CHEMISTRY

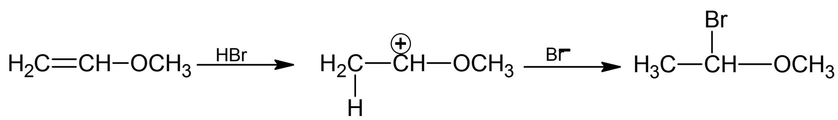
PART – C

96. HBr reacts with $CH_2 = CH – OCH_3$ under anhydrous conditions at room temperature to give

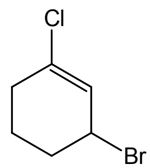
(1) CH_3CHO and CH_3Br
(2) $BrCH_2CHO$ and CH_3OH
(3) $BrCH_2 – CH_2 – OCH_3$
(4) $H_3C – CHBr – OCH_3$

Ans. **(4)**

Sol. Electrophilic addition reaction more favourable.



97. The IUPAC name of the compound shown below is



(1) 2-bromo-6-chlorocyclohex-1-ene
(2) 6-bromo-2-chlorocyclohexene
(3) 3-bromo-1-chlorocyclohexene
(4) 1-bromo-3-chlorocyclohexene

Ans. **(3)**

98. The increasing order of the rate of HCN addition to compounds A – D is

(A) HCHO
(B) CH_3COCH_3
(C) $PhCOCH_3$
(D) PhCOPh
(1) A < B < C < D
(2) D < B < C < A
(3) D < C < B < A
(4) C < D < B < A

Ans. **(3)**

99. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms?

(1) 0.02
(2) 3.125×10^{-2}
(3) 1.25×10^{-2}
(4) 2.5×10^{-2}

Ans. **(2)**

Sol. $Mg_3(PO_4)_2$

'n' moles

$$8n = 0.25$$

$$n = \frac{0.25}{8}$$

$$= \frac{25}{8 \times 100} = 3.125 \quad 10^{-2} \qquad \times$$

100. According to Bohr's theory, the angular momentum of an electron in 5th orbit is

(1) $25\frac{h}{\pi}$
(2) $1.0\frac{h}{\pi}$
(3) $10\frac{h}{\pi}$
(4) $2.5\frac{h}{\pi}$

Ans. **(4)**

Sol. $$mvr = \frac{nh}{2\pi}$$

$$= \frac{5h}{2\pi} = 2.5\frac{h}{\pi}$$

101. Which of the following molecules/ions does not contain unpaired electrons?

(1) O_2^{2-} (2) B_2

(3) N_2^{+} (4) O_2

Ans. (1)

102. Total volume of atoms present in a face-centre cubic unit cell of a metal is (r is atomic radius)

(1) $\frac{20}{3}\pi r^3$ (2) $\frac{24}{3}\pi r^3$

(3) $\frac{12}{3}\pi r^3$ (4) $\frac{16}{3}\pi r^3$

Ans. (4)

Sol.

$$V = n \times \left(\frac{4}{3}\ r^3\right)\pi$$

$$= 4 \times \left(\frac{4}{3}\ r^3\right)\pi$$

$$= \frac{16}{3}\pi r^3$$

103. A reaction was found to be second order with respect to the concentration of carbon monoxide. If the concentration of carbon monoxide is doubled, with everything else kept the same, the rate of reaction will

(1) remain unchanged (2) triple

(3) increase by a factor of 4 (4) double

Ans. (3)

Sol.

$R \propto [W]^2$

$R' \propto [2CO]^2$

$R \propto 4[W]^2$

$R \propto 4M$

104. Which of the following chemical reactions depicts the oxidizing behaviour of H_2SO_4?

(1) $2HI + H_2SO_4 \longrightarrow I_2 + SO_2 \quad 2\cancel{H_2}O$ (2) $Ca(OH)_2 + H_2SO_4 \longrightarrow CaSO_4 + 2\cancel{H_2O}$

(3) $NaCl + H_2SO_4 \longrightarrow NaHSO_4 + \cancel{HCl}$ (4) $2PCl_5 + H_2SO_4 \longrightarrow 2POCl_3 + 2\cancel{HCl} \quad SO_2Cl_2$ +

Ans. (1)

105. The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]Cl_2$ is

(1) nitrito-N-pentaamminecobalt (III) chloride (2) nitrito-N-pentaamminecobalt (II) chloride

(3) pentaammine nitrito-N-cobalt (II) chloride (4) pentaammine nitrito-N-cobalt (III) chloride

Ans. (4)

106. The term anomers of glucose refers to

(1) isomers of glucose that differ in configurations at carbons one and four (C-1 and C-4)

(2) a mixture of (D)-glucose and (L)-glucose

(3) enantiomers of glucose

(4) isomers of glucose that differ in configuration at carbon one (C-1)

Ans. (4)

107. In the transformation of $^{238}_{92}U$ to $^{234}_{92}U$, if one emission is an α-particle, what should be the other emission(s)?

