

- i. Which one of the following statements is not true in respect of properties of interhalogen compounds?
- (A) They are all covalent compounds
  - (B) They are volatile solids or liquids except ClF
  - (C)  $\text{IF}_5$  has square pyramidal structure
  - (D) They are all paramagnetic in nature
  - (E)  $\text{BrF}_3$  is used in the preparation of  $\text{UF}_6$  in the enrichment of  $^{235}\text{U}$
- . Which one of the following is an incorrect statement?
- (A)  $\text{O}_3$  oxidises  $\text{PbS}$  to  $\text{PbSO}_4$
  - (B)  $\text{O}_3$  oxidises nitric oxide to nitrogen dioxide
  - (C)  $\text{O}_3$  oxidises aqueous  $\text{KI}$  at  $\text{pH} = 9.2$
  - (D) The two oxygen-oxygen bond lengths in  $\text{O}_3$  are different
  - (E)  $\text{O}_3$  is used as an oxidizing agent in the manufacture of  $\text{KMnO}_4$
- . The correct descending order of oxidizing power of the following is
- (A)  $\text{Cr}_2\text{O}_7^{2-} > \text{MnO}_4^- > \text{VO}_2^+$
  - (B)  $\text{MnO}_4^- > \text{Cr}_2\text{O}_7^{2-} > \text{VO}_2^+$
  - (C)  $\text{VO}_2^+ > \text{MnO}_4^- > \text{Cr}_2\text{O}_7^{2-}$
  - (D)  $\text{MnO}_4^- > \text{VO}_2^+ > \text{Cr}_2\text{O}_7^{2-}$
  - (E)  $\text{Cr}_2\text{O}_7^{2-} > \text{VO}_2^+ > \text{MnO}_4^-$
- . The number of electrons that are involved in the reduction of permanganate to manganese(II) salt, manganate and manganese dioxide respectively are
- (A) 5, 1, 3
  - (B) 5, 3, 1
  - (C) 2, 7, 1
  - (D) 5, 2, 3
  - (E) 2, 3, 1

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77. The calculated magnetic moment of a divalent ion of an atom with atomic number 24 in aqueous solution is  
 (A) 4.90 BM (B) 5.92 BM (C) 3.87 BM  
 (D) 2.84 BM (E) 1.73 BM
78. The entropy of vaporization of a liquid is  $58 \text{ JK}^{-1}\text{mol}^{-1}$ . If 100 g of its vapour condenses at its boiling point of  $123^\circ\text{C}$ , the value of entropy change for the process is  
 (Molar mass of the liquid =  $58 \text{ g mol}^{-1}$ )  
 (A)  $-100 \text{ JK}^{-1}$  (B)  $100 \text{ JK}^{-1}$  (C)  $-123 \text{ JK}^{-1}$   
 (D)  $123 \text{ JK}^{-1}$  (E)  $1230 \text{ JK}^{-1}$
79. The values of limiting ionic conductance of  $\text{H}^+$  and  $\text{HCOO}^-$  ions are respectively  $347$  and  $53 \text{ S cm}^2 \text{ mol}^{-1}$  at  $298 \text{ K}$ . If the molar conductance of  $0.025\text{M}$  methanoic acid at  $298 \text{ K}$  is  $40 \text{ S cm}^2 \text{ mol}^{-1}$ , the dissociation constant of methanoic acid at  $298 \text{ K}$  is  
 (A)  $1 \times 10^{-5}$  (B)  $2 \times 10^{-5}$  (C)  $1.5 \times 10^{-4}$  (D)  $2.5 \times 10^{-5}$  (E)  $2.5 \times 10^{-4}$
80. In a closed cylinder of capacity  $24.6 \text{ L}$  the following reaction occurs at  $27^\circ\text{C}$   
 $\text{A}_2(\text{s}) \rightleftharpoons \text{B}_2(\text{s}) + 2\text{C}(\text{g})$ . At equilibrium  $1 \text{ g}$  of  $\text{B}_2(\text{s})$  (molar mass =  $50 \text{ g mol}^{-1}$ ) is present. The equilibrium constant  $K_p$  for the equilibrium in  $\text{atm}^2$  unit is  
 ( $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$ )  
 (A)  $1.6 \times 10^{-2}$  (B)  $1.6 \times 10^{-5}$  (C)  $1.6 \times 10^{-3}$   
 (D)  $1.6 \times 10^{-4}$  (E)  $1.6 \times 10^{-1}$

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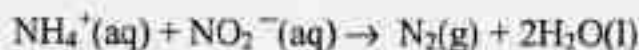
- The pH of a saturated solution of a metal hydroxide of formula  $X(OH)_2$  is 12.0 at 298 K. What is the solubility product of the metal hydroxide at 298 K (in  $\text{mol}^3 \text{L}^{-3}$ )?
- (A)  $2 \times 10^{-6}$  (B)  $1 \times 10^{-7}$  (C)  $5 \times 10^{-5}$   
 (D)  $2 \times 10^{-5}$  (E)  $5 \times 10^{-7}$
- An aqueous solution containing 3 g of a solute of molar mass  $111.6 \text{ g mol}^{-1}$  in a certain mass of water freezes at  $-0.125^\circ\text{C}$ . The mass of water in grams present in the solution is ( $K_f = 1.86 \text{ K kg mol}^{-1}$ )
- (A) 300 (B) 600 (C) 500 (D) 400 (E) 250
- A sample of sea water contains  $5 \times 10^{-3} \text{ g}$  of dissolved oxygen in 1 kilogram of the sample. The concentration of  $\text{O}_2$  in that sea water sample in ppm is
- (A)  $5 \times 10^{-4}$  (B)  $5 \times 10^{-3}$  (C)  $5 \times 10^{-2}$  (D)  $5 \times 10^{-1}$  (E) 5
- The change in potential of the half-cell  $\text{Cu}^{2+}|\text{Cu}$ , when aqueous  $\text{Cu}^{2+}$  solution is diluted 100 times at 298 K?  $\left(\frac{2.303RT}{F} = 0.06\right)$
- (A) increases by 120 mV (B) decreases by 120 mV (C) increases by 60 mV  
 (D) decreases by 60 mV (E) no change
- Consider the following electrolytic cells
- (i)  $\text{M}(\text{s}) | \text{M}^{2+}(\text{aq}), 0.1\text{M} || \text{X}^{2+}(\text{aq}), 0.01\text{M} | \text{X}(\text{s})$   
 (ii)  $\text{M}(\text{s}) | \text{M}^{2+}(\text{aq}), 0.1\text{M} || \text{X}^{2+}(\text{aq}), 0.1\text{M} | \text{X}(\text{s})$  and  
 (iii)  $\text{M}(\text{s}) | \text{M}^{2+}(\text{aq}), 0.01\text{M} || \text{X}^{2+}(\text{aq}), 0.1\text{M} | \text{X}(\text{s})$
- The cell EMF of the above cells are  $E_1$ ,  $E_2$  and  $E_3$  respectively. Which one of the following is true?
- (A)  $E_1 > E_2 > E_3$  (B)  $E_2 > E_3 > E_1$  (C)  $E_3 > E_1 > E_2$   
 (D)  $E_1 > E_3 > E_2$  (E)  $E_3 > E_2 > E_1$

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86. In a reaction  $2A + B \rightarrow 3C$ , the concentration of A decreases from  $0.5 \text{ mol L}^{-1}$  to  $0.3 \text{ mol L}^{-1}$  in 10 minutes. The rate of production of 'C' during this period is
- (A)  $0.01 \text{ mol L}^{-1} \text{ min}^{-1}$       (B)  $0.04 \text{ mol L}^{-1} \text{ min}^{-1}$       (C)  $0.05 \text{ mol L}^{-1} \text{ min}^{-1}$   
 (D)  $0.03 \text{ mol L}^{-1} \text{ min}^{-1}$       (E)  $0.02 \text{ mol L}^{-1} \text{ min}^{-1}$

87. Ammonium ion ( $\text{NH}_4^+$ ) reacts with nitrite ion ( $\text{NO}_2^-$ ) in aqueous solution according to the equation



The following initial rates of reaction have been measured for the given reactant concentrations.

Expt. No.	$[\text{NH}_4^+]$ , (M)	$[\text{NO}_2^-]$ , (M)	Rate (M/hr)
1	0.010	0.020	0.020
2	0.015	0.020	0.030
3	0.010	0.010	0.005

Which of the following is the rate law for this reaction?

- (A)  $\text{rate} = k [\text{NH}_4^+] [\text{NO}_2^-]^4$       (B)  $\text{rate} = k [\text{NH}_4^+] [\text{NO}_2^-]$   
 (C)  $\text{rate} = k [\text{NH}_4^+] [\text{NO}_2^-]^2$       (D)  $\text{rate} = k [\text{NH}_4^+]^2 [\text{NO}_2^-]$   
 (E)  $\text{rate} = k [\text{NH}_4^+]^{1/2} [\text{NO}_2^-]^{1/4}$

88. Gold sol can be prepared by

- (A) hydrolysis of gold(III) chloride  
 (B) oxidation of gold by aqua regia  
 (C) peptization  
 (D) treating gold(III) chloride with metallic zinc  
 (E) reduction of gold(III) chloride with formalin solution

89. The IUPAC name of the complex  $[\text{Co}(\text{NH}_3)_2(\text{H}_2\text{O})_4]\text{Cl}_3$  is

- (A) Diaminetetraaquacobalt(III) trichloride  
 (B) Diaminetetraaquacobalt(II) chloride  
 (C) Diaminetetraaquacobalt(III) chloride  
 (D) Tetraaquadiaminecobalt(III) trichloride  
 (E) Tetraaquadiaminecobalt(II) chloride

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The products obtained by the ozonolysis of 2-ethylbut-1-ene are

- (A) propanone and ethanal
- (B) ethanal and 3-pentanone
- (C) butanal and ethanal
- (D) methanal and 2-pentanone
- (E) methanal and 3-pentanone

When but-2-yne is treated with Na in liquid ammonia

- (A) *cis*-2-butene is obtained
- (B) *trans*-2-butene is formed
- (C) *n*-butane is the major product
- (D) it rearranges to but-1-yne
- (E) there is no reaction

