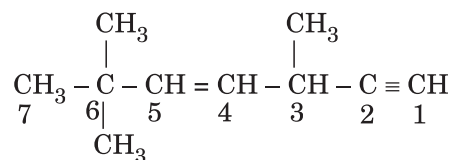


AIPMT - 2009 - CHEMISTRY

Question Paper with Solution

151. The state of hybridization of C₂, C₃, C₅ and C₆ of the hydrocarbon,



is in the following sequence:

- (1) sp³, sp², sp² and sp
(2) sp, sp², sp² and sp³
(3) sp, sp², sp³ and sp²
(4) sp, sp³, sp² and sp³

Sol: sp, sp³, sp², sp³

∴ Correct choice : (4)

152. Oxidation numbers of P in PO₄³⁻, of S in SO₄²⁻ and that of Cr in Cr₂O₇²⁻ are respectively:

- (1) + 3, + 6 and + 5
(2) + 5, + 3 and + 6
(3) - 3, + 6 and + 6
(4) + 5, + 6 and + 6

Sol: PO₄³⁻ (P = + 5)

SO₄²⁻ (S = + 6)

Cr₂O₇²⁻ (Cr = + 6)

∴ Correct choice : (4)

153. Lithium metal crystallises in a body centred cubic crystal. If the length of the side of the unit cell of lithium is 351 pm, the atomic radius of the lithium will be:

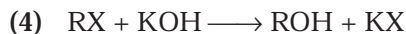
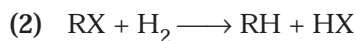
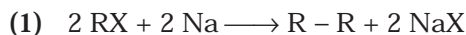
- (1) 151.8 pm (2) 75.5 pm (3) 300.5 pm (4) 240.8 pm

Sol: $a\sqrt{3} = 4r$

$$r = \frac{a\sqrt{3}}{4} = \frac{351 \times 1.732}{4} = 151.98 \text{ pm}$$

∴ Correct choice : (1)

154. Which of the following reactions is an example of nucleophilic substitution reaction?



Sol: X^- is replaced by OH^-

∴ Correct choice : (4)

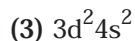
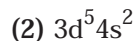
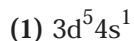
155. In the case of alkali metals, the covalent character decreases in the order:



Sol: $\text{MI} > \text{MBr} > \text{MCl} > \text{MF}$. As the size of the anion decreases covalency decreases

∴ Correct choice : (3)

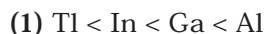
156. Which one of the elements with the following outer orbital configurations may exhibit the largest number of oxidation states?



Sol: The configuration $3\text{d}^5 4\text{s}^2$ can have various oxidation states upto + 7.

∴ Correct choice : (2)

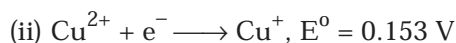
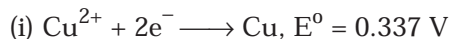
157. The stability of + 1 oxidation state increases in the sequence:



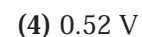
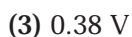
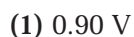
Sol: The order is due to 'inert pair effect'

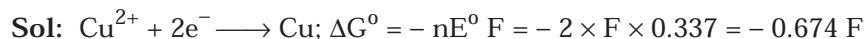
∴ Correct choice : (4)

158. Given:



Electrode potential, E^0 for the reaction, $\text{Cu}^+ + \text{e}^- \longrightarrow \text{Cu}$, will be:





\therefore Correct choice : (4)

159. For the reaction, $\text{N}_2 + 3\text{H}_2 \longrightarrow 2\text{NH}_3$, if $\frac{d[\text{NH}_3]}{dt} = 2 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$, the

value of $\frac{-d[\text{H}_2]}{dt}$ would be:

(1) $4 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

(2) $6 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

(3) $1 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

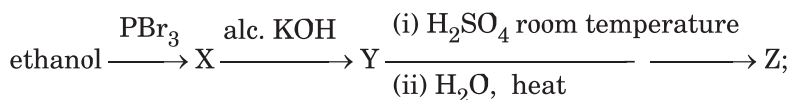
(4) $3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