(1) Two β^-
(2) Two β^- and one β^+
(3) One β^- and one γ
(4) One β^+ and one β^-

Ans. **(1)**

Sol. $^{238}_{92}U \longrightarrow {}^{234}_{92}U + {}^{4}_{2}He + 2\,{}^{0}_{-1}e$

108. Phenyl magnesium bromide reacts with methanol to give

(1) a mixture of anisole and Mg(OH)Br
(2) a mixture of benzene and Mg(OMe)Br
(3) a mixture of toluene and Mg(OH)Br
(4) a mixture of phenol and Mg(Me)Br

Ans. **(2)**

109. $CH_3Br + Nu^- \longrightarrow CH_3-Nu + Br^-$

The decreasing order of the rate of the above reaction with nucleophiles (Nu^-) A to D is
[Nu^- = (A) PhO^-, (B) AcO^-, (C) HO^-, (D) CH_3O^-]

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

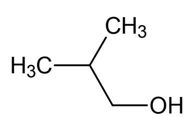
Ans. **(1)**

110. The pyrimidine bases present in DNA are

(1) cytosine and adenine
(2) cytosine and guanine
(3) cytosine and thymine
(4) cytosine and uracil

Ans. **(3)**

111. Among the following the one that gives positive iodoform test upon reaction with I_2 and NaOH is

(1) $CH_3CH_2CH(OH)CH_2CH_3$
(2) $C_6H_5CH_2CH_2OH$
(3)


(4) $PhCHOHCH_3$

Ans. **(4)**

112. The increasing order of stability of the following free radicals is

(1) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$
(2) $(C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
(3) $(C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C} < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
(4) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H$

Ans. **(1)**

113. Uncertainty in the position of an electron (mass = 9.1×10^{-31} kg) moving with a velocity 300 ms^{-1}, accurate upto 0.001%, will be

(1) 19.2×10^{-2} m
(2) 5.76×10^{-2} m
(3) 1.92×10^{-2} m
(4) 3.84×10^{-2} m

(h = 6.63×10^{-34} Js)

Ans. **(3)**

Sol. $\Delta x.\Delta V \geq \frac{h}{4\pi m}$

$$\Delta x \geq \frac{h}{4\pi m\Delta V} = \frac{6.63\times10^{-34}}{4\times3.14\times9.1\times10^{-31}\times300\times\frac{0.001}{100}}$$

$$= \frac{6.63\times10^{-34}}{4\times3.14\times9.1\times3\times10^{-31}\times10^{-3}}$$

= 0.01933

= 1.93×10^{-2}

114. Phosphorus pentachloride dissociates as follows, in a closed reaction vessel,

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

If total pressure at equilibrium of the reaction mixture is P and degree of dissociation of PCl_5 is x, the partial pressure of PCl_3 will be

(1) $\left(\frac{x}{x+1}\right)P$ (2) $\left(\frac{2x}{1-x}\right)P$

(3) $\left(\frac{x}{x-1}\right)P$ (4) $\left(\frac{x}{1-x}\right)P$

Ans. **(1)**

Sol.

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

$$(1-x) \qquad x \qquad x$$

$$P_{PCl_3} = \left(\frac{x}{1+x}\right)\times P$$

115. The standard enthalpy of formation $(\Delta_f H^o)$ at 298 K for methane, $CH_4(g)$, is –74.8 kJ mol^{-1}. The additional information required to determine the average energy for C – H bond formation would be

(1) the dissociation energy of H_2 and enthalpy of sublimation of carbon
(2) latent heat of vapourization of methane
(3) the first four ionization energies of carbon and electron gain enthalpy of hydrogen
(4) the dissociation energy of hydrogen molecule, H_2

Ans. **(1)**

116. Among the following mixtures, dipole-dipole as the major interaction, is present in

(1) benzene and ethanol (2) acetonitrile and acetone
(3) KCl and water (4) benzene and carbon tetrachloride

Ans. **(2)**

117. Fluorobenzene (C_6H_5F) can be synthesized in the laboratory

(1) by heating phenol with HF and KF
(2) from aniline by diazotisation followed by heating the diazonium salt with HBF_4
(3) by direct fluorination of benzene with F_2 gas
(4) by reacting bromobenzene with NaF solution

Ans. **(2)**

118. A metal, M forms chlorides in its +2 and +4 oxidation states. Which of the following statements about these chlorides is correct?