The correct decreasing order of reactivity for a given alkyl (R) group in both  $S_N1$  and  $S_N2$  reaction mechanisms is

- (A)  $R-I > R-Br > R-Cl > R-F$
- (B)  $R-I > R-Cl > R-Br > R-F$
- (C)  $R-F > R-Cl > R-Br > R-I$
- (D)  $R-F > R-I > R-Cl > R-Br$
- (E)  $R-Br > R-I > R-F > R-Cl$

The compound of molecular formula  $C_5H_{10}O$  (A) reacts with Tollen's reagent to give silver mirror but does not undergo aldol condensation. The compound A is

- (A) 3-pentanone
- (B) 2,2-dimethylpropanal
- (C) 3-hydroxy-2-pentene
- (D) 3-methylbutanal
- (E) 3-methyl-2-butanone

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94. When *n*-hexane is heated with anhydrous  $\text{AlCl}_3$  and  $\text{HCl}$  gas, the major product obtained is
- (A) 1-chlorohexane
  - (B) 2-chlorohexane
  - (C) 3-chlorohexane
  - (D) hex-3-ene
  - (E) mixture of 2-methylpentane and 3-methylpentane
95. How many monochloro structural isomers are expected in free radical monochlorination of 2-methylbutane?
- (A) 2                      (B) 3                      (C) 4                      (D) 5                      (E) 6
96. Chloroform reacts with oxygen in the presence of light to give
- (A) carbon tetrachloride
  - (B) carbonyl chloride
  - (C) methyl chloride
  - (D) methylene dichloride
  - (E) acetaldehyde
97. Which one of the following is not expected to undergo iodoform reaction?
- (A) Propan-2-ol                      (B) 1-Phenylethanol                      (C) 2-Butanol
- (D) Ethanol                      (E) Diphenyl methanol
98. Identify the combination of compounds that undergo Aldol condensation followed by dehydration to produce but-2-enal
- (A) methanal and ethanal
  - (B) two moles of ethanal
  - (C) methanal and propanone
  - (D) ethanal and propanone
  - (E) two moles of ethanol

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The correct increasing order of the acid strength of benzoic acid(I), 4-nitrobenzoic acid(II), 3,4-dinitrobenzoic acid(III) and 4-methoxybenzoic acid(IV) is

- (A)  $I < II < III < IV$                       (B)  $II < I < IV < III$                       (C)  $IV < I < II < III$   
(D)  $IV < II < I < III$                       (E)  $I < IV < II < III$

. An organic compound with the molecular formula  $C_8H_8O$  forms 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1,2-benzenedicarboxylic acid. The organic compound is

- (A) 2-ethylbenzaldehyde  
(B) 2-methylbenzaldehyde  
(C) acetophenone  
(D) 3-methylbenzaldehyde  
(E) phenylacetaldehyde

. Phenyl isocyanide is prepared from aniline by

- (A) Rosenmund's reaction  
(B) Kolbe's reaction  
(C) Reimer-Tiemann reaction  
(D) Wurtz reaction  
(E) Carbylamine reaction

. Choose the correct order of decreasing basic strength of the following compounds in aqueous solution

(i)  $C_6H_5NH_2$     (ii)  $C_2H_5NH_2$     (iii)  $NH_3$     (iv)  $(CH_3)_2NH$

- (A) (i) > (ii) > (iii) > (iv)  
(B) (iv) > (ii) > (iii) > (i)  
(C) (ii) > (i) > (iii) > (iv)  
(D) (iv) > (iii) > (ii) > (i)  
(E) (ii) > (iv) > (iii) > (i)

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103. Gabriel's phthalimide synthesis can be used to prepare
- (A) ethanamine (B) N-methylmethanamine  
(C) benzeneamine (D) N,N-dimethylmethanamine  
(E) p-toluidine
104. The sugar moiety present in RNA molecule is
- (A)  $\beta$ -D-2-deoxyribose (B)  $\beta$ -D-galactose  
(C)  $\beta$ -D-fructofuranose (D)  $\beta$ -D-ribose  
(E)  $\beta$ -D-glucopyranose
105. Novlac, the linear polymer used in paints is
- (A) copolymer of 1,3-butadiene and styrene  
(B) obtained by the polymerization of methyl methacrylate  
(C) initial product obtained in the condensation of phenol and formaldehyde in the presence of acid catalyst  
(D) obtained by the polymerization of caprolactam  
(E) copolymer of melamine and formaldehyde
106. The carbohydrate used as storage molecules in animals is
- (A) sucrose (B) glycogen (C) maltose  
(D) glucose (E) fructose
107. Green chemistry deals with
- (A) study of plant physiology  
(B) study of extraction of natural products from plants  
(C) detailed study of reactions involved in the synthesis of chlorophyll  
(D) utilization of existing knowledge base for reducing the chemical hazards along with developmental activities  
(E) synthesis of chemical compounds using green light

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A 250 W electric bulb of 80% efficiency emits a light of 6626 Å wavelength. The number of photons emitted per second by the lamp is ( $h = 6.626 \times 10^{-34}$  Js)

- (A)  $1.42 \times 10^{17}$  (B)  $2.18 \times 10^{16}$  (C)  $6.66 \times 10^{20}$   
(D)  $2.83 \times 10^{16}$  (E)  $4.25 \times 10^{16}$

The shortest wavelength of the line in hydrogen atomic spectrum of Lyman series when  $R_H = 109678 \text{ cm}^{-1}$  is

- (A) 1002.7 Å (B) 1215.67 Å (C) 1127.30 Å  
(D) 911.7 Å (E) 1234.7 Å

The work function of a metal is 5 eV. What is the kinetic energy of the photoelectron ejected from the metal surface if the energy of the incident radiation is 6.2 eV? (1 eV =  $1.6 \times 10^{-19}$  J)

- (A)  $6.626 \times 10^{-19}$  J (B)  $8.01 \times 10^{-19}$  J (C)  $1.92 \times 10^{-18}$  J  
(D)  $8.010 \times 10^{-18}$  J (E)  $1.92 \times 10^{-19}$  J

The lattice energy of NaCl is  $788 \text{ kJ mol}^{-1}$ . This means that 788 kJ of energy is required

- (A) to separate one mole of solid NaCl into one mole of Na(g) and one mole of Cl(g) to infinite distance  
(B) to separate one mole of solid NaCl into one mole of  $\text{Na}^+(\text{g})$  and one mole of  $\text{Cl}^-(\text{g})$  to infinite distance  
(C) to convert one mole of solid NaCl into one mole of gaseous NaCl  
(D) to convert one mole of gaseous NaCl into one mole of solid NaCl  
(E) to separate one mole of gaseous NaCl into one mole of  $\text{Na}^+(\text{g})$  and one mole of  $\text{Cl}^-(\text{g})$  to infinite distance

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112. Arrange the following species in the correct order of their stability



- (A)  $Li_2 < He_2^+ < O_2^+ < C_2$       (B)  $C_2 < O_2^+ < Li_2 < He_2^+$   
(C)  $He_2^+ < Li_2 < C_2 < O_2^+$       (D)  $O_2^+ < C_2 < Li_2 < He_2^+$   
(E)  $C_2 < Li_2 < He_2^+ < O_2^+$

113. Molecular formulae and shapes of some molecules are given below. Choose the incorrect match

Formula	Shape
(A) $NH_3$	- Trigonal pyramidal
(B) $SF_4$	- Tetrahedral
(C) $ClF_3$	- T-shaped
(D) $PCl_5$	- Trigonal bipyramidal
(E) $BF_3$	- Trigonal planar

114. Potassium dichromate belongs to which crystal system?

- (A) Tetragonal      (B) Orthorhombic      (C) Triclinic  
(D) Hexagonal      (E) Monoclinic

115. If two moles of an ideal gas at 500 K occupies a volume of 41 litres, the pressure of the gas is ( $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$ )

- (A) 2 atm      (B) 3 atm      (C) 4 atm      (D) 5 atm      (E) 1 atm

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116. At 273 K, the density of a certain gaseous oxide at 2 atmosphere is same as that of dioxygen at 5 atmosphere. The molecular mass of the oxide (in  $g\ mol^{-1}$ ) is  
(A) 80 (B) 64 (C) 32  
(D) 160 (E) 70
117. The reaction of  $H_2$  is given below  
 $H_2 + CO + R-CH=CH_2 \rightarrow R-CH_2-CH_2-CHO$   
is specifically called as  
(A) hydrogenation (B) reduction (C) hydroformylation  
(D) dehydration (E) formylation
118. Which of the following are isoelectronic species?  
(i)  $NH_3$  (ii)  $CH_3^+$  (iii)  $NH_2^-$  (iv)  $NH_4^+$   
Choose the correct answer from the codes given below  
(A) (i), (ii), (iii) (B) (ii), (iii), (iv) (C) (i), (ii), (iv)  
(D) (i), (iii), (iv) (E) (ii), (iii)
119. The salt of an alkali metal gives violet colour in the flame test. Its aqueous solution gives a white precipitate with barium chloride in hydrochloric acid medium. The salt is  
(A)  $K_2SO_4$  (B)  $KCl$  (C)  $Na_2SO_4$   
(D)  $K_2CO_3$  (E)  $Li_2SO_4$
120. In which one of the following the central atom is  $sp^3$  hybridized?  
(A)  $NH_4^+$  (B)  $BF_3$  (C)  $SF_6$   
(D)  $PCl_5$  (E)  $XeF_4$

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Q.No.	VERSION		Q.No.	VERSION	
		A2			A2
			91		B
			92		A
			93		B
			94		E
			95		C
			96		B
			97		E
			98		B
			99		C
			100		B
			101		E
			102		B
73		D	103		A
74		D	104		D
75		B	105		C
76		A	106		B
77		A	107		D
78		A	108		C
79		E	109		D
80		C	110		E
81		E	111		B
82		D	112		C
83		E	113		B
84		D	114		C
85		E	115		A
86		D	116		A
87		C	117		C
88		E	118		D
89		C	119		A
90		E	120		A