Sol: $-\frac{1}{3} \frac{d[\text{H}_2]}{dt} = \frac{1}{2} \frac{d[\text{NH}_3]}{dt}$

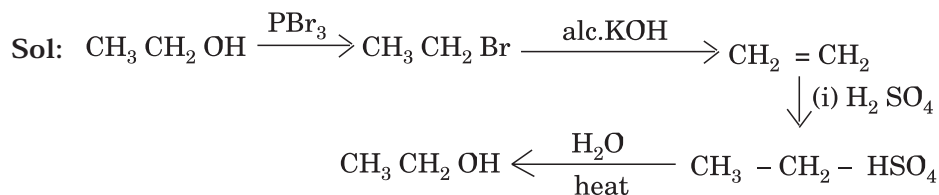
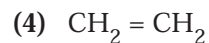
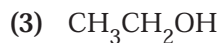
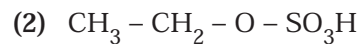
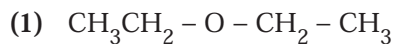
$$\frac{-d[\text{H}_2]}{dt} = \frac{3}{2} \frac{d[\text{NH}_3]}{dt} = \frac{3}{2} \times 2 \times 10^{-4} = 3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$

\therefore Correct choice : (4)

160. Consider the following reaction,



the product Z is:



\therefore Correct choice : (3)

161. The energy absorbed by each molecule (A_2) of a substance is 4.4×10^{-19} J and bond energy per molecule is 4.0×10^{-19} J. The kinetic energy of the molecule per atom will be:

- (1) 2.2×10^{-19} J (2) 2.0×10^{-19} J
(3) 4.0×10^{-20} J (4) 2.0×10^{-20} J

Sol: K.E per atom = $\frac{(4.4 \times 10^{-19}) - (4.0 \times 10^{-19})}{2} = \frac{0.4 \times 10^{-19}}{2} = 2.0 \times 10^{-20}$

∴ Correct choice : (4)

162. Amongst the elements with following electronic configurations, which one of them may have the highest ionization energy?

- (1) Ne $[3s^2 3p^2]$ (2) Ar $[3d^{10} 4s^2 4p^3]$
(3) Ne $[3s^2 3p^1]$ (4) Ne $[3s^2 3p^3]$

Sol: Smallest atom having half filled p-sub shell has highest I_0 value

∴ Correct choice : (4)

163. In the reaction

$BrO_3^- (aq) + 5 Br^- (aq) + 6H^+ \rightarrow 3 Br_2(l) + 3 H_2O_{(l)}$. The rate of appearance of bromine (Br_2) is related to rate of disappearance of bromide ions as following:

(1) $\frac{d(Br_2)}{dt} = -\frac{5}{3} \frac{d(Br^-)}{dt}$

(2) $\frac{d(Br_2)}{dt} = \frac{5}{3} \frac{d(Br^-)}{dt}$

(3) $\frac{d(Br_2)}{dt} = \frac{3}{5} \frac{d(Br^-)}{dt}$

(4) $\frac{d(Br_2)}{dt} = -\frac{3}{5} \frac{d(Br^-)}{dt}$

Sol: $\frac{1}{3} \frac{d[\text{Br}_2]}{dt} = -\frac{1}{5} \frac{d[\text{Br}^-]}{dt}$

$$\frac{d[\text{Br}_2]}{dt} = -\frac{3}{5} \frac{d[\text{Br}^-]}{dt}$$

∴ Correct choice : (4)

164. A 0.0020 m aqueous solution of an ionic compound $\text{Co}(\text{NH}_3)_5(\text{NO}_2)\text{Cl}$ freezes at -0.00732°C . Number of moles of ions which 1 mol of ionic compound produces on being dissolved in water will be ($k_f = -1.86^\circ\text{C}/\text{m}$)

- (1) 3 (2) 4 (3) 1 (4) 2

Sol: $\Delta T_f = i \times k_f \times m$

$$i = \frac{\Delta T_f}{k_f \times m} = \frac{0.00732}{1.86 \times 0.002} = 2$$

∴ Correct choice : (4)

165. What is the dominant intermolecular force or bond that must be overcome in converting liquid CH_3OH to a gas?

- (1) Dipole-dipole interaction (2) Covalent bonds
(3) London dispersion force (4) Hydrogen bonding