(1) MCl_2 is more volatile than MCl_4
(2) MCl_2 is more soluble in anhydrous ethanol than MCl_4
(3) MCl_2 is more ionic than MCl_4
(4) MCl_2 is more easily hydrolysed than MCl_4

Ans. **(3)**

119. Which of the following statements is true?
(1) H_3PO_3 is a stronger acid than H_2SO_3
(2) In aqueous medium HF is a stronger acid than HCl
(3) $HClO_4$ is a weaker acid than $HClO_3$
(4) HNO_3 is a stronger acid than HNO_2

Ans. (4)

120. The molar conductivities $\wedge^{o}_{NaOAc}$ and $\wedge^{o}_{HCl}$ at infinite dilution in water at 25°C are 91.0 and 426.2 S cm²/mol respectively. To calculate $\wedge^{o}_{HOAc}$, the additional value required is

(1) $\wedge^{o}_{H_2O}$ (2) $\wedge^{o}_{KCl}$
(3) $\wedge^{o}_{NaOH}$ (4) $\wedge^{o}_{NaCl}$

Ans. (4)

Sol. $\lambda^{o}_{CH_3COONa} = {}^{o}_{CH_3COO^-} \quad {}^{o}_{Na^+}$ λ……… (1) $+$ λ

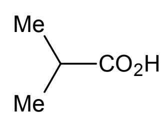
$\lambda^{o}_{HCl} = {}^{o}_{H^+} \quad \lambda^{o}_{Cl^-}$ ….+….λ……….. (2)

$\lambda^{o}_{NaCl} = {}^{o}_{Na} \quad {}^{o}\lambda_{Cl^-}$ ……+……λ……… (3)

$\lambda^{o}_{CH_3COOH} = (1) \quad (2) \quad (3) \quad + \quad -$

121. Which one of the following sets of ions represents a collection of isoelectronic species?
(1) K^+, Cl^-, Ca^{2+}, Sc^{3+} (2) Ba^{2+}, Sr^{2+}, K^+, S^{2-}
(3) N^{3-}, O^{2-}, F^-, S^{2-} (4) Li^+, Na^+, Mg^{2+}, Ca^{2+}

Ans. (1)

122. The correct order of increasing acid strength of the compounds
(a) CH_3CO_2H (b) $MeOCH_2CO_2H$
(c) CF_3CO_2H (d)


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

Ans. (3)

123. In which of the following molecules/ions are all the bonds not equal?
(1) SF_4 (2) SiF_4
(3) XeF_4 (4) BF_4^-

Ans. (1)

124. What products are expected from the disproportionation reaction of hypochlorous acid?
(1) $HClO_3$ and Cl_2O (2) $HClO_2$ and $HClO_4$
(3) HCl and Cl_2O (4) HCl and $HClO_3$

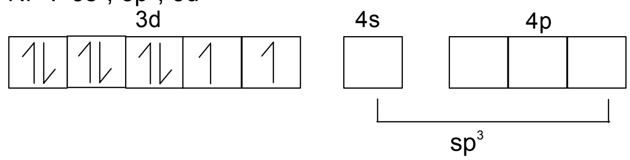
Ans. (4)

125. Nickel (Z = 28) combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electron(s) in the nickel and geometry of this complex ion are, respectively
(1) one, tetrahedral (2) two, tetrahedral
(3) one, square planar (4) two, square planar

Ans. **(2)**

Sol. $_{28}Ni$: ……… $3s^2, 3p^6, 3d^8, 4s^2$

Ni^{2+}: $3s^2, 3p^6, 3d^8$



Tetrahedral geometry

126. In $Fe(CO)_5$, the Fe – C bond possesses

(1) π-character only
(2) both σ and π characters
(3) ionic character
(4) σ-character only

Ans. **(2)**

127. The increasing order of the first ionization enthalpies of the elements B, P, S and F (lowest first) is

(1) F < S < P < B
(2) P < S < B < F
(3) B < P < S < F
(4) B < S < P < F

Ans. **(4)**

128. An ideal gas is allowed to expand both reversibly and irreversibly in an isolated system. If T_i is the initial temperature and T_f is the final temperature, which of the following statements is correct?