73. The threshold frequency of a metal corresponds to the wavelength of  $x$  nm. In two separate experiments 'A' and 'B', incident radiations of wavelengths  $\frac{1}{2}x$  nm and  $\frac{1}{4}x$  nm respectively are used. The ratio of kinetic energy of the released electrons in experiment 'B' to that in experiment 'A' is
- (A)  $\frac{1}{3}$       (B) 2      (C) 4      (D) 3      (E)  $\frac{1}{2}$
74. The minimum values of uncertainties involved in the determination of both the position and velocity of a particle are respectively  $1 \times 10^{-10}$  m and  $1 \times 10^{-10}$  ms<sup>-1</sup>. Then, the mass (in kg) of the particle is
- (A)  $5.270 \times 10^{-13}$       (B)  $5.270 \times 10^{-20}$       (C)  $5.270 \times 10^{-16}$   
(D)  $5.270 \times 10^{-10}$       (E)  $5.270 \times 10^{-34}$
75. The number of electrons with azimuthal quantum number  $l = 1$  and  $l = 2$  for Cr in ground state are respectively
- (A) 16, 5      (B) 16, 4      (C) 12, 4      (D) 16, 3      (E) 12, 5

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76. An odd electron molecule among the following is  
(A) CO      (B) SO<sub>2</sub>      (C) CO<sub>2</sub>      (D) NO      (E) OF<sub>2</sub>
77. Aluminium (Atomic mass = 27) crystallizes in a cubic system with edge length of 4 Å. Its density is 2.7 g cm<sup>-3</sup>. The number of aluminium atoms present per unit cell is  
(A) 5      (B) 6      (C) 4      (D) 2      (E) 3
78. Which of the following changes in the respective bond order values are caused by removal of an electron from N<sub>2</sub> and F<sub>2</sub> molecules?  
(A) decrease by 0.5 in both  
(B) increase by 0.5 in both  
(C) increase by 0.5 in the former and decrease by 0.5 in the later  
(D) decrease by 0.5 in the former and increase by 0.5 in the later  
(E) no change in both
79. For two isomorphous crystals A and B, the ratio of density of A to that of B is 1.6 while the ratio of the edge length of B to that of A is 2. If the molar mass of crystal B is 200 g mol<sup>-1</sup> then that of crystal A is  
(A) 240 g mol<sup>-1</sup>      (B) 120 g mol<sup>-1</sup>      (C) 80 g mol<sup>-1</sup>  
(D) 160 g mol<sup>-1</sup>      (E) 40 g mol<sup>-1</sup>

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80. A binary solid has a primitive cubical structure with  $B^-$  ions constituting the lattice points and  $A^+$  ions occupying 25% of its tetrahedral holes. The molecular formula of the crystal is

- (A)  $A_2B$       (B)  $AB_3$       (C)  $AB_2$       (D)  $A_2B_3$       (E)  $A_2B_5$

81. The correct order of first ionisation enthalpies of the following elements is

- (A)  $Be > Mg > Ca > Sr > Ra > Ba$       (B)  $Ra > Ba > Sr > Ca > Mg > Be$   
(C)  $Be > Mg > Ca > Sr > Ba > Ra$       (D)  $Ra > Sr > Ba > Mg > Ca > Be$   
(E)  $Be > Mg > Ca > Ra > Ba > Sr$

82. Which one of the following is reduced by  $H_2O_2$  in alkaline medium?

- (A)  $Fe^{2+}$       (B)  $HOCl$       (C)  $KMnO_4$       (D)  $PbS$       (E)  $Mn^{2+}$

83. Match the following

- | Column I       |   | Column II                    |
|----------------|---|------------------------------|
| (a) Sphalerite | - | (i) $FeCO_3$                 |
| (b) Malachite  | - | (ii) $ZnCO_3$                |
| (c) Calamine   | - | (iii) $Na_3AlF_6$            |
| (d) Cryolite   | - | (iv) $CuCO_3 \cdot Cu(OH)_2$ |
| (e) Siderite   | - | (v) $ZnS$                    |
- (A) (a) - (iii), (b) - (i), (c) - (v), (d) - (ii), (e) - (iv)  
(B) (a) - (v), (b) - (iv), (c) - (ii), (d) - (i), (e) - (iii)  
(C) (a) - (v), (b) - (iii), (c) - (ii), (d) - (i), (e) - (iv)  
(D) (a) - (v), (b) - (iv), (c) - (ii), (d) - (iii), (e) - (i)  
(E) (a) - (ii), (b) - (iii), (c) - (i), (d) - (v), (e) - (iv)

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84. In the metallurgy of zinc, the reducing agent employed in reducing the zinc oxide to crude zinc metal in the last stage is  
 (A) Al (B) Li (C) Coke (D) Water gas (E) H<sub>2</sub> gas
85. Which one of the following has the maximum number of P–OH bonds?  
 (A) H<sub>3</sub>PO<sub>2</sub> (B) H<sub>2</sub>PO<sub>4</sub> (C) H<sub>2</sub>PO<sub>3</sub> (D) H<sub>4</sub>P<sub>2</sub>O<sub>7</sub> (E) H<sub>4</sub>P<sub>2</sub>O<sub>6</sub>
86. The relative strengths of trichlorides of boron group to accept a pair of electron is given by  
 (A) GaCl<sub>3</sub> < AlCl<sub>3</sub> < BCl<sub>3</sub> (B) AlCl<sub>3</sub> < BCl<sub>3</sub> < GaCl<sub>3</sub>  
 (C) AlCl<sub>3</sub> < GaCl<sub>3</sub> < BCl<sub>3</sub> (D) BCl<sub>3</sub> < AlCl<sub>3</sub> < GaCl<sub>3</sub>  
 (E) GaCl<sub>3</sub> < BCl<sub>3</sub> < AlCl<sub>3</sub>
87. The hybridised state of bromine in bromine pentafluoride is  
 (A) sp<sup>3</sup>d (B) dsp<sup>3</sup> (C) d<sup>2</sup>sp<sup>3</sup> (D) sp<sup>2</sup>d (E) sp<sup>3</sup>d<sup>2</sup>
88. In which one of the following, d-d transition involves absorption in the ultraviolet region  
 (A) [Cu(H<sub>2</sub>O)<sub>4</sub>]<sup>2+</sup> (B) [Ti(H<sub>2</sub>O)<sub>6</sub>]<sup>3+</sup> (C) [Co(NH<sub>3</sub>)<sub>6</sub>]<sup>3+</sup>  
 (D) [Co(CN)<sub>6</sub>]<sup>3-</sup> (E) [Co(NH<sub>3</sub>)<sub>5</sub>Cl]<sup>2+</sup>
89. Which one of the following has a different crystal lattice from those of the rest?  
 (A) Ag (B) V (C) Cu (D) Pt (E) Au
90. The hardest lanthanide element is  
 (A) Sm (B) La (C) Gd (D) Dy (E) Yb

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Space for rough work

91. The enthalpy change for a reaction at equilibrium is  $-20.5 \text{ kJ mol}^{-1}$ . Then the entropy change for this equilibrium at 410 K is
- (A)  $+50 \text{ JK}^{-1}\text{mol}^{-1}$       (B)  $+55 \text{ JK}^{-1}\text{mol}^{-1}$       (C)  $+75 \text{ JK}^{-1}\text{mol}^{-1}$   
 (D)  $-50 \text{ JK}^{-1}\text{mol}^{-1}$       (E)  $-55 \text{ JK}^{-1}\text{mol}^{-1}$
92. The enthalpy of combustion of glucose (mol. wt:  $180 \text{ g mol}^{-1}$ ) is  $-2840 \text{ kJ mol}^{-1}$ . Then the amount of heat evolved when 0.9 g of glucose is burnt, will be
- (A) 14.2 kJ      (B) 14.2 J      (C) 28.4 kJ      (D) 1420 kJ      (E) 142 kJ
93. If the ionic product of  $\text{M(OH)}_2$  is  $5 \times 10^{-16}$ , then the molar solubility of  $\text{M(OH)}_2$  in 0.1M NaOH is
- (A)  $5 \times 10^{-12} \text{ M}$       (B)  $5 \times 10^{-9} \text{ M}$       (C)  $5 \times 10^{-10} \text{ M}$   
 (D)  $5 \times 10^{-8} \text{ M}$       (E)  $5 \times 10^{-16} \text{ M}$
94. Equilibrium constants are given for the following two equilibria
- (i)  $\text{A}_2(\text{g}) + \text{B}_2(\text{g}) \rightleftharpoons 2\text{AB}(\text{g}); K = 2 \times 10^{-4}$   
 (ii)  $2\text{AB}(\text{g}) + \text{C}_2(\text{g}) \rightleftharpoons 2\text{ABC}(\text{g}); K = 2 \times 10^{-2} \text{ L mol}^{-1}$
- Calculate the equilibrium constant for the following equilibrium
- $$\text{ABC}(\text{g}) \rightleftharpoons \frac{1}{2}\text{A}_2(\text{g}) + \frac{1}{2}\text{B}_2(\text{g}) + \frac{1}{2}\text{C}_2(\text{g})$$
- (A)  $500 \text{ mol}^{1/2} \text{ L}^{1/2}$       (B)  $4 \times 10^{-6} \text{ mol}^{1/2} \text{ L}^{1/2}$       (C)  $500 \text{ mol}^{-1/2} \text{ L}^{1/2}$   
 (D)  $200 \text{ mol}^{1/2} \text{ L}^{-1/2}$       (E)  $500 \text{ mol}^{1/2} \text{ L}^{-1/2}$

