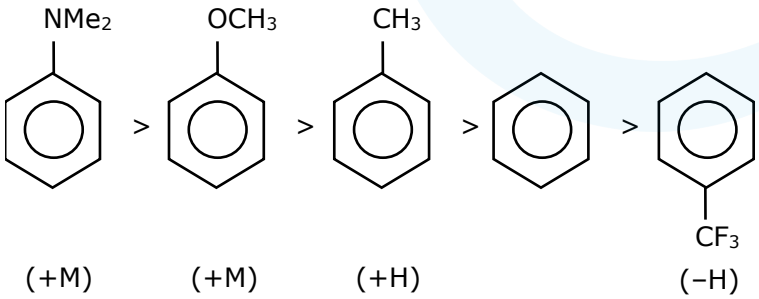


(1) a > d > e > b > c
(2) c > b > a > d > e
(3) e > d > a > b > c
(4) d > a > e > c > b

Sol. **3**

Higher the electron density on Benzene Ring, Higher its Reactivity towards electrophilic substitution Reaction

$$\text{Rate} \propto \text{EDG} \propto \frac{1}{\text{EWG}}$$



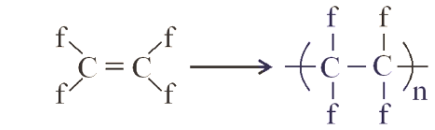
80. Match List-I with List-II :

List-I (Monomer)	**List-II (Polymer)**
(A) Tetrafluoroethene	(I) Orlon
(B) Acrylonitrile	(II) Natural rubber
(C) Caprolactam	(III) Teflon
(D) Isoprene	(IV) Nylon-6

Choose the correct answer from the options given below :

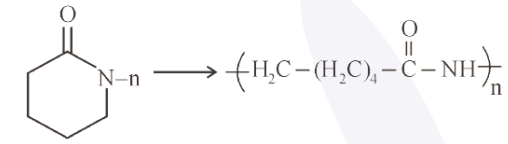
(1) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
(2) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(3) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
(4) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

Sol. **2**

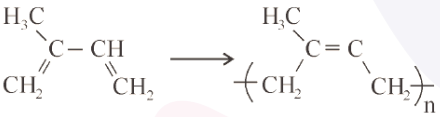


Tetra Fluoroethene Teflon

Acrylonitrile Orlon



Caprolactum Nylon - 6



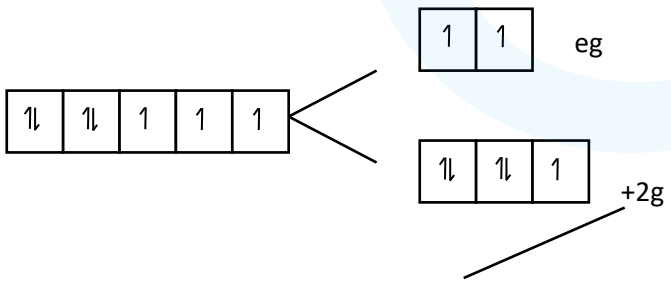
Isoprene Natural rubber

SECTION - B

81. The homoleptic and octahedral complex of Co^{2+} and H_2O has _____unparied electrons(s) in the t_{2g} set of orbitals.

Sol. **1**

$$\left(Co\left(H_2O\right)_6\right)^{+2} \rightarrow CO^{+2} \rightarrow 3d^7$$



u.e. in t_2g is = (1)

82. 30.4 kJ of heat is required to melt one mole of sodium chloride and the entropy change at the melting point is 28.4 $J\,K^{-1}\,mol^{-1}$ at 1 atm. The melting point of sodium chloride is _____ K. (Nearest Integer)

Sol. **1070**

$$\Delta S = \frac{\Delta H}{T_{mp}}$$

$$28.4 = \frac{30.4 \times 1000}{T_{mp}}$$

T_{mp} = 1070.422 K.