∴ Correct choice : (4)

166. Which of the following oxides is **not** expected to react with sodium hydroxide?

- (1) CaO (2) SiO_2 (3) BeO (4) B_2O_3

∴ Correct choice : (1)

167. The segment of DNA which acts as the instrumental manual for the synthesis of the protein is:

- (1) ribose (2) gene (3) nucleoside (4) nucleotide

∴ Correct choice : (2)

168. Maximum number of electrons in a subshell of an atom is determined by the following:

- (1) $2\ell + 1$ (2) $4\ell - 2$ (3) $2n^2$ (4) $4\ell + 2$

Sol: The number of sub shell is $(2\ell + 1)$. The maximum number of electrons in the sub shell is $2(2\ell + 1) = (4\ell + 2)$

∴ Correct choice : (4)

169. Half life period of a first-order reaction is 1386 seconds. The specific rate constant of the reaction is:

(1) $0.5 \times 10^{-2} \text{ s}^{-1}$

(2) $0.5 \times 10^{-3} \text{ s}^{-1}$

(3) $5.0 \times 10^{-2} \text{ s}^{-1}$

(4) $5.0 \times 10^{-3} \text{ s}^{-1}$

Sol: $t_{1/2} = \frac{0.693}{k}$; $k = \frac{0.693}{1386} = 0.5 \times 10^{-3} \text{ s}^{-1}$

∴ Correct choice : (2)

170. Which one of the following is employed as a tranquilizer?

(1) Naproxen

(2) Tetracycline

(3) Chlorpheninamine

(4) Equanil

∴ Correct choice : (4)

171. Al_2O_3 is reduced by electrolysis at low potentials and high currents. If 4.0×10^4 amperes of current is passed through molten Al_2O_3 for 6 hours, what mass of aluminium is produced? (Assume 100% current efficiency. At. mass of Al = 27 g mol^{-1})

(1) $8.1 \times 10^4 \text{ g}$

(2) $2.4 \times 10^5 \text{ g}$

(3) $1.3 \times 10^4 \text{ g}$

(4) $9.0 \times 10^3 \text{ g}$

Sol: Total current = $4.0 \times 10^4 \times 6 \times 60 \times 60 \text{ C}$

96500 C liberates 9 g of Al (1 g. eq)

$(4 \times 10^4 \times 6 \times 60 \times 60) \text{ C}$ liberates $8.1 \times 10^4 \text{ g}$ of Al

∴ Correct choice : (1)

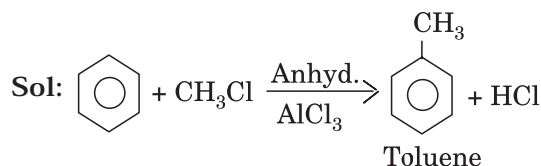
172. Benzene reacts with CH_3Cl in the presence of anhydrous AlCl_3 to form:

(1) Chlorobenzene

(2) Benzylchloride

(3) Xylene

(4) Toluene



∴ Correct choice : (4)

173. Which of the following is **not** permissible arrangement of electrons in an atom?

- (1) $n = 5, \ell = 3, m = 0, s = +1/2$
(2) $n = 3, \ell = 2, m = -3, s = -1/2$
(3) $n = 3, \ell = 2, m = -2, s = -1/2$
(4) $n = 4, \ell = 0, m = 0, s = -?$

Sol: For $\ell = 2$, m cannot have -3 value

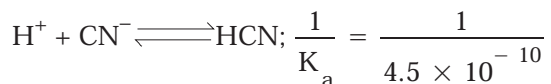
\therefore Correct choice : (2)

174. The dissociation constants for acetic acid and HCN at 25°C are 1.5×10^{-5} and 4.5×10^{-10} respectively. The equilibrium constant for the equilibrium

$\text{CN}^- + \text{CH}_3\text{COOH} \rightleftharpoons \text{HCN} + \text{CH}_3\text{COO}^-$ would be:

- (1) 3.0×10^{-5} (2) 3.0×10^{-4} (3) 3.0×10^4 (4) 3.0×10^5

Sol: $\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+ ; K_a = 1.5 \times 10^{-5}$



$\therefore K_a$ for $\text{CN}^- + \text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{HCN}$ is

$$\frac{1.5 \times 10^{-5}}{4.5 \times 10^{-10}} = \frac{1}{3} \times 10^5 = 3.33 \times 10^4$$

\therefore Correct choice : (3)

175. Propionic acid with Br_2/P yields a dibromo product. Its structure would be:

- (1) $\begin{array}{c} \text{Br} \\ | \\ \text{H} - \text{C} - \text{CH}_2\text{COOH} \\ | \\ \text{Br} \end{array}$ (2) $\text{CH}_2\text{Br} - \text{CH}_2 - \text{COBr}$
(3) $\begin{array}{c} \text{Br} \\ | \\ \text{CH}_3 - \text{C} - \text{COOH} \\ | \\ \text{Br} \end{array}$ (4) $\text{CH}_2\text{Br} - \text{CHBr} - \text{COOH}$

Sol: α hydrogen is substituted by bromine

\therefore Correct choice : (3)

176. The values of ΔH and ΔS for the reaction, $C_{(\text{graphite})} + CO_2(g) \longrightarrow 2CO(g)$ are 170 kJ and 170 JK^{-1} , respectively. This reaction will be spontaneous at

- (1) 910 K (2) 1110 K (3) 510 K (4) 710 K

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

$$0 = (170 \times 10^3 \text{ J}) - T (170 \text{ JK}^{-1})$$

$$T = 1000 \text{ K}$$

For spontaneity, ΔG is -ve

Hence T should be $> 1000 \text{ K}$

\therefore Correct choice : (2)

177. Copper crystallises in a face-centred cubic lattice with a unit cell length of 361 pm. What is the radius of copper atom in pm?

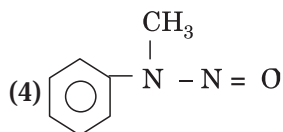
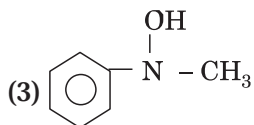
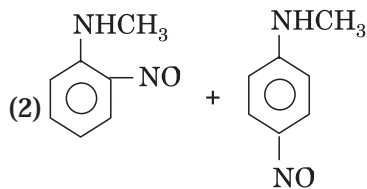
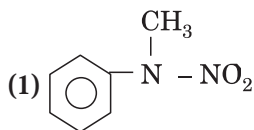
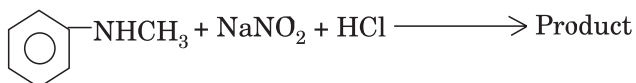
- (1) 157 (2) 181 (3) 108 (4) 128

Sol: $a \sqrt{2} = 4 r$

$$r = \frac{a \times 1.414}{4} = \frac{361 \times 1.414}{4} = 128 \text{ pm}$$

\therefore Correct choice : (4)

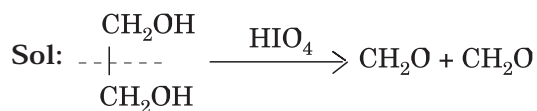
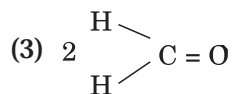
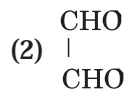
178. Predict the product:



Sol: Secondary amine with $(NaNO_2 + HCl)$ gives a nitroso product

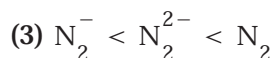
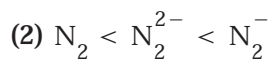
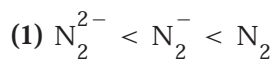
\therefore Correct choice : (4)

179. $\text{H}_2\text{COH} \cdot \text{CH}_2\text{OH}$ on heating with periodic acid gives:



∴ Correct choice : (3)

180. According to MO theory which of the following lists ranks the nitrogen species in terms of increasing bond order?



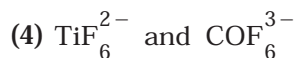
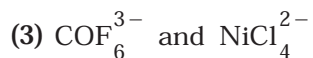
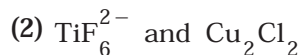
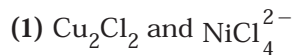
Sol: Bond order $\text{N}_2 = 3$

$$\text{N}_2^- = 2.5$$

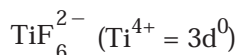
$$\text{N}_2^{2-} = 2.0$$

∴ Correct choice : (1)