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Space for rough work

95. The equilibrium constant for the equilibrium  $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$  at a particular temperature is  $2 \times 10^{-2} \text{ mol L}^{-1}$ . The number of moles of  $\text{PCl}_5$  that must be taken in a one-litre flask at the same temperature to obtain a concentration of 0.20 mol of chlorine at equilibrium is
- (A) 2.2      (B) 2.0      (C) 1.8      (D) 0.2      (E) 0.1
96. 18 g of glucose is dissolved in 178.2 g of water. The vapour pressure of the solution at  $100^\circ\text{C}$  is (vapour pressure of pure water at  $100^\circ\text{C}$  is 760 mm Hg)
- (A) 767.6 mm Hg      (B) 760 mm Hg      (C) 752.4 mm Hg  
(D) 725.4 mm Hg      (E) 745.2 mm Hg
97. Which one of the following binary liquid mixtures exhibit positive deviation from Raoult's law?
- (A) Carbon disulphide – acetone      (B) Chloroform – acetone  
(C) Bromobenzene – chlorobenzene      (D) Benzene – toluene  
(E) Phenol – aniline
98. The standard electrode potentials of Zn and Ni are respectively  $-0.76 \text{ V}$  and  $-0.25 \text{ V}$ . Then the standard emf of the spontaneous cell by coupling these under standard conditions is
- (A)  $+1.01 \text{ V}$       (B)  $-0.51 \text{ V}$       (C)  $+0.82 \text{ V}$       (D)  $+0.25 \text{ V}$       (E)  $+0.51 \text{ V}$

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Space for rough work

99. How many moles of platinum will be deposited on the cathode when 0.60 F of electricity is passed through a 1.0M solution of  $\text{Pt}^{4+}$ ?
- (A) 0.60 mol (B) 0.15 mol (C) 0.30 mol (D) 0.45 mol (E) 1.0 mol
100. The half-life period of a first order reaction having rate constant  $k = 0.231 \times 10^{-10} \text{ s}^{-1}$  will be
- (A)  $32 \times 10^{10} \text{ s}$  (B)  $2 \times 10^{10} \text{ s}$  (C)  $3 \times 10^{10} \text{ s}$   
(D)  $2 \times 10^{10} \text{ s}$  (E)  $3 \times 10^{12} \text{ s}$
101. For the reaction  $X \rightarrow Y$ , the concentrations of 'X' are 1.2M, 0.6M, 0.3M and 0.15M at 0, 1, 2 and 3 hours respectively. The order of the reaction is
- (A) zero (B) half (C) one (D) two (E) three
102. The enzyme that converts glucose into ethyl alcohol and carbon dioxide is
- (A) invertase (B) maltase (C) urease (D) diastase (E) zymase

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Space for rough work.

103. List I contains the type of colloid while List II contains the examples

List I	List II
(a) Sol	(i) dust
(b) Aerosol	(ii) cheese
(c) Gel	(iii) soap lather
(d) Foam	(iv) plants cell fluids

Choose the correct match

- (A) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)  
(B) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii)  
(C) (a) - (iii), (b) - (iv), (c) - (i), (d) - (i)  
(D) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)  
(E) (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)

104. The chelating ligand used to remove excess of copper and iron in chelate therapy is

- (A) D-Penicillamine (B) Oxalate ion (C) EDTA  
(D) Ethylene diamine (E) Dimethyl glyoxime

105. The correct ascending order of ligand field strengths of the given ligands is

- (A)  $F^- < I^- < CN^- < H_2O < CO$  (B)  $I^- < F^- < H_2O < CO < CN^-$   
(C)  $I^- < F^- < H_2O < CN^- < CO$  (D)  $F^- < H_2O < I^- < CN^- < CO$   
(E)  $F^- < I^- < CO < H_2O < CN^-$

106. An organic compound contains 90% carbon and 10% hydrogen by mass. Its empirical formula is

- (A)  $C_2H_4$  (B)  $C_3H_6$  (C)  $C_3H_8$  (D)  $C_5H_8$  (E)  $C_2H_6$

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Space for rough work

107. Glycerol can be separated from spent-lye in soap industry by
- (A) crystallization (B) sublimation  
(C) differential extraction (D) chromatography  
(E) distillation under reduced pressure
108. The IUPAC name of  $(\text{CH}_3)_2\text{C}=\text{CH}-\text{CH}_2$  is
- (A) 2, 2-dimethylbut-3-ene (B) 2, 2-dimethylpent-3-ene  
(C) 3, 3-dimethylbut-1-ene (D) hex-1-ene  
(E) 2, 2-dimethylhex-2-ene
109. When methane is heated with dioxygen in the presence of  $\text{Mo}_2\text{O}_3$  catalyst, the organic product obtained is
- (A) methanal (B) ethanoic acid (C) methanol  
(D) ethanol (E) 2-methylpropan-2-ol
110. Isomers which can be interconverted through rotation about C-C single bond are
- (A) diastereomers (B) enantiomers (C) conformers  
(D) chain isomers (E) position isomers
111. Which one of the following compounds shows cis-trans isomerism?
- (A) Pent-1-ene (B) But-2-ene (C) But-1-ene  
(D) Propene (E) Ethene

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Space for rough work

112. Among the following, the ambident nucleophile is  
(A) iodide (B) alkoxy (C) hydroxyl (D) hydride (E) cyanide
113. Which one of the following is an allylic halide?  
(A) 2-chlorobutane (B) Chloroethene (C) 3-bromopropene  
(D) 2-chlorotoluene (E) Dichloromethane
114. Out of the following isomeric alcohols containing five carbon atoms, the alcohol that exhibits optical isomerism is  
(A) 1-pentanol (B) 2-pentanol (C) 3-pentanol  
(D) 2-methyl-2-butanol (E) 2,2-dimethyl-1-propanol
115. Which one of the following undergoes iodoform test?  
(A) Propanal (B) Ethanal (C) Benzophenone  
(D) Benzaldehyde (E) Phenol
116. Which one of the following is used as a test for aliphatic primary amines?  
(A) Tollen's test (B) Fehling's test (C) Isocyanide test  
(D) Azo dye test (E) Phthalein fusion test
117. When methanamine is treated with benzoyl chloride, the major product is  
(A) N-phenylethanamide (B) N-methylbenzamide  
(C) benzanilide (D) acetophenone  
(E) N-ethylethanamide

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Space for rough work.

118. In DNA, the consecutive deoxynucleotides are connected by

- (A) phosphodiester linkage      (B) phosphomonoester linkage  
(C) phosphotriester linkage      (D) amide linkage  
(E) imide linkage

119. Which one of the following monomers form biodegradable polymer?

- (A) Urea and formaldehyde  
(B) Ethylene glycol and terephthalic acid  
(C) 3-hydroxybutanoic acid and 3-hydroxypentanoic acid  
(D) Phenol and caproic acid  
(E) Adipic acid and hexamethylenediamine

120. Match the following

Drug		Class			
(a) Dimetapp	-	(i) Antidepressant			
(b) Furacine	-	(ii) Analgesic			
(c) Phenelzine	-	(iii) Antiseptic			
(d) Aspirin	-	(iv) Antifertility			
(e) Norethindrone	-	(v) Antihistamine			
(A)	(a) - (ii),	(b) - (iv),	(c) - (v),	(d) - (iii),	(e) - (i)
(B)	(a) - (iii),	(b) - (v),	(c) - (ii),	(d) - (i),	(e) - (iv)
(C)	(a) - (v),	(b) - (iv),	(c) - (ii),	(d) - (i),	(e) - (iii)
(D)	(a) - (v),	(b) - (iii),	(c) - (i),	(d) - (ii),	(e) - (iv)
(E)	(a) - (ii),	(b) - (iii),	(c) - (i),	(d) - (v),	(e) - (iv)

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73	D
74	A
75	E
76	D
77	C
78	D
79	E
80	C
81	A
82	C
83	D
84	C
85	E
86	A
87	E
88	D
89	B
90	A
91	D
92	A
93	B
94	E
95	A
96	C
97	A
98	E
99	B
100	C
101	C
102	E
103	B
104	A
105	C
106	D
107	E
108	C
109	A
110	C
111	B
112	E
113	C
114	B
115	B
116	C
117	B
118	A
119	C
120	D

76. The standard enthalpy of formation of  $\text{H}_2\text{O}(\text{l})$  and  $\text{Fe}_2\text{O}_3(\text{s})$  are respectively  $-286 \text{ kJ mol}^{-1}$  and  $-824 \text{ kJ mol}^{-1}$ . What is the standard enthalpy change for the following reaction?



- (A)  $-538 \text{ kJ mol}^{-1}$       (B)  $+538 \text{ kJ mol}^{-1}$       (C)  $-102 \text{ kJ mol}^{-1}$   
(D)  $+34 \text{ kJ mol}^{-1}$       (E)  $-34 \text{ kJ mol}^{-1}$
77. The correct descending order of the heat liberated (in kJ) during the neutralization of the acids  $\text{CH}_3\text{COOH}$  (W),  $\text{HF}$  (X),  $\text{HCOOH}$  (Y) and  $\text{HCN}$  (Z) under identical conditions ( $K_a$  of  $\text{CH}_3\text{COOH}=1.8\times 10^{-5}$ ,  $\text{HCOOH}=1.8\times 10^{-4}$ ,  $\text{HCN}=4.9\times 10^{-10}$  and  $\text{HF}=3.2\times 10^{-4}$ ) is
- (A)  $Y > X > Z > W$       (B)  $X > Y > W > Z$   
(C)  $W > X > Y > Z$       (D)  $Z > W > Y > X$   
(E)  $Z > Y > X > W$
78. How many times a 0.1 M strong monobasic acid solution should be diluted so that pH of the resulting solution is tripled?
- (A) 50      (B) 10      (C) 25  
(D) 100      (E) 1000