83. The total number of isoelectronic species from the given set is _____.

O^{2-}, F^{-}, Al, Mg^{2+}, Na^{+}, O^{+}, Mg, Al^{3+}, F

Sol. **5**

O^{-2},	F^{-}	mg^{+2}	Na^{+1}	Al^{+3}	
$10e^{-}$	$10e^{-}$	$10e^{-}$	$10e^{-}$	$10e^{-}$	Isoelectronic species

84. For a reversible reaction A $\rightleftharpoons$ B, the $\Delta H_{\text{forward reaction}}$ = 20 kJ mol^{-1}. The activation energy of the uncatalysed forward reaction is 300 kJ mol^{-1}. When the reaction is catalysed keeping the reactant concentration same, the rate of the catalyzed forward reaction at 27°C is found to be same as that of the uncatalysed reaction at 327°C. The activation energy of the catalyzed backward reaction is _____ KJ mol^{-1}.

Sol. **130**

$E_a = 300$ kJ mol^{-1}

$$\frac{E_a}{T} = \frac{E'_a}{T'}$$

(Since rate of catalyzed and uncatalysed reaction is same)

$$\frac{300}{600} = \frac{E'_{a,f}}{300}$$

$$E'_{a,f} = 150$$

$$20 = 150$$

$$20 = 150 - E'_{a,b}$$

$$E'_{a,b} = 130$$

85. The vapour pressure of 30% (w/v) aqueous solution of glucose is _____ mm Hg at 25°C.

[Given : The density of 30% (w/v), aqueous solutions of glucose is 1.2 g cm^{-3} and vapour pressure of pure water is 24 mm Hg.]

(Molar mass of glucose is 180 g mol^{-1})

Sol. **23**

$$\frac{24 - P_s}{P_s} = \frac{m \times 18}{1000}$$

wt of solute = 30 gm

Volume of solution = 100 mL

wt. of solution = 1.2 × 100 = 120 gm

wt. of solvent = 120 – 30 = 90 gm

$$m\frac{30 \times 1000}{180 \times 90} = 185$$

$$\frac{24 - P_s}{P_s} = \frac{1.85 \times 18}{1000}$$

$24 - P_s = 0.0333\ P_s$

$P_s(1.033) = 24$

$P_s = 23.22$

86. In Chromyl chloride, the oxidation state of chromium is (+) _____.

Sol. **6**

$CrO_2\ CO_2$ (Chromyl chloride)

$\downarrow$

$x - 4 - 2 = 0$

$\boxed{x = +6}$

87. The volume (in mL) of 0.1 M $AgNO_3$ required for complete precipitation of chloride ions present in 20 mL of 0.01 M solution of $[Cr(H_2O)_5Cl]Cl_2$ as silver chloride is _____ .

Sol. **4**

$[Cr(H_2O)_5Cl]Cl_2 + 2\ AgNO_3 \rightarrow$

0.01 M, 20 mL 0.1M

For 0.2 milimole $AgNO_3$ required

= 0.4 milimole

$0.4 = 0.1 \times V(ml)$

$V = 4mL$

88. 20 mL of 0.5 M NaCl is required to coagulate 200 mL, of As_2S_3 solution in 2 hours. The coagulating value of NaCl is _____ .

Sol. **50**

Coagulating value is required milimole of electrolyte needed to coagulate 1 L sol in 2 hours. Coagulating value

$$\frac{20 \times 0.5}{200} \times 1000 = 50$$

89. The total change in the oxidation state of manganese involved in the reaction of $KMnO_4$ and potassium iodide in the acidic medium is _____ .

Sol. **5**

$$\overset{+7}{KMnO_4} + KI \xrightarrow{H^+} \overset{+2}{Mn^{+2}} + I_2$$

Change in O.S. = (5)

90. The number of correct statements from the following is _____.

(A) Conductivity always decreases with decrease in concentration for both strong and weak electrolysis.

(B) The number of ions per unit volume that carry current in a solution increases on dilution.

(C) Molar conductivity increases with decrease in concentration.

(D) The variation in molar conductivity is different for strong and weak electrolysis.

(E) For weak electrolysis, the change in molar conductivity with dilution is due to decrease in degree of dissociation.

Sol. **3**

(A) Conductivity decreases with dilution for strong electrolyte as well as weak electrolyte.

(B) On dilution, The number of ions per unit volume that carry current in a solution decreases.

(C) Molar conductivity increases with dilution.

(D) Molar conductivity of strong electrolyte follows DHO equation but it is not applicable for weak electrolyte.

(E) On dilution degree of dissociation of weak electrolyte increases.

So answer is (A), (C) & (D)