76. Which of the following is a redox reaction ?
    (a) $NaCl + KNO_3 \longrightarrow NaNO_3 + KCl$
    (b) $CaC_2O_4 + 2HCl \longrightarrow CaCl_2 + H_2C_2O_4$
    (c) $Ca(OH)_2 + 2NH_4Cl \longrightarrow CaCl_2 + 2NH_3$
    $\qquad\qquad\qquad\qquad\qquad + 2H_2O$
    (d) $2K[Ag(CN)_2] + Zn \longrightarrow 2Ag$
    $\qquad\qquad\qquad\qquad\qquad + K_2[Zn(CN)_4]$

77. For an ideal gas, number of mol per litre in terms of its pressure P, temperature T and gas constant R is :
    (a) $\dfrac{PT}{R}$
    (b) PRT
    (c) $\dfrac{P}{RT}$
    (d) $\dfrac{RT}{P}$

78. Number of P—O bonds in P_4O_{10} is :
    (a) 17
    (b) 16
    (c) 15
    (d) 6

79. KO_2 is used in space and submarines because it :
    (a) absorbs CO_2 and increases O_2 concentration
    (b) absorbs moisture
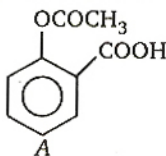   (c) absorbs CO_2
    (d) produces ozone

80. Which of the following ions has the maximum magnetic moment ?
    (a) Mn^{2+}
    (b) Fe^{2+}
    (c) Ti^{2+}
    (d) Cr^{2+}

81. Acetylene does not react with :
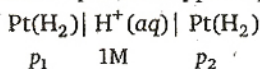   (a) Na
    (b) ammoniacal $AgNO_3$
    (c) HCl
    (d) NaOH

82. Compound A given below is :

    (a) antiseptic
    (b) antibiotic
    (c) analgesic
    (d) pesticide

83. For the following cell with hydrogen electrodes at two different pressures p_1 and p_2
    $$Pt(H_2)\mid H^+(aq)\mid Pt(H_2)$$
    $$\quad p_1 \qquad 1M \qquad p_2$$
    emf is given by :
    (a) $\dfrac{RT}{F}\log_e\dfrac{p_1}{p_2}$
    (b) $\dfrac{RT}{2F}\log_e\dfrac{p_1}{p_2}$
    (c) $\dfrac{RT}{F}\log_e\dfrac{p_2}{p_1}$
    (d) $\dfrac{RT}{2F}\log_e\dfrac{p_2}{p_1}$

84. Acetylene reacts with hypochlorous acid to form :
    (a) Cl_2CHCHO
    (b) $ClCH_2COOH$
    (c) CH_3COCl
    (d) $ClCH_2CHO$

85. On heating benzyl amine with chloroform and ethanolic KOH, product obtained is :
    (a) benzyl alcohol
    (b) benzaldehyde
    (c) benzonitrile
    (d) benzyl isocyanide

86. Which of the following reaction is possible at anode ?
    (a) $F_2 + 2e^- \longrightarrow 2F^-$
    (b) $2H^+ + \dfrac{1}{2}O_2 + 2e^- \longrightarrow H_2O$
    (c) $2Cr_2^{3+} + 7H_2O \longrightarrow Cr_2O_7^{2-}$
    $\qquad\qquad\qquad\qquad + 14H^+ + 6e^-$
    (d) $Fe^{2+} \longrightarrow Fe^{3+} + e^-$

87. Which of the following concentration factor is affected by change in temperature ?
    (a) Molarity
    (b) Molality
    (c) Mole fraction
    (d) Weight fraction

88. Cyanide process is used for the extraction of :
    (a) barium
    (b) silver
    (c) boron
    (d) zinc

89. Following reaction
    $$(CH_3)_3CBr + H_2O \longrightarrow (CH_3)_3COH + HBr$$
    is an example of :
    (a) elimination reaction
    (b) free radical substitution
    (c) nucleophilic substitution
    (d) electrophilic substitution

90. A metal M forms water soluble MSO_4 and inert MO. MO in aqueous solution forms insoluble $M(OH)_2$ soluble in NaOH. Metal M is :
    (a) Be
    (b) Mg
    (c) Ca
    (d) Si