181. Out of TiF_6^{2-} , COF_6^{3-} , Cu_2Cl_2 and NiCl_4^{2-} (Z of Ti = 22, CO = 27, Cu = 29, Ni = 28) the colourless species are:



Sol: Cu_2Cl_2 ($\text{Cu}^+ = 3d^{10}$)



∴ Correct choice : (2)

182. Which of the following molecules acts as a Lewis acid?

- (1) $(\text{CH}_3)_2\text{O}$ (2) $(\text{CH}_3)_3\text{P}$ (3) $(\text{CH}_3)_3\text{N}$ (4) $(\text{CH}_3)_3\text{B}$

Sol: $(\text{CH}_3)_3\text{B}$ – is electron deficient

∴ Correct choice : (4)

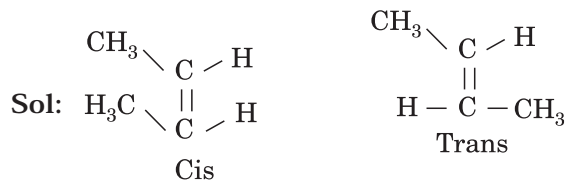
183. The IUPAC name of the compound having the formula $\text{CH} \equiv \text{C} - \text{CH} = \text{CH}_2$ is:

- (1) 1-butyne-3-ene (2) but-1-yne-3-ene (3) 1-butene-3-yne (4) 3-butene-1-yne

∴ Correct choice : (3)

184. Which of the following compounds will exhibit cis-trans (geometrical) isomerism?

- (1) Butanol (2) 2-Butyne (3) 2-Butenol (4) 2-Butene



∴ Correct choice : (4)

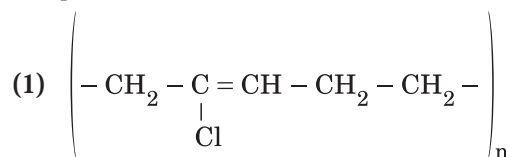
185. Which of the following **does not** show optical isomerism?

- (1) $[\text{CO}(\text{NH}_3)_3\text{Cl}_3]^0$ (2) $[\text{CO}(\text{en})\text{Cl}_2(\text{NH}_3)_2]^+$
(3) $[\text{CO}(\text{en})_3]^{3+}$ (4) $[\text{CO}(\text{en})_2\text{Cl}_2]^+$ (en = ethylenediamine)

∴ Correct choice : (1)

186. Structures of some common polymers are given. Which one is **not** correctly presented?

Neoprene



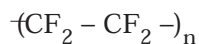
(2) Terylene

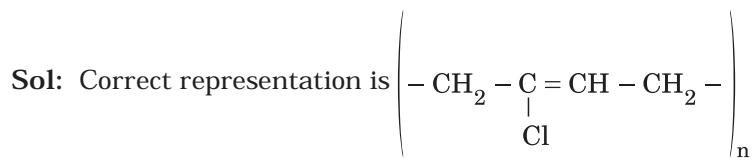


(3) Nylon 66



(4) Teflon





∴ Correct choice : (1)

187. The ionization constant of ammonium hydroxide is 1.77×10^{-5} at 298 K. Hydrolysis constant of ammonium chloride is:

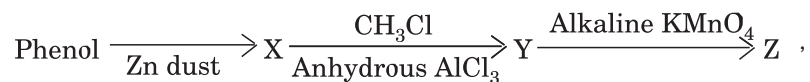
(1) 6.50×10^{-12} (2) 5.65×10^{-13}

(3) 5.65×10^{-12} (4) 5.65×10^{-10}

Sol: $K_h = \frac{K_w}{K_b} = \frac{1 \times 10^{-14}}{1.77 \times 10^{-5}} = 5.65 \times 10^{-10}$