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Space for rough work

79. The equilibrium pressure for the reaction  $\text{MSO}_4 \cdot 2\text{H}_2\text{O}(s) \rightleftharpoons \text{MSO}_4(s) + 2\text{H}_2\text{O}(g)$  is  $\pi/4$  atm at 400 K. The  $K_p$  for the given reaction (in  $\text{atm}^2$ ) is  
 (A)  $\pi^2/4$  (B)  $\pi/6$  (C)  $\pi^2/16$   
 (D)  $\pi/16$  (E)  $16/\pi$
80. Calculate the molality of a solution that contains 51.2 g of naphthalene, ( $\text{C}_{10}\text{H}_8$ ), in 500 mL of carbon tetrachloride. The density of  $\text{CCl}_4$  is 1.60 g/mL.  
 (A) 0.250 m (B) 0.500 m (C) 0.750 m  
 (D) 0.840 m (E) 1.69 m
81. 31 g of ethylene glycol ( $\text{C}_2\text{H}_6\text{O}_2$ ) is mixed with 500 g of solvent ( $K_f$  of the solvent is  $2 \text{ K kg mol}^{-1}$ ). What is the freezing point of the solution in K? (freezing point of solvent = 273 K)  
 (A) 272 (B) 271 (C) 270  
 (D) 274 (E) 275
82. The standard reduction potential for  $\text{Zn}^{2+} / \text{Zn}$ ,  $\text{Ni}^{2+} / \text{Ni}$  and  $\text{Fe}^{2+} / \text{Fe}$  are  $-0.76$ ,  $-0.23$  and  $-0.44$  V respectively. The reaction  $\text{X} + \text{Y}^{2+} \rightarrow \text{X}^{2+} + \text{Y}$  will have more negative  $\Delta G$  value when X and Y are  
 (A) X = Ni; Y = Fe (B) X = Ni; Y = Zn (C) X = Fe; Y = Zn  
 (D) X = Zn; Y = Ni (E) X = Fe; Y = Ni

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Space for rough work

83. Thermal decomposition of ammonium dichromate gives  
(A)  $N_2$ ,  $H_2O$  and  $Cr_2O_3$  (B)  $N_2$ ,  $NH_3$  and  $CrO$   
(C)  $(NH_4)_2CrO_4$  and  $H_2O$  (D)  $N_2$ ,  $H_2O$  and  $CrO_3$   
(E)  $N_2$ ,  $H_2O$  and  $CrO$
84. An element crystallising in body centred cubic lattice has an edge length of 500 pm. If its density is  $4 \text{ g cm}^{-3}$ , the atomic mass of the element (in  $\text{g mol}^{-1}$ ) is (consider  $N_A = 6 \times 10^{23}$ )  
(A) 100 (B) 250 (C) 125  
(D) 150 (E) 50
85. The rate constant of the reaction,  $2N_2O_5 \rightarrow 4NO_2 + O_2$  at 300 K is  $3 \times 10^{-5} \text{ s}^{-1}$ . If the rate of the reaction at the same temperature is  $2.4 \times 10^{-5} \text{ mol dm}^{-3} \text{ s}^{-1}$ , then the molar concentration of  $N_2O_5$  is  
(A) 0.4 M (B) 0.8 M (C) 0.04 M  
(D) 0.08 M (E) 0.6 M
86. In the reaction  $A \rightarrow \text{Products}$  when the concentration of A was reduced from  $2.4 \times 10^{-2} \text{ M}$  to  $1.2 \times 10^{-2} \text{ M}$  the rate decreased 8 times at the same temperature. The order of the reaction is  
(A) 0 (B) 1 (C) 2 (D) 3 (E) 0.5

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Space for rough work

87. Enzymatic reactions are given in Column I and enzymes in Column II

Column I	Column II
(a) Maltose $\rightarrow$ Glucose	- (i) Zymase
(b) Sucrose $\rightarrow$ Glucose + Fructose	- (ii) Pepsin
(c) Glucose $\rightarrow$ Ethyl alcohol + $\text{CO}_2$	- (iii) Maltase
(d) Starch $\rightarrow$ Maltose	- (iv) Invertase
(e) Proteins $\rightarrow$ Amino acids	- (v) Diastase

Choose the correct matching of enzymatic reaction and enzyme that catalyses the correct reaction from the codes given below

- (A) (a) - (ii), (b) - (iv), (c) - (v), (d) - (iii), (e) - (i)  
(B) (a) - (iii), (b) - (iv), (c) - (i), (d) - (v), (e) - (ii)  
(C) (a) - (v), (b) - (iv), (c) - (ii), (d) - (i), (e) - (iii)  
(D) (a) - (v), (b) - (iii), (c) - (iv), (d) - (ii), (e) - (i)  
(E) (a) - (ii), (b) - (iii), (c) - (i), (d) - (v), (e) - (iv)
88. In which one of the following properties, physisorption and chemisorption resemble each other?
- (A) Force of attraction (B) Enthalpy of adsorption  
(C) Temperature effect (D) Effect of surface area  
(E) Number of adsorption layers
89. Consider the following two complex ions:  $[\text{CoF}_6]^{3-}$  and  $[\text{Co}(\text{C}_2\text{O}_4)_3]^{2-}$ . Which of the following statement(s) is/are **false**?
- (I) Both are octahedral  
(II)  $[\text{Co}(\text{C}_2\text{O}_4)_3]^{2-}$  is diamagnetic while  $[\text{CoF}_6]^{3-}$  is paramagnetic  
(III) Both are outer orbital complexes  
(IV) In both the complexes the central metal is in the same oxidation state
- (A) (II) and (III) (B) (II), (III) and (IV) (C) (III) only  
(D) (III) and (IV) (E) (I), (II) and (IV)

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Space for rough work

90. Chlorophyll is a coordination compound of  
(A) iron (B) magnesium (C) manganese  
(D) chromium (E) zinc
91. Which one of the following is a benzenoid aromatic compound?  
(A) Furan (B) Thiophene (C) Pyridine  
(D) Aniline (E) Cyclopentadienyl anion
92. The major product obtained by the addition reaction of HBr to 4-Methylpent-1-ene in the presence of peroxide is  
(A) 1-Bromo-4-methylpentane (B) 4-Bromo-2-methylpentane  
(C) 2-Bromo-4-methylpentane (D) 3-Bromo-2-methylpentane  
(E) 2-Bromo-2-methylpentane
93. Which one of the following involves nucleophilic addition?  
(A) Kolbe's reaction of phenol  
(B) Williamson's synthesis of ethers  
(C) Reimer-Tiemann's reaction of phenol  
(D) Kolbe's electrolytic synthesis of ethane from sodium acetate  
(E) Aldol formation from ethanal
94. The number of possible stereoisomers of the compound  $\text{CH}_3\text{-CH}=\text{CH-CH}_3$  is  
(A) 2 (B) 4 (C) 3 (D) 5 (E) 6

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Space for rough work

95. Some organic compounds are given in List I and their uses in List II. Choose the correct matching

List I	List II
(a) Triiodomethane	(i) solvent for alkaloids
(b) <i>p, p'</i> -Dichlorodiphenyltrichloroethane	(ii) propellant in aerosols
(c) Trichloromethane	(iii) antiseptic
(d) Dichloromethane	(iv) insecticide

(A) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)  
(B) (a) - (iii), (b) - (iv), (c) - (i), (d) - (ii)  
(C) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)  
(D) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)  
(E) (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)

96. The total number of monohalogenated products formed by halogenation of 2,4,4-Trimethylhexane is  
(A) 5 (B) 7 (C) 6 (D) 8 (E) 9
97. Number of acyclic structural isomers of the compound having the molecular formula  $C_4H_{10}O$  is  
(A) 4 (B) 5 (C) 6 (D) 7 (E) 3
98. 375 mg of an alcohol reacts with required amount of methyl magnesium bromide and releases 140 mL of methane gas at STP. The alcohol is  
(A) ethanol (B) *n*-Butanol (C) methanol  
(D) *n*-Propanol (E) phenol

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Space for rough work.



99. Predict the product (B) in the following sequence of reactions



- (A) Benzaldehyde      (B) Benzophenone      (C) Benzene  
(D) Acetophenone      (E) Benzoic acid

100. Freon 12 is manufactured from  $\text{CCl}_4$  by

- (A) Wurtz reaction      (B) Swarts reaction      (C) Fittig reaction  
(D) Wurtz-Fittig reaction      (E) Sandmeyer reaction

101. Which one of the following can be prepared by Gabriel phthalimide synthesis?

- (A) Aniline      (B) *o*-Toluidine      (C) Benzylamine  
(D) N-Methylethanamine      (E) 4-Bromoaniline

102. 4-Nitrotoluene is treated with bromine to get compound 'P'. 'P' is reduced with Sn and HCl to get compound 'Q'. 'Q' is diazotised and the product is treated with phosphinic acid to get compound 'R'. 'R' is oxidized with alkaline  $\text{KMnO}_4$  to get compound 'S'. Compound 'S' is

- (A) 2-Bromo-4-hydroxybenzoic acid  
(B) Benzoic acid  
(C) 4-Bromobenzoic acid  
(D) 3-Bromobenzoic acid  
(E) 2-Bromobenzoic acid

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Space for rough work

103. Narcotic analgesic is  
(A) Aspirin (B) Paracetamol (C) Codeine  
(D) Zantac (E) Cimetidine
104. In double strand helix structure of DNA, heterocyclic base cytosine forms hydrogen bond with  
(A) Adenine (B) Guanine (C) Purine  
(D) Thymine (E) Uracil
105. The amino acid containing mercaptan unit is  
(A) Leucine (B) Glutamine (C) Cysteine  
(D) Lysine (E) Isoleucine
106. Which one of the following is a non-reducing sugar?  
(A) Maltose (B) Lactose (C) Sucrose  
(D) Glucose (E) Fructose

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Space for rough work

107. In the hydrogen atomic spectrum, the emission of the least energetic photon takes place during the transition from  $n = 6$  energy level to  $n = \dots\dots\dots$  energy level.  
(A) 1 (B) 3 (C) 5 (D) 4 (E) 2
108. If 27 g of water is formed during complete combustion of pure propene ( $C_3H_6$ ), the mass of propene burnt is  
(A) 42 g (B) 21 g (C) 14 g (D) 56 g (E) 40 g
109. When 2.46 g of a hydrated salt ( $MSO_4 \cdot x H_2O$ ) is completely dehydrated, 1.20 g of anhydrous salt is obtained. If the molecular weight of anhydrous salt is  $120 \text{ g mol}^{-1}$  what is the value of  $x$ ?  
(A) 2 (B) 4 (C) 5 (D) 6 (E) 7
110. Identify the T-shaped molecule in the following  
(A)  $BF_3$  (B)  $NH_3$  (C)  $NF_3$  (D)  $ClF_3$  (E)  $PCl_3$
111. Which one of the following molecules has the least dipole moment?  
(A)  $H_2O$  (B)  $BeF_2$  (C)  $NH_3$  (D)  $NF_3$  (E)  $BF_3$
112. Dipole-dipole interaction energy between polar molecules in solids depends on the radius of the molecule ( $r$ ) and it is directly proportional to  
(A)  $(1/r^2)$  (B)  $(1/r^6)$  (C)  $(1/r)$  (D)  $(1/r^3)$  (E)  $(1/r^5)$