91. Half-life of a substance A following first order kinetics is 5 days. Starting with 100g of A, amount left after 15 days is :
    (a) 25 g
    (b) 50 g
    (c) 12.5 g
   (d) 6.25 g

92. The most stable ion is :
    (a) $[Fe(OH)_5]^{3-}$
    (b) $[FeCl_6]^{3-}$
    (c) $[Fe(CN)_6]^{3-}$
    (d) $[Fe(H_2O)_6]^{3+}$

93. A substance forms Zwitter ion. It can have functional groups :
    (a) $-NH_2, -COOH$
    (b) $-NH_2, -SO_3H$
    (c) both (a) and (b)
    (d) none of these

94. If Fe^{3+} and Cr^{3+} both are present in group III of qualitative analysis, then distinction can be made by :

(a) addition of NH_4OH in presence of NH_4Cl when only $Fe(OH)_3$ is precipitated

(b) addition of NH_4OH in presence of NH_4Cl when $Cr(OH)_3$ and $Fe(OH)_3$ both are precipitated and on adding Br_2 water and NaOH, $Cr(OH)_3$ dissolves

(c) precipitate of $Cr(OH)_3$ and $Fe(OH)_3$ as obtained in (b) are treated with conc. HCl when only $Fe(OH)_3$ dissolves

(d) both (b) and (c)

95. In an organic compound of molar mass 108 g mol^{-1} C, H and N atoms are present in $9 : 1 : 3.5$ by weight. Molecular formula can be :

(a) $C_6H_8N_2$ (b) $C_7H_{10}N$

(c) $C_5H_6N_3$ (d) $C_4H_{18}N_3$

96. Solubility of $Ca(OH)_2$ is s mol L^{-1}. The solubility product (K_{sp}) under the same condition is :

(a) $4s^3$ (b) $3s^4$

(c) $4s^2$ (d) s^3

97. Heat required to raise the temperature of 1 mole of a substance by $1°$ is called :

(a) specific heat
(b) molar heat capacity
(c) water equivalent
(d) specific gravity

98. β-particle is emitted in a radioactive reaction when :

(a) a proton changes to neutron
(b) a neutron changes to proton
(c) a neutron changes to electron
(d) an electron changes to neutron

99. In a mixture of A and B, components show negative deviation when :

(a) A—B interaction is stronger than A—A and B—B interaction

(b) A—B interaction is weaker than A—A and B—B interaction

(c) $\Delta V_{mix} > 0, \quad \Delta S_{mix} > 0$

(d) $\Delta V_{mix} = 0, \quad \Delta S_{mix} > 0$

100. Refining of impure copper with zinc impurity is to be done by electrolysis using electrodes as :

	Cathode	Anode
(a)	pure copper	pure zinc
(b)	pure zinc	pure copper
(c)	pure copper	impure copper
(d)	pure zinc	impure zinc

101. Aluminium is extracted by the electrolysis of :

(a) alumina
(b) bauxite
(c) molten cryolite
(d) alumina mixed with molten cryolite

102. For an aqueous solution, freezing point is $-0.186°C$. Elevation of the boiling point of the same solution is $(K_f = 1.86° mol^{-1}$ kg and $K_b = 0.512° mol^{-1}$ kg) :

(a) $0.186°$ (b) $0.0512°$

(c) $1.86°$ (d) $5.12°$

103. Underlined carbon is sp^3 hybridised in :

(a) $CH_3\underline{C}H=CH_2$ (b) $CH_3\underline{C}H_2NH_2$

(c) $CH_3\underline{C}ONH_2$ (d) $CH_3CH_2\underline{C}N$

104. Bond angle of $109°28'$ is found in :

(a) NH_3 (b) H_2O

(c) $\overset{\oplus}{C}H_5$ (d) $\overset{\oplus}{N}H_4$

105. For a reaction $A + 2B \longrightarrow C$, rate is given by $+\dfrac{d[C]}{dt} = k[A][B]$, hence the order of the reaction is :