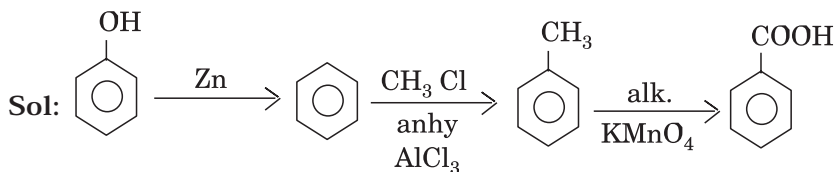
∴ Correct choice : (4)

188. Consider the following reaction:



the product Z is:

(1) Benzaldehyde (2) Benzoic acid (3) Benzene (4) Toluene



∴ Correct choice : (2)

189. The equivalent conductance of $\frac{M}{32}$ solution of a weak monobasic acid is 8.0 mhos cm^2 and at infinite dilution is 400 mhos cm^2 . The dissociation constant of this acid is:

(1) 1.25×10^{-6} (2) 6.25×10^{-4} (3) 1.25×10^{-4} (4) 1.25×10^{-5}

Sol: $\alpha = \frac{\Lambda}{\Lambda_D} = \frac{8.0}{400} = 2 \times 10^{-2}$

$$K_a = \frac{C\alpha^2}{(1-\alpha)} \approx C\alpha^2 = \frac{1}{32} \times (2 \times 10^{-2})^2 = 1.25 \times 10^{-5}$$

∴ Correct choice : (4)

190. The straight chain polymer is formed by:

- (1) hydrolysis of CH_3SiCl_3 followed by condensation polymerisation
- (2) hydrolysis of $(\text{CH}_3)_4\text{Si}$ by addition polymerisation
- (3) hydrolysis of $(\text{CH}_3)_2\text{SiCl}_2$ followed by condensation polymerisation
- (4) hydrolysis of $(\text{CH}_3)_3\text{SiCl}$ followed by condensation polymerisation

∴ Correct choice : (3)

191. From the following bond energies:

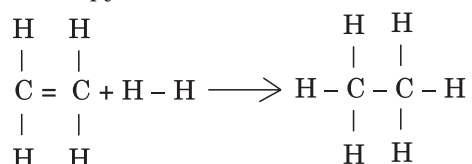
H – H bond energy: $431.37 \text{ kJ mol}^{-1}$

C = C bond energy: $606.10 \text{ kJ mol}^{-1}$

C – C bond energy: $336.49 \text{ kJ mol}^{-1}$

C – H bond energy: $410.50 \text{ kJ mol}^{-1}$

Enthalpy for the reaction,



will be:

- (1) $-243.6 \text{ kJ mol}^{-1}$
- (2) $-120.0 \text{ kJ mol}^{-1}$
- (3) $553.0 \text{ kJ mol}^{-1}$
- (4) $1523.6 \text{ kJ mol}^{-1}$

Sol: $[(4 \times 410.5) + 606.1 + 431.3] - [(6 \times 410.5) + 336.49] = -120.0 \text{ kJ mol}^{-1}$

∴ Correct choice : (2)

192. 10 g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be:

- (1) 3 mol
- (2) 4 mol
- (3) 1 mol
- (4) 2 mol

Sol: $\text{H}_2 + \frac{1}{2} \text{O}_2 \longrightarrow \text{H}_2\text{O}$

$$\begin{array}{cc} \frac{10}{2} & \frac{64}{32} \\ = 5 \text{ mol} & = 2 \text{ mol} \end{array}$$

Oxygen is the limiting agent. Hence 4 mole of water formed

∴ Correct choice : (2)

193. Among the following which is the strongest oxidising agent?

- (1) Br_2
- (2) I_2
- (3) Cl_2
- (4) F_2

∴ Correct choice : (4)

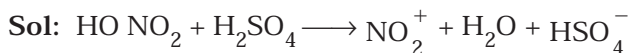
194. In which of the following molecules / ions BF_3 , NO_2^- , NH_2^- and H_2O , the central atom is sp^2 hybridized?

- (1) NH_2^- and H_2O (2) NO_2^- and H_2O
(3) BF_3 and NO_2^- (4) NO_2^- and NH_2^-

∴ Correct choice : (3)

195. Nitrobenzene can be prepared from benzene by using a mixture of conc. HNO_3 and conc. H_2SO_4 in the mixture, nitric acid acts as a/an:

- (1) acid (2) base (3) catalyst (4) reducing agent



Nitric acid acts as a base by accepting a proton.

∴ Correct choice : (2)

196. Which of the following complex ions is expected to absorb visible light?

- (1) $[\text{Ti}(\text{en})_2(\text{NH}_3)_2]^{4+}$ (2) $[\text{Cr}(\text{NH}_3)_6]^{3+}$
(3) $[\text{Zn}(\text{NH}_3)_6]^{2+}$ (4) $[\text{Sc}(\text{H}_2\text{O})_3(\text{NH}_3)_3]^{3+}$
(At. no. Zn = 30, Sc = 21, Ti = 22, Cr = 24)

Sol: Cr^{3+} in the complex has unpaired electrons in the d orbital

∴ Correct choice : (2)

197. What is the $[\text{OH}^-]$ in the final solution prepared by mixing 20.0 mL of 0.050 M HCl with 30.0 mL of 0.10 M $\text{Ba}(\text{OH})_2$?

- (1) 0.40 M (2) 0.0050 M (3) 0.12 M (4) 0.10 M

Sol: No. of m. equivalent of HCl = $20 \times 0.05 = 1.0$

No. of m. equivalent of $\text{Ba}(\text{OH})_2 = 30 \times 0.1 \times 2 = 6.0$

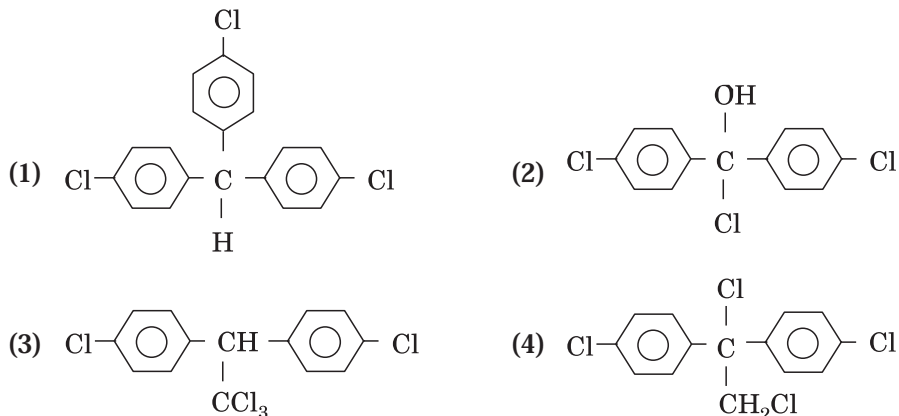
After neutralization, no. of milli equivalents in 50 ml. of solution = $(6 - 1) = 5$

No. of m. equivalent of OH^- is 5 in 50 ml

$$[\text{OH}^-] = \frac{5 \times 100}{50} \times 10^{-3} \text{ (i.e.,)} = 0.1 \text{ M}$$

∴ Correct choice : (4)

198. Trichloroacetaldehyde, CCl_3CHO reacts with chlorobenzene in presence of sulphuric acid and produces:



∴ Correct choice : (3)

199. For the reaction $\text{A} + \text{B} \longrightarrow \text{products}$, it is observed that:

- (a) on doubling the initial concentration of A only, the rate of reaction is also doubled and
 (b) on doubling the initial concentrations of both A and B, there is a change by a factor of 8 in the rate of the reaction.

The rate of this reaction is given by:

- (1) rate = $k [\text{A}] [\text{B}]^2$ (2) rate = $k [\text{A}]^2 [\text{B}]^2$
 (3) rate = $k [\text{A}] [\text{B}]$ (4) rate = $k [\text{A}]^2 [\text{B}]$

Sol: When concentration A is doubled, rate is doubled. Hence order with respect to A is one.

When concentrations of both A and B are doubled, rate increases by 8 times hence total order is 3

$$\therefore \text{rate} = k [\text{A}]^1 [\text{B}]^2$$

$$\text{order} = 1 + 2 = 3$$

∴ Correct choice : (1)

200. Which of the following hormones contains iodine?

- (1) testosterone (2) adrenaline (3) thyroxine (4) insulin

∴ Correct choice : (3)