Space for rough work

113. Critical density of a gas having molecular weight  $39 \text{ g mol}^{-1}$  is  $0.1 \text{ g cm}^{-3}$ . Its critical volume in  $\text{L mol}^{-1}$  is  
(A) 0.390 (B) 3.90 (C) 0.039 (D) 39.0 (E) 390

114. The various types of hydrides and examples of each type are given below

Hydride type	Compound
(a) Electron deficient	(i) LiH
(b) Saline	(ii) $\text{CH}_4$
(c) Electron-precise	(iii) $\text{NH}_3$
(d) Interstitial	(iv) $\text{B}_2\text{H}_6$
(e) Electron rich	(v) CrH

Choose the correct matching from the codes given below

- (A) (a) - (ii), (b) - (iv), (c) - (v), (d) - (iii), (e) - (i)  
(B) (a) - (iv), (b) - (i), (c) - (ii), (d) - (v), (e) - (iii)  
(C) (a) - (iv), (b) - (iii), (c) - (v), (d) - (ii), (e) - (i)  
(D) (a) - (v), (b) - (iii), (c) - (iv), (d) - (ii), (e) - (i)  
(E) (a) - (iv), (b) - (v), (c) - (i), (d) - (ii), (e) - (iii)
115. One mole of hydrazine ( $\text{N}_2\text{H}_4$ ) loses 10 moles of electrons in a reaction to form a new compound X. Assuming that all the nitrogen atoms in hydrazine appear in the new compound, what is the oxidation state of nitrogen in X? (Note: There is no change in the oxidation state of hydrogen in the reaction)  
(A) -1 (B) -3 (C) +3 (D) +5 (E) +1

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Space for rough work

116. The low solubility of  $\text{LiF}$  and that of  $\text{CsI}$  in water are respectively due to which of the properties of the alkali metal ions?
- (A) higher hydration enthalpy of  $\text{Li}^+$ , higher lattice enthalpy of  $\text{Cs}^+$   
(B) smaller hydration enthalpy of  $\text{Li}^+$ , higher lattice enthalpy of  $\text{Cs}^+$   
(C) smaller lattice enthalpy of  $\text{Li}^+$ , higher hydration enthalpy of  $\text{Cs}^+$   
(D) smaller hydration enthalpy of  $\text{Li}^+$ , smaller lattice enthalpy of  $\text{Cs}^+$   
(E) higher lattice enthalpy of  $\text{Li}^+$ , smaller hydration enthalpy of  $\text{Cs}^+$
117. The second ionization enthalpy of which of the following alkaline earth metals is the highest?
- (A) Ba (B) Mg (C) Ca (D) Sr (E) Be
118. Which one of the following group 16 elements does not exist in  $-2$  oxidation state?
- (A) S (B) Se (C) O (D) Po (E) Te
119. In which one of the following compounds of xenon, highest number of lone pair of electrons is present on xenon?
- (A)  $\text{XeF}_6$  (B)  $\text{XeF}_4$  (C)  $\text{XeOF}_4$  (D)  $\text{XeO}_3$  (E)  $\text{XeF}_2$
120. The hybridized state of  $\text{Al}^{3+}$  in the complex ion formed when  $\text{AlCl}_3$  is treated with aqueous acid is
- (A)  $sp^3$  (B)  $dsp^2$  (C)  $sp^3d^2$  (D)  $sp^2d$  (E)  $sp^2$

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Space for rough work

73	E
74	B
75	A
76	E
77	B
78	D
79	C
80	E
81	B
82	D
83	A
84	D
85	B
86	D
87	B
88	D
89	C
90	B
91	D
92	A
93	E
94	A
95	B
96	C
97	D
98	D
99	E
100	B
101	C
102	E
103	C
104	B
105	C
106	C
107	C
108	B
109	E
110	D
111	B
112	E
113	A
114	B
115	C
116	E
117	E
118	D
119	E
120	C

73. Uncertainty principle is valid for  
(A) Proton (B) Methane (C) Both (A) and (B)  
(D) 1  $\mu\text{m}$  sized platinum particles (E) 1  $\mu\text{m}$  sized NaCl particles
74. The energy of an electron in the 3S orbital (excited state) of H-atom is  
(A) -1.5 eV (B) 13.6 eV (C) -3.4 eV  
(D) -4.53 eV (E) 4.53 eV
75. Among the following, the molecule that will have the highest dipole moment is  
(A)  $\text{H}_2$  (B) HI (C) HBr  
(D) HCl (E) HF
76. Which of the following pair have identical bond order?  
(A)  $\text{CN}^-$  and  $\text{NO}^+$  (B)  $\text{CN}$  and  $\text{O}_2^-$  (C)  $\text{CN}^-$  and  $\text{CN}^+$   
(D)  $\text{NO}^+$  and  $\text{O}_2$  (E)  $\text{O}_2$  and  $\text{CN}^+$
77. A gas will approach ideal behaviour at  
(A) Low temperature and low pressure  
(B) Low temperature and high pressure  
(C) High temperature and low pressure  
(D) High temperature and high pressure  
(E) Low volume and high pressure
78. Pressure of ideal and real gases at 0 K are  
(A)  $> 0$  and 0 (B)  $< 0$  and 0 (C) 0 and 0  
(D)  $> 0$  and  $> 0$  (E) 0 and  $> 0$

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Space for rough work

79. For the process  
 $A(l, 0.05 \text{ atm}, 32^\circ\text{C}) \rightarrow A(g, 0.05 \text{ atm}, 32^\circ\text{C})$ .  
 The correct set of thermodynamic parameters is  
 (A)  $\Delta G = 0$  and  $\Delta S < 0$  (B)  $\Delta G = 0$  and  $\Delta S > 0$   
 (C)  $\Delta G < 0$  and  $\Delta S < 0$  (D)  $\Delta G < 0$  and  $\Delta S = 0$   
 (E)  $\Delta G = 0$  and  $\Delta S = 0$
80. Mixing of  $N_2$  and  $H_2$  form an ideal gas mixture at room temperature in a container. For this process, which of the following statement is true?  
 (A)  $\Delta H = 0$ ,  $\Delta S_{\text{surrounding}} = 0$ ,  $\Delta S_{\text{system}} < 0$  and  $\Delta G < 0$   
 (B)  $\Delta H = 0$ ,  $\Delta S_{\text{surrounding}} = 0$ ,  $\Delta S_{\text{system}} > 0$  and  $\Delta G < 0$   
 (C)  $\Delta H > 0$ ,  $\Delta S_{\text{surrounding}} = 0$ ,  $\Delta S_{\text{system}} > 0$  and  $\Delta G < 0$   
 (D)  $\Delta H < 0$ ,  $\Delta S_{\text{surrounding}} > 0$ ,  $\Delta S_{\text{system}} < 0$  and  $\Delta G = -ve$   
 (E)  $\Delta H = 0$ ,  $\Delta S_{\text{surrounding}} = 0$ ,  $\Delta S_{\text{system}} < 0$  and  $\Delta G = -ve$
81. Which of the following is not true about a catalyst?  
 (A) Mechanism of the reaction in presence and absence of catalyst could be different  
 (B) Enthalpy of the reaction does not change with catalysts  
 (C) Catalyst enhances both forward and backward reaction at equal rate  
 (D) Catalyst participates in the reaction, but not consumed in the process  
 (E) Use of catalyst cannot change the order of the reaction
82. In the  $\ln K$  vs.  $\frac{1}{T}$  plot of a chemical process having  $\Delta S^\circ > 0$  and  $\Delta H^\circ < 0$  the slope is proportional to (where  $K$  is equilibrium constant)  
 (A)  $|\Delta H^\circ|$  (B)  $|\Delta H^\circ|$  (C)  $\Delta S^\circ$   
 (D)  $\Delta S^\circ$  (E)  $\Delta G^\circ$

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Space for rough work



83. For the process

$\frac{3}{2}A \rightarrow B$ , at 298 K,  $\Delta G^\circ$  is  $163 \text{ kJ mol}^{-1}$ . The composition of the reaction mixture is  $[B] = 1$  and  $[A] = 10000$ . Predict the direction of the reaction and the relation between reaction quotient (Q) and the equilibrium constant (K)

- (A) forward direction because  $Q > K$
- (B) reverse direction because  $Q > K$
- (C) forward direction because  $Q < K$
- (D) reverse direction because  $Q < K$
- (E) it is at equilibrium as  $Q = K$

84. Solubility product ( $K_{sp}$ ) of saturated  $PbCl_2$  in water is  $1.8 \times 10^{-4} \text{ mol}^3 \text{ dm}^{-3}$ . What is the concentration of  $Pb^{2+}$  in the solution?