(a) 3   (b) 2
(c) 1   (d) 0

106. CH_3MgI is an organometallic compound due to :

(a) Mg—I bond   (b) C—I bond
(c) C—Mg bond   (d) C—H bond

107. One of the following species acts as both Bronsted acid and base :

(a) $H_2PO_2^-$ (b) HPO_3^{2-}

(c) HPO_4^{2-} (d) all of these

108. Hybridisation of the underline atom changes in :

(a) $\underline{A}lH_3$ changes to AlH_4^-

(b) $H_2\underline{O}$ changes to H_3O^+

(c) $\underline{N}H_3$ changes to NH_4^+

(d) in all cases

109. Racemic mixture is formed by mixing two :

(a) isomeric compounds
(b) chiral compounds
(c) meso compounds
(d) enantiomers with chiral carbon

110. The number of lone pairs on Xe in XeF_2, XeF_4 and XeF_6 respectively are :

(a) 3, 2, 1   (b) 2, 4, 6
(c) 1, 2, 3   (d) 6, 4, 2

111. An aqueous solution of 1M NaCl and 1M HCl is :

(a) not a buffer but pH < 7
(b) not a buffer but pH > 7
(c) a buffer with pH < 7
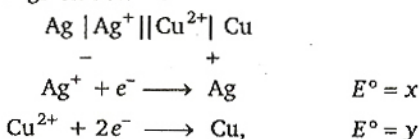(d) a buffer with pH > 7

112. Consider following two reactions

$$A \longrightarrow \text{Product} \quad -\frac{d[A]}{dt} = k_1 [A]^0$$

$$B \longrightarrow \text{Product} \quad -\frac{d[B]}{dt} = k_2 [B]$$
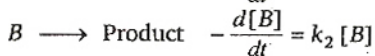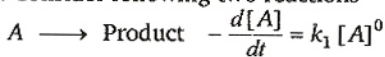
k_1 and k_2 are expressed in terms of molarity (mol L^{-1}) and time (s^{-1}) as :
(a) s^{-1}, $M s^{-1} L^{-1}$
(b) $M s^{-1}$, $M s^{-1}$
(c) s^{-1}, $M^{-1} s^{-1}$
(d) $M s^{-1}$, s^{-1}

113. RNA contains :
(a) ribose sugar and thymine
(b) ribose sugar and uracil
(c) deoxyribose sugar and uracil
(d) deoxyribose sugar and thymine
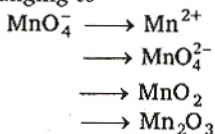
114. For a cell given below :

$$Ag \mid Ag^+ \mid\mid Cu^{2+} \mid Cu$$

$$\overset{-}{} \qquad \overset{+}{}$$

$$Ag^+ + e^- \longrightarrow Ag \qquad E° = x$$

$$Cu^{2+} + 2e^- \longrightarrow Cu, \qquad E° = y$$

$E°$ cell is :
(a) $x + 2y$
(b) $2x + y$
(c) $y - x$
(d) $y - 2x$

115. Based on kinetic theory of gases following laws can be proved :
(a) Boyle's law
(b) Charles' law
(c) Avogadro's law
(d) all of these

116. MnO_4^- is a good oxidising agent in different medium changing to

$$MnO_4^- \longrightarrow Mn^{2+}$$
$$\longrightarrow MnO_4^{2-}$$
$$\longrightarrow MnO_2$$
$$\longrightarrow Mn_2O_3$$

Changes in oxidation number respectively are :
(a) 1, 3, 4, 5
(b) 5, 4, 3, 2
(c) 5, 1, 3, 4
(d) 2, 6, 4, 3

117. For the reaction : $H_2 + I_2 \longrightarrow 2HI$, the differential rate law is :

(a) $-\dfrac{d[H_2]}{dt} = -\dfrac{d[I_2]}{dt} = 2\dfrac{d[HI]}{dt}$

(b) $-2\dfrac{d[H_2]}{dt} = -2\dfrac{d[I_2]}{dt} = \dfrac{d[HI]}{dt}$

(c) $-\dfrac{d[H_2]}{dt} = -\dfrac{d[I_2]}{dt} = \dfrac{d[HI]}{dt}$

(d) $-\dfrac{d[H_2]}{2dt} = -\dfrac{d[I_2]}{2dt} = \dfrac{d[HI]}{dt}$

118. Number of atoms in 560g of Fe (atomic mass 56 g mol^{-1}) is :
(a) twice that of 70 g N
(b) half that of 20 g H
(c) both (a) and (b)
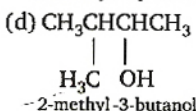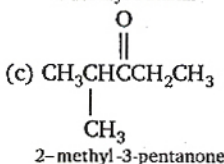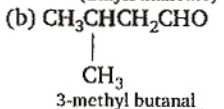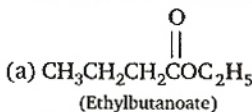(d) none of the above

119. Geometrical isomerism is not shown by :
(a) 1, 1–dichloro-1-pentene
(b) 1, 2-dichloro-1-pentene
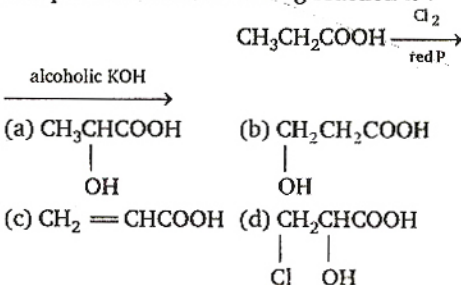(c) 1, 3-dichloro-2-pentene
(d) 1, 4-dichloro-2-pentene

120. Number of atoms in the unit cell of Na (BCC type crystal) and Mg (FCC type crystal) are respectively :
(a) 4, 4
(b) 4, 2
(c) 2, 4
(d) 1, 1

121. Which of the following compounds has incorrect IUPAC nomenclature ?

(a) $CH_3CH_2CH_2\overset{\overset{O}{\|}}{C}OC_2H_5$
(Ethylbutanoate)

(b) $CH_3\underset{\underset{CH_3}{|}}{C}HCH_2CHO$
3-methyl butanal

(c) $CH_3\underset{\underset{CH_3}{|}}{C}H\overset{\overset{O}{\|}}{C}CH_2CH_3$
2-methyl-3-pentanone

(d) $CH_3\underset{\underset{H_3C}{|}}{C}H\underset{\underset{OH}{|}}{C}HCH_3$
2-methyl-3-butanol

122. End product of the following reaction is :

$$CH_3CH_2COOH \xrightarrow[\text{red P}]{Cl_2}$$

$$\xrightarrow{\text{alcoholic KOH}}$$

(a) $CH_3\underset{\underset{OH}{|}}{C}HCOOH$

(b) $CH_2\underset{\underset{OH}{|}}{C}H_2COOH$

(c) $CH_2 = CHCOOH$

(d) $CH_2\underset{\underset{Cl}{|}}{\underset{\underset{OH}{|}}{C}}HCOOH$

123. For the following reaction in gaseous phase

$$CO + \frac{1}{2}O_2 \longrightarrow CO_2 \qquad K_c / K_p \text{ is :}$$
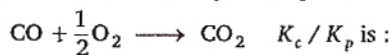
(a) $(RT)^{1/2}$
(b) $(RT)^{-1/2}$
(c) (RT)
(d) $(RT)^{-1}$

124. Energy of H-atom in the ground state is −13.6 eV, hence energy in the second excited state is :
(a) − 6.8 eV
(b) − 3.4 eV
(c) − 1.51 eV
(d) − 4.53 eV

125. A square planar complex is formed by hybridisation of the following atomic orbitals :

(a) s, p_x, p_y, p_z
(b) s, p_x, p_y, p_z, d
(c) d, s, p_x, p_y
(d) s, p_x, p_y, p_z, d, d

126. Type of isomerism shown by $[Cr(NH_3)_5NO_2]Cl_2$ is :

(a) optical
(b) ionisation
(c) geometrical
(d) linkage

127. One of the following equilibria is not affected by change in volume of the flask :

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

(b) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(c) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

(d) $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$

128. Uncertainty in position of a particle of 25 g in space is 10^{-5} m. Hence, uncertainty in velocity (ms^{-1}) is (Planck's constant $h = 6.6 \times 10^{-34}$ Js) :

(a) 2.1×10^{-28}
(b) 2.1×10^{-34}
(c) 0.5×10^{-34}
(d) 5.0×10^{-24}

129. Consider the following reactions at $1100°C$

(I) $2C + O_2 \longrightarrow 2CO, \Delta G° = -460$ kJ mol^{-1}

(II) $2Zn + O_2 \longrightarrow 2ZnO,$
$$\Delta G° = -360 \text{ kJ mol}^{-1}$$

Based on these, select correct alternate :
(a) zinc can be oxidised by CO
(b) zinc oxide can be reduced by carbon
(c) both (a) and (b)
(d) none is the correct

130. A reaction is non-spontaneous at the freezing point of water but is spontaneous at the boiling point of water then :
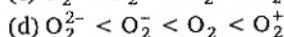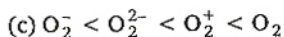
	ΔH	ΔS
(a)	+ve	+ve
(b)	– ve	– ve
(c)	– ve	+ve
(d)	+ve	– ve

131. Monomers are converted to polymer by :
(a) hydrolysis of monomers
(b) condensation reaction between monomers
(c) protonation of monomers
(d) none of the above

132. Increasing order of bond strength of O_2, O_2^- O_2^{2-} and O_2^+ is :
(a) $O_2^+ < O_2 < O_2^- < O_2^{2-}$
(b) $O_2 < O_2^+ < O_2^- < O_2^{2-}$

(c) $O_2^- < O_2^{2-} < O_2^+ < O_2$
(d) $O_2^{2-} < O_2^- < O_2 < O_2^+$

133. Most common oxidation states of Ce (Cerium) are :
(a) +3, + 4
(b) +2, +3
(c) +2, +4
(d) +3, +5

134. $Ce^{3+}, La^{3+}, Pm^{3+}$ and Yb^{3+} have ionic radii in the increasing order as :
(a) $La^{3+} < Ce^{3+} < Pm^{3+} < Yb^{3+}$
(b) $Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$
(c) $La^{3+} = Ce^{3+} < Pm^{3+} < Yb^{3+}$
(d) $Yb^{3+} < Pm^{3+} < La^{3+} < Ce^{3+}$

135. pH of 0.005 M calcium acetate (pK_a of $CH_3COOH = 4.74$) is :
(a) 7.04
(b) 9.37
(c) 9.26
(d) 8.37

136. H_2 gas is absorbed on the metal surface like tungsten. This follows . . . . . . order reaction.
(a) third
(b) second
(c) zero
(d) first

137. Rate constant k of the first order reaction when initial concentration C_0 and concentration C_t at time t is given by equation
$$kt = \log C_0 - \log C_t$$
Graph is a straight line if we plot :
(a) t vs $\log C_0$
(b) t vs $\log C_t$
(c) t^{-1} vs $\log C_t$
(d) $\log C_0$ vs $\log C_t$

138. Alum is widely used to purify water since :
(a) it forms complex with clay particles
(b) it coagulates the mud particles
(c) it exchanges Ca^{2+} and Mg^{2+} ions present in hard water
(d) its sulphate ion is water purifier

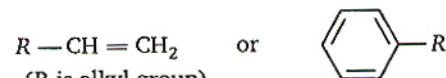**139.** On vigorous oxidation by permangnate solution
$(CH_3)_2$ C $=CHCH_2CHO$ gives :
(a) $(CH_3)_2CO$ and $OHCCH_2CHO$
(b) $(CH_3)_2C—CHCH_2CHO$
      | |
    OH OH
(c) $(CH_3)_2CO$ and $OHCCH_2COOH$
(d) $(CH_3)_2CO$ and $CH_2(COOH)_2$

140. In the following benzyl/allyl system

$R—CH = CH_2$ or $\langle \rangle$—R
(R is alkyl group)
decreasing order of inductive effect is :

(a) $(CH_3)_3C \longrightarrow > (CH_3)_2CH \longrightarrow > CH_3CH_2 \longrightarrow$

(b) $CH_3CH_2 \longrightarrow > (CH_3)_2CH \longrightarrow > (CH_3)_3C \longrightarrow$

(c) $(CH_3)_2CH \longrightarrow > CH_3CH_2 \longrightarrow > (CH_3)_3C \longrightarrow$

(d) $(CH_3)_2C \longrightarrow > CH_3CH_2 \longrightarrow > (CH_3)_3CH \longrightarrow$

141. PCl_3 and PCl_5 both exist; NCl_3 exists but NCl_5 does not exist. It is due to :

(a) lower electronegativity of P than N

(b) lower tendency of N to form covalent bond

(c) availability of vacant d-obital in P but not in N

(d) statement is itself incorrect

142. Following types of compounds (as I, II)

(I) $CH_3CH = CHCH_3$ (II) $CH_3 - CH - OH$
$$\qquad\qquad\qquad\qquad\quad |$$
$$\qquad\qquad\qquad\quad CH_2CH_3$$
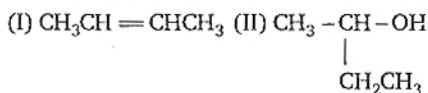
are studied in terms of isomerism in :

(a) chain isomerism   (b) position isomerism

(c) conformers   (d) stereoisomerism

143. Conductivity (Seimen's S) is directly proportional to area of the vessel and the concentration of the solution in it and is inversely proportional to the length of the vessel, then constant of proportionality is expressed in :

(a) $S\ m\ mol^{-1}$ (b) $S^2\ m^2\ mol^{-2}$

(c) $S\ m^2\ mol^{-1}$ (d) $S^2\ m^2\ mol$

144. A heat engine absorbs heat q_1 from a source at temperature T_1 and heat q_2 from a source at temperature T_2. Work done is found to be $J(q_1 + q_2)$. This is in accordance with :

(a) first law of thermodynamics

(b) second law of thermodynamics

(c) Joules equivalent law

(d) none of the above

**145.** Select correct statement :

(a) when a covalent bond is formed, transfer of electrons takes place

(b) pure H_2O does not contain any ion

(c) a bond is formed when attractive forces overcome repulsive forces

(d) HF is less polar than HBr

146. The metallic sodium dissolves in liquid ammonia to form a deep blue coloured solution. The deep blue colour is due to formation of :
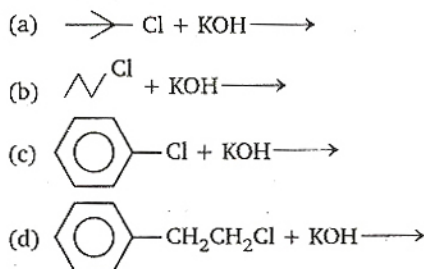
(a) solvated electron, $e^-(NH_3)_x^-$

(b) solvated atomic sodium, $Na(NH_3)_y$

(c) $(Na^+ + Na^-)$

(d) $NaNH_2 + H_2$

147. Maximum dehydration takes place that of :

(a)

(b)

(c)

(d)
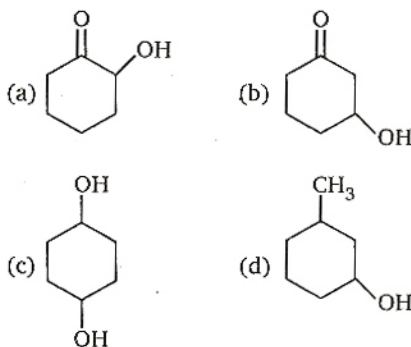
148. SN^1 reaction is feasible in :

(a) $Cl + KOH \longrightarrow$

(b) $+ KOH \longrightarrow$

(c) $Cl + KOH \longrightarrow$

(d) $CH_2CH_2Cl + KOH \longrightarrow$

149. Oxidation number of Cl in $CaOCl_2$ (bleaching powder) is :

(a) zero, since it contains Cl_2

(b) -1, since it contains Cl^-

(c) $+1$, since it contains ClO^-

(d) $+1$ and -1 since it contains ClO^- and Cl^-

150. Picric acid is :

(a)

(b)

(c)

(d)