(1) $(T_f)_{irrev} > (T_f)_{rev}$
(2) $T_f > T_i$ for reversible process but $T_f = T_i$ for irreversible process
(3) $(T_f)_{rev} = (T_f)_{irrev}$
(4) $T_f = T_i$ for both reversible and irreversible processes

Ans. **(1)**

129. In Langmuir's model of adsorption of a gas on a solid surface

(1) the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered
(2) the adsorption at a single site on the surface may involve multiple molecules at the same time
(3) the mass of gas striking a given area of surface is proportional to the pressure of the gas
(4) the mass of gas striking a given area of surface is independent of the pressure of the gas

Ans. **(3)**

130. Rate of a reaction can be expressed by Arrhenius equation as:

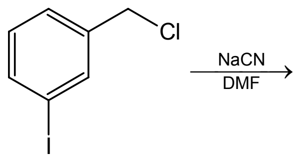
$k = A e^{-E/RT}$

In this equation, E represents

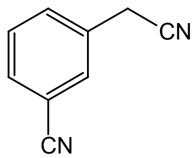
(1) the energy above which all the colliding molecules will react
(2) the energy below which colliding molecules will not react
(3) the total energy of the reacting molecules at a temperature, T
(4) the fraction of molecules with energy greater than the activation energy of the reaction

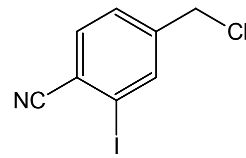
Ans. **(2)**

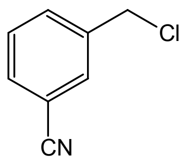
131. The structure of the major product formed in the following reaction

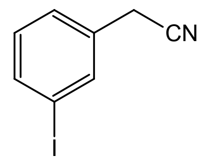


is

(1) 

(2) 

(3) 

(4) 

Ans. **(4)**

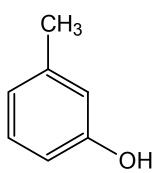
132. Reaction of trans-2-phenyl-1-bromocyclopentane on reaction with alcoholic KOH produces
(1) 4-phenylcyclopentene
(2) 2-phenylcyclopentene
(3) 1-phenylcyclopentene
(4) 3-phenylcyclopentene

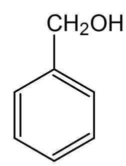
Ans. **(4)**
Sol. According to E_2 mechanism.

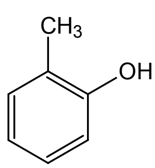
133. Increasing order of stability among the three main conformations (i.e. Eclipse, Anti, Gauche) of 2-fluoroethanol is
(1) Eclipse, Gauche, Anti
(2) Gauche, Eclipse, Anti
(3) Eclipse, Anti, Gauche
(4) Anti, Gauche, Eclipse

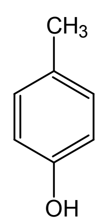
Ans. **(3)**

134. The structure of the compound that gives a tribromo derivative on treatment with bromine water is

(1) 

(2) 

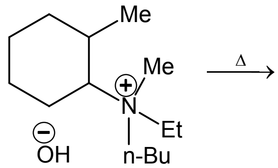
(3) 

(4) 

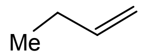
Ans. **(1)**

135. The decreasing values of bond angles from NH_3 (106^o) to SbH_3 (101^o) down group-15 of the periodic table is due to
(1) increasing bp-bp repulsion
(2) increasing p-orbital character in sp^3
(3) decreasing lp-bp repulsion
(4) decreasing electronegativity

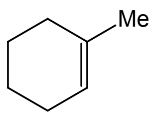
Ans. **(4)**

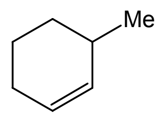
136. 

The alkene formed as a major product in the above elimination reaction is

(1) 

(2) $CH_2 = CH_2$

(3) 

(4) 

Ans. **(2)**

137. The "spin-only" magnetic moment [in units of Bohr magneton, (μ_B)] of Ni^{2+} in aqueous solution would be (Atomic number of Ni = 28)

(1) 2.84
(2) 4.90
(3) 0
(4) 1.73

Ans. **(1)**

138. The equilibrium constant for the reaction

$$SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g)$$

is $K_c = 4.9 \times 10^{-2}$. The value of K_c for the reaction

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

will be

(1) 416
(2) 2.40×10^{-3}
(3) 9.8×10^{-2}
(4) 4.9×10^{-2}

Ans. **(1)**

Sol.
$$K_c' = \left(\frac{1}{4.9 \times 10^{-2}}\right)^2$$
$$= \frac{10^4}{4.9 \times 4.9} = \frac{100 \times 100}{24.01}$$
$$= 4.1649 \times 100$$
$$= 416.49$$

139. Following statements regarding the periodic trends of chemical reactivity of the alkali metals and the halogens are given. Which of these statements gives the correct picture?

(1) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group
(2) In both the alkali metals and the halogens the chemical reactivity decreases with increase in atomic number down the group
(3) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens
(4) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group

Ans. **(4)**

140. Given the data at 25°C,

$$Ag + I^- \longrightarrow AgI + e^-;\quad E^o\quad 0.152\ V$$

$$Ag \longrightarrow Ag^+ + e^-;\quad E^o\quad 0.800\ V\quad -$$

What is the value of log K_{sp} for AgI?

$$\left(2.303\frac{RT}{F} = 0.059\ V\right)$$

(1) –8.12 (2) +8.612
(3) –37.83 (4) –16.13

Ans. **(4)**

Sol.

$$AgI(s) + e^- \rightleftharpoons Ag(s) + I^-;\quad E^\circ\quad 0.152\quad = \quad -$$

$$Ag(s) \longrightarrow Ag^+ + e^-;\quad E^\circ\quad 0.8\quad = \quad -$$

$$AgI(s) \longrightarrow Ag^+ + I^-;\quad E^\circ\quad 0.952 = \quad -$$

$$E^\circ_{cell} = \frac{0.059}{n}\log K$$

$$-0.952 = \frac{0.059}{1}\log K_{sp}$$

$$\log K_{sp} = -\frac{0.952}{0.059} = -16.135$$

141. The following mechanism has been proposed for the reaction of NO with Br_2 to form NOBr:

$$NO(g) + Br_2(g) \rightleftharpoons NOBr_2(g)$$

$$NOBr_2(g) + NO(g) \longrightarrow 2NOBr(g)$$

If the second step is the rate determining step, the order of the reaction with respect to NO(g) is

(1) 1 (2) 0
(3) 3 (4) 2

Ans. **(4)**

Sol.

$$NO(g) + Br_2(g) \rightleftharpoons NOBr_2(g)$$

$$NOBr_2(g) + NO(g) \longrightarrow 2NOBr(g)$$

$$R = K[NOBr_2]\,[NO]$$

$$= K.K_c\,[NO]\,[Br_2][NO],\ \text{where } K_c = \frac{[NOBr_2]}{[NO]\,[Br_2]}$$

$$= K'[NO]^2\,[Br_2]$$

142. Lanthanoid contraction is caused due to

(1) the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
(2) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge
(3) the same effective nuclear charge from Ce to Lu
(4) the imperfect shielding on outer electrons by 4f electrons from the nuclear charge

Ans. **(4)**

143. Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1 M is 100 Ω. The conductivity of this solution is 1.29 S m^{-1}. Resistance of the same cell when filled with 0.2 M of the same solution is 520 Ω. The molar conductivity of 0.02 M solution of the electrolyte will be

(1) 124×10^{-4} S m^2 mol^{-1} (2) 1240×10^{-4} S m^2 mol^{-1}
(3) 1.24×10^{-4} S m^2 mol^{-1} (4) 12.4×10^{-4} S m^2 mol^{-1}

Ans. **(4)**

Sol. There is one mistake in Question paper.
Assuming concentration of solution is 0.2 M instead of 0.02 M. Since resistance of 0.2 M is 520 Ω.

$R = 100\,\Omega$

$K = \frac{1}{R}\left(\frac{\ell}{a}\right)$

$1.29 = \frac{1}{100}\left(\frac{\ell}{a}\right)$

$\left(\frac{\ell}{a}\right) = 129\ m^{-1}$

$R = 520\,\Omega$, C = 0.2 M

$K = \frac{1}{R}\left(\frac{\ell}{a}\right) = \frac{1}{520}(129)\ \Omega^{-1}m^{-1}$

$\mu = K \times V_{\text{in cm}^3}$

$= \frac{1}{520} \times 129 \times \frac{1000}{0.2} \times 10^{-6}\ m^3$

$= \frac{129}{520} \times \frac{1000}{0.2} \times 10^{-6}$

$= 1.24 \times 10^{-3}$

$= 12.4 \times 10^{-4}$

144. The ionic mobility of alkali metal ions in aqueous solution is maximum for
(1) K^+
(2) Rb^+
(3) Li^+
(4) Na^+

Ans. **(2)**

145. Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is
(1) 1.14 mol kg^{-1}
(2) 3.28 mol kg^{-1}
(3) 2.28 mol kg^{-1}
(4) 0.44 mol kg^{-1}

Ans. **(3)**

146. The enthalpy changes for the following processes are listed below:
$Cl_2(g) = 2Cl(g)$, 242.3 kJ mol^{-1}
$I_2(g) = 2I(g)$, 151.0 kJ mol^{-1}
$ICl(g) = I(g) + Cl(g)$, 211.3 kJ mol^{-1}
$I_2(s) = I_2(g)$, 62.76 kJ mol^{-1}
Given that the standard states for iodine and chlorine are $I_2(s)$ and $Cl_2(g)$, the standard enthalpy of formation for ICl(g) is
(1) –14.6 kJ mol^{-1}
(2) –16.8 kJ mol^{-1}
(3) +16.8 kJ mol^{-1}
(4) +244.8 kJ mol^{-1}

Ans. **(3)**

Sol. $\frac{1}{2}I_2(s) + \frac{1}{2}Cl_2 \longrightarrow ICl(g)$

$\Delta H = \left[\frac{1}{2}\Delta H_{I_2(s)\to I_2(g)} + \frac{1}{2}\mu_{I-I} + \frac{1}{2}\mu_{Cl-Cl}\right] - \left[\mu_{I-Cl}\right]$

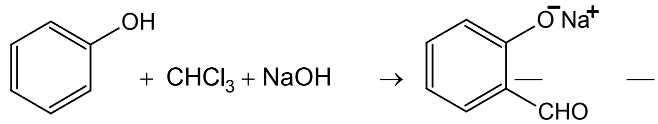
$= \left(\frac{1}{2} \times 62.76 + \frac{1}{2} \times 151.0 + \frac{1}{2} \times 242.3\right) - (211.3)$

= 228.03 – 211.3

$\Delta H = 16.73$

147. How many EDTA (ethylenediaminetetraacetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion?
(1) Six
(2) Three
(3) One
(4) Two

Ans. **(3)**

148. 

The electrophile involved in the above reaction is

(1) dichloromethyl cation $(\overset{\oplus}{C}HCl_2)$ (2) dichlorocarbene $(:CCl_2)$

(3) trichloromethyl anion $(\overset{\ominus}{C}Cl_3)$ (4) formyl cation $(\overset{\oplus}{C}HO)$

Ans. **(2)**

149. 18 g of glucose ($C_6H_{12}O_6$) is added to 178.2 g of water. The vapour pressure of water for this aqueous solution at 100°C is

(1) 759.00 Torr (2) 7.60 Torr

(3) 76.00 Torr (4) 752.40 Torr

Ans. **(4)**

Sol. $\frac{P^o - P_s}{P_s} = \frac{n}{N}$

$$\frac{760 - P_s}{P_s} = \frac{\frac{18}{180}}{\frac{178.2}{18}} = \frac{\frac{1}{10}}{9.9} \quad \frac{0.1}{9.9} \qquad =$$

$$760 - P_s = \frac{1}{99} P_s$$

$760 \times 99 - P_s \times 99 = P_s$

$760 \times 99 = 100\ P_s$

$$P_s = \frac{760 \times 99}{100} = 752.4$$

150. $(\Delta H - \Delta U)$ for the formation of carbon monoxide (CO) from its elements at 298 K is

($R = 8.314\ J\ K^{-1}\ mol^{-1}$)

(1) $-1238.78\ J\ mol^{-1}$ (2) $1238.78\ J\ mol^{-1}$

(3) $-2477.57\ J\ mol^{-1}$ (4) $2477.57\ J\ mol^{-1}$

Ans. **(1)**

Sol. $\Delta H - \Delta U = \Delta n_g RT$

$$= -\frac{1}{2} \times 8.314 \times 298$$

$= -1238.78$