- (A)  $(0.45 \times 10^{-4})^{1/3} \text{ mol dm}^{-3}$
- (B)  $(1.8 \times 10^{-4})^{1/3} \text{ mol dm}^{-3}$
- (C)  $(0.9 \times 10^{-6})^{1/3} \text{ mol dm}^{-3}$
- (D)  $(2.0 \times 10^{-4})^{1/3} \text{ mol dm}^{-3}$
- (E)  $(2.45 \times 10^{-4})^{1/3} \text{ mol dm}^{-3}$

85. The freezing point of equimolar aqueous solutions will be highest for

- (A)  $C_6H_5NH_2Cl$       (B)  $AgNO_3$       (C)  $Ca(NO_3)_2$
- (D)  $La(NO_3)_3$       (E) D-fructose

86. The molality of the 3M solution of methanol if the density of the solution is  $0.9 \text{ g cm}^{-3}$  is

- (A) 3.73      (B) 3.0      (C) 3.33
- (D) 3.1      (E) 3.2

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Space for rough work

87. Consider a fuel cell supplied with 1 mole of  $H_2$  gas and 10 moles of  $O_2$  gas. If fuel cell is operated at 96.5 mA current, how long will it deliver power? (Assume  $1 F = 96500 C / \text{mole of electrons}$ )
- (A)  $1 \times 10^9 s$                       (B)  $0.5 \times 10^6 s$                       (C)  $2 \times 10^6 s$   
 (D)  $4 \times 10^9 s$                       (E)  $5 \times 10^9 s$
88. Consider the equilibrium obtained by electrically connecting zinc-amalgam (Zn(Hg)) and HgO electrodes in mercury cell,
- $$Zn(Hg) + HgO(s) \rightleftharpoons ZnO(s) + Hg(l)$$
- Under this equilibrium, what is the relation between the potential of the Zn(Hg) and HgO electrodes measured against the standard hydrogen electrode?
- (A) Zn(Hg) electrode potential is equal to HgO electrode potential  
 (B) Zn(Hg) electrode potential is more than HgO electrode potential  
 (C) HgO electrode potential is more than Zn(Hg) electrode  
 (D) Cell voltage at above said equilibrium is 1.35 V  
 (E) Both (C) and (D)
89. 10 g of  $MgCO_3$  decomposes on heating to 0.1 mole  $CO_2$  and 4 g  $MgO$ . The per cent purity of  $MgCO_3$  is
- (A) 24 %                      (B) 44 %                      (C) 54 %  
 (D) 74 %                      (E) 84 %
90. The compound  $Na_2CO_3 \cdot x H_2O$  has 50 %  $H_2O$  by mass. The value of 'x' is
- (A) 4                      (B) 5                      (C) 6  
 (D) 7                      (E) 8
91. Hybridisation of carbon in  $CH_3^-$
- (A)  $sp^2$                       (B)  $sp^3$                       (C)  $sp^3d$   
 (D)  $sp^3d^2$                       (E)  $sp^2d^3$

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Space for rough work

92. The common features among  $\text{CO}$ ,  $\text{CN}^-$  and  $\text{NO}_2^+$  are
- (A) Bond order three and isoelectronic
  - (B) Bond order three and weak field ligands
  - (C) Bond order two and  $\pi$ -acceptors
  - (D) Bond order three and  $\pi$ -donors
  - (E) Isoelectronic and strong field ligands
93. Which of the following is covalent?
- (A)  $\text{NaCl}$                       (B)  $\text{KCl}$                       (C)  $\text{BeCl}_2$
  - (D)  $\text{MgCl}_2$                      (E)  $\text{CaCl}_2$
94. One mole of an unknown compound was treated with excess water and resulted in the evolution of two moles of a readily combustible gas. The resulting solution was treated with  $\text{CO}_2$  and resulted in the formation of white turbidity. The unknown compound is
- (A)  $\text{Ca}$                           (B)  $\text{CaH}_2$                       (C)  $\text{Ca(OH)}_2$
  - (D)  $\text{Ca(NO}_3)_2$                 (E)  $\text{CaSO}_4$
95. When potassium is reacted with water, which compound(s) is (are) formed preferentially?
- (A)  $\text{K}_2\text{O}$                         (B)  $\text{KO}_2$                       (C) Both  $\text{K}_2\text{O}$  and  $\text{KO}_2$
  - (D)  $\text{K}_2\text{O}_2$                       (E)  $\text{K}_2\text{O}_3$
96. Purification of aluminium by electrolytic refining is called
- (A) Hall's process    (B) Froth flotation process
  - (C) Bayer's process    (D) Hoop's process
  - (E) Serpeck's process

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Space for rough work

97. Select the most appropriate statement  
in  $\text{BF}_3$
- (A) All the bonds are completely ionic
  - (B) The B-F bond is partially ionic
  - (C) B-F bond has partial double bond character
  - (D) Bond energy and bond length data indicates single bond character of the B-F bond
  - (E) All the bonds are covalent
98. The inert gas found most abundant in the atmosphere is
- (A) He
  - (B) Ne
  - (C) Ar
  - (D) Kr
  - (E) Xe
99. When  $\text{MnO}_2$  is fused with  $\text{KOH}$  and  $\text{KNO}_2$ , a coloured compound is formed. Choose the right compound with the appropriate colour
- (A)  $\text{K}_2\text{MnO}_4$ , green
  - (B)  $\text{KMnO}_4$ , purple
  - (C)  $\text{Mn}_2\text{O}_3$ , brown
  - (D)  $\text{Mn}_3\text{O}_4$ , black
  - (E)  $\text{MnO}_2$ , black
100. Identify the case(s) where there is change in oxidation number
- (A) Acidified solution of  $\text{CrO}_4^{2-}$
  - (B)  $\text{SO}_2$  gas bubbled through an acidic solution of  $\text{Cr}_2\text{O}_7^{2-}$
  - (C) Alkaline solution of  $\text{Cr}_2\text{O}_7^{2-}$
  - (D) Ammoniacal solution of  $\text{CrO}_4^{2-}$
  - (E) Aqueous solution of  $\text{CrO}_2\text{Cl}_2$  in  $\text{NaOH}$
101. Water gas is produced by
- (A) Passing steam over red hot coke
  - (B) Passing steam and air over red hot coke
  - (C) Burning coke in excess air
  - (D) Burning coke in limited supply of air
  - (E) Both (A) and (B)

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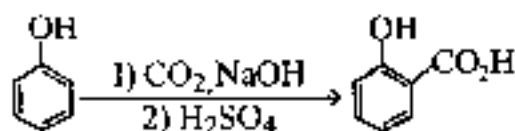
102. The volume of oxygen liberated at STP from 15 mL of 20 volume  $H_2O_2$  is  
(A) 100 mL (B) 150 mL (C) 200 mL  
(D) 250 mL (E) 300 mL
103. Corundum is \_\_\_\_\_ mineral of aluminium.  
(A) Silicate (B) Oxide (C) Double salt  
(D) Sulphate (E) Nitrate
104. The solution which does not produce precipitate when treated with aqueous  $K_2CO_3$  is  
(A)  $BaCl_2$  (B)  $CaBr_2$  (C)  $MgCl_2$   
(D)  $Na_2SO_4$  (E)  $Pb(NO_3)_2$
105. If the boiling point difference between the two liquids is not much, then \_\_\_\_\_ method is used to separate them.  
(A) simple distillation (B) distillation under reduced pressure  
(C) steam distillation (D) fractional distillation  
(E) differential extraction
106. Lassaigne's test (with silver nitrate) is commonly used to detect halogens such as chlorine, bromine and iodine but not useful to detect fluorine because the product  $AgF$  formed is  
(A) volatile (B) reactive (C) explosive  
(D) soluble in water (E) a liquid
107. Protein is a polymer made of  
(A) carbohydrates (B) amino acids (C) nucleic acids  
(D) carboxylic acids (E) polycyclic aromatics
108. The letter 'D' in D-carbohydrates represents  
(A) dextrorotation (B) direct synthesis (C) configuration  
(D) mutarotation (E) optical activity

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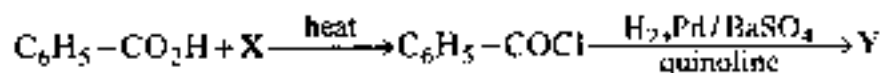
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109. Phenol is a highly corrosive substance, but its 0.2 per cent solution is used as  
 (A) antibiotic (B) antiseptic (C) disinfectant  
 (D) antihistamine (E) antacid

110. Name of the following reaction is



- (A) Reimer-Tiemann (B) Kolbe-Schmitt (C) Cannizzaro  
 (D) Gattermann (E) Gattermann-Koch
111. X and Y in the below reaction are ----- and -----, respectively

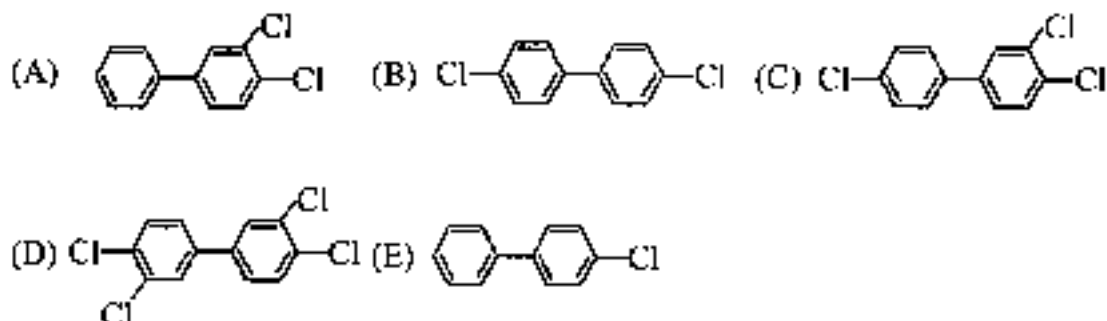
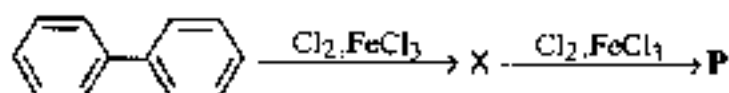


- (A)  $\text{SOCl}_2$  and  $\text{C}_6\text{H}_5\text{CHO}$  (B)  $(\text{COCl})_2$  and  $\text{C}_6\text{H}_5\text{CH}_3$   
 (C)  $\text{SOCl}_2$  and  $\text{C}_6\text{H}_5\text{CH}_3$  (D)  $(\text{COCl})_2$  and  $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$   
 (E)  $\text{SOCl}_2$  and  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$
112. The reaction of propene with HBr in presence of peroxide proceeds through the intermediate
- (A)  $\text{H}_3\text{C}-\underset{\cdot}{\text{C}}\text{H}-\text{CH}_3$  (B)  $\text{H}_2\text{C}-\underset{\cdot}{\text{C}}\text{H}-\text{CH}_2\text{Br}$   
 (C)  $\text{H}_3\text{C}-\overset{\text{Br}}{\underset{\cdot}{\text{C}}}\text{H}-\overset{\cdot}{\text{C}}\text{H}_2$  (D)  $\text{H}_3\text{C}-\text{CH}_2-\overset{\cdot}{\text{C}}\text{H}_2$   
 (E) None of the above

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113. The major product **P** formed in the following reaction is



114. The correct increasing order of the acid strength of acids, butyric acid (I), 2-chlorobutyric acid (II), 3-chlorobutyric acid (III) and 2,2-dichlorobutyric acid (IV) is

- (A) I < II < III < IV    (B) III < II < IV < I    (C) I < III < II < IV  
 (D) III < I < II < IV    (E) IV < III < II < I

115. Cycloheptatrienyl cation is

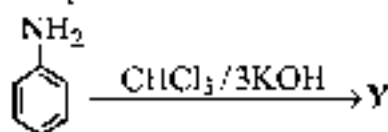
- (A) non-benzenoid and non-aromatic    (B) non-benzenoid and aromatic  
 (C) benzenoid and non-aromatic    (D) benzenoid and aromatic  
 (E) non-benzenoid and anti-aromatic

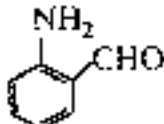


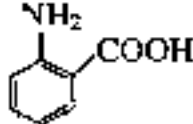

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116. The correct order of increasing reactivity of the following alkyl halides,  $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{CH}_3$  (I),  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$  (II),  $(\text{CH}_3)_2\text{CClCH}_2\text{CH}_3$  (III) and  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$  (IV) towards  $\text{S}_{\text{N}}2$  displacement is
- (A)  $\text{I} < \text{II} < \text{III} < \text{IV}$     (B)  $\text{III} < \text{I} < \text{IV} < \text{II}$     (C)  $\text{III} < \text{I} < \text{II} < \text{IV}$   
 (D)  $\text{II} < \text{IV} < \text{I} < \text{III}$     (E)  $\text{I} < \text{III} < \text{II} < \text{IV}$
117. The strongest base among the following is
- (A) amide ion                      (B) hydroxide ion    (C) trimethylamine  
 (D) ammonia                      (E) aniline
118. The condensation reaction between one equivalent of acetone and two equivalents of benzaldehyde in presence of dilute alkali leads to the formation of
- (A) benzalacetophenone                      (B) benzylideneacetone  
 (C) dibenzylideneacetone                      (D) benzoic acid and acetic acid  
 (E) only benzoic acid

119. The product Y for the below reaction is



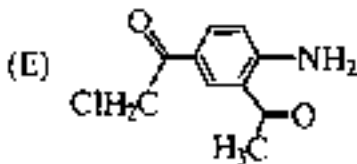
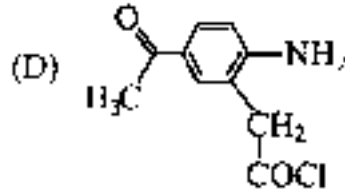
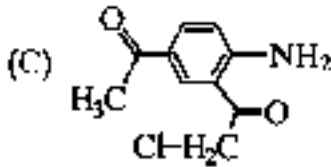
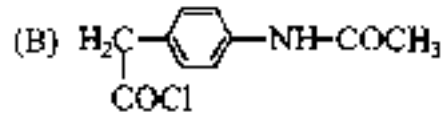
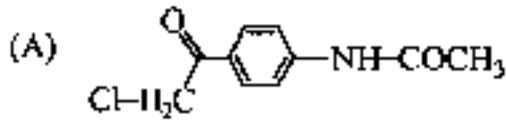
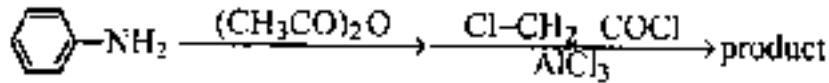
- (A)     (B)     (C)     (D)     (E) 

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120. The product formed in the following reaction is




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73	C
74	A
75	E
76	A
77	C
78	C
79	B
80	B
81	E
82	B
83	B
84	A
85	E
86	A
87	C
88	A
89	E
90	C
91	B
92	A
93	C
94	B
95	A
96	A
97	C
98	C
99	A
100	B
101	A
102	E
103	B
104	D
105	D
106	D
107	B
108	C
109	B
110	B
111	A
112	B
113	B
114	C
115	B
116	B
117	A
118	C
119	C
120	A

73. Which element has the highest first ionization potential?  
(A) N (B) Ne (C) He (D) H (E) Li
74. Which statement(s) is(are) false for the periodic classification of elements?  
(A) The properties of the elements are the periodic functions of their atomic numbers  
(B) Non-metallic elements are lesser in number than the metallic elements  
(C) The first ionization energies of the elements along a period do not vary in a regular manner with increase in atomic number  
(D) For transition elements, the *d*-electrons are filled monotonically with increase in atomic number  
(E) Both (C) and (D)
75. The electronegativities of N, C, Si and P are in the order  
(A)  $P < Si < C < N$  (B)  $Si < P < N < C$  (C)  $Si < P < C < N$   
(D)  $P < Si < N < C$  (E) Difficult to predict
76. Gd(64) has \_\_\_\_\_ unpaired electrons with sum of spin \_\_\_\_\_  
(A) 7, 3.5 (B) 8, 3 (C) 6, 3 (D) 8, 4 (E) 9, 3.5
77. When  $SO_2$  gas is passed into aqueous  $Na_2CO_3$  the product(s) formed is(are)  
(A)  $NaHSO_3$  (B)  $Na_2SO_3$  (C)  $NaHSO_4$   
(D)  $Na_2SO_3$  and  $NaHSO_3$  (E)  $NaHSO_4$  and  $Na_2SO_4$
78. Portland cement does not contain  
(A)  $CaSiO_3$  (B)  $CaSiO_2$  (C)  $Ca_3Al_2O_6$   
(D)  $Ca_3(PO_4)_2$  (E) Both (C) and (D)

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Space for rough work

79.  $\text{Al}_2(\text{SO}_4)_3$  is used in the following but not
- (A) As a coagulant in treating drinking water and sewage
  - (B) In plastics industry
  - (C) As a mordant in dyeing
  - (D) In paper industry
  - (E) Both (C) and (D)
80. Maximum number of covalent bonds formed by N and P are
- (A) 3, 5
  - (B) 3, 6
  - (C) 3, 4, 5
  - (D) 3, 4, 6
  - (E) None of the above
81. Consider the following statements concerning  $\text{N}_2\text{H}_4$
1. It is an exothermic compound
  2. It burns in air with the evolution of heat
  3. It has kinetic stability
  4. It reduces  $\text{Fe}^{3+}$  to  $\text{Fe}^{2+}$  in acidic medium
- Which of the following combination is correct?
- (A) 2 and 3 are correct
  - (B) 1 and 2 are correct
  - (C) All are correct
  - (D) 3 and 4 are correct
  - (E) 2, 3 and 4 are correct
82. Consider the following species
1.  $[\text{O}_2]^{2-}$
  2.  $[\text{CO}]^+$
  3.  $[\text{O}_2]^+$
- Among these sigma bond alone is present in
- (A) 1 alone
  - (B) 2 alone
  - (C) 3 alone
  - (D) 1 and 2
  - (E) 1, 2 and 3
83. Select the correct option(s) for the following statements
1.  $\text{Cl}_2\text{O}$  and  $\text{ClO}_2$  are used as bleaching agents
  2.  $\text{OCl}^-$  salts are used as detergents
  3.  $\text{OCl}^-$  disproportionates in alkaline medium
  4.  $\text{BrO}_3^-$  is oxidized in acidic medium
- (A) 1, 2, 3 correct
  - (B) 2, 3, 4 correct
  - (C) 1, 2, 4 correct
  - (D) 1, 3, 4 correct
  - (E) All are correct

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84. When  $\text{H}_2\text{O}_2$  is added to an acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  solution
- (A) A green colour solution is obtained (B) A yellow solution is obtained  
(C) A blue-violet solution is obtained (D) A green precipitate is formed  
(E) A yellow precipitate is formed
85. Consider the following compounds
1.  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$     2.  $\text{NH}_4\text{NO}_2$     3.  $\text{NH}_4\text{VO}_3$     4.  $\text{NH}_4\text{NO}_3$
- Which compound(s) yield nitrogen gas upon heating?
- (A) 1 and 2 (B) 2 and 3 (C) 3 and 4 (D) 1 and 4 (E) All
86. How many peroxy linkages are present in  $\text{CrO}_5$ ?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
87. More than four bonds are made by how many elements in carbon family?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
88. The effective nuclear charge of an element with three valence electrons is 2.60. What is the atomic number of the element?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
89. The elution sequence of a mixture of compounds containing chlorobenzene, anthracene and *p*-cresol developed on an alumina column using a solvent system of progressively increasing polarity is
- (A) anthracene  $\rightarrow$  chlorobenzene  $\rightarrow$  *p*-cresol  
(B) anthracene  $\rightarrow$  *p*-cresol  $\rightarrow$  chlorobenzene  
(C) chlorobenzene  $\rightarrow$  *p*-cresol  $\rightarrow$  anthracene  
(D) chlorobenzene  $\rightarrow$  anthracene  $\rightarrow$  *p*-cresol  
(E) *p*-cresol  $\rightarrow$  anthracene  $\rightarrow$  chlorobenzene

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90. Number of constitutional isomers of alkane with formula  $C_6H_{14}$  is  
 (A) 3 (B) 2 (C) 5 (D) 10 (E) 8
91. Phenylacetylene on treatment with  $HgSO_4/H_2SO_4, H_2O$  produces  
 (A) acetophenone (B) phenylacetaldehyde (C) phenylacetic acid  
 (D) 1-phenylethanol (E) 2-phenylethanol

92. Which of the following compounds are aromatic?



- (A) A, B (B) A, B, C (C) B, C (D) B, C, D (E) A, B, D
93. Aromatic electrophilic substitution reaction that is reversible is  
 (A) nitration (B) chlorination (C) sulphonation  
 (D) alkylation (E) acylation
94. Which one of the following statements is false?  
 (A) R and S configurations correspond to the enantiomers of an optically active compound  
 (B) The process of converting an optically active compound into a racemate is called racemization  
 (C) A molecule containing a plane of symmetry can be optically active  
 (D) Optical isomers that are not enantiomers are called diastereoisomers  
 (E) All chiral objects are asymmetric

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95. Neopentyl bromide undergoes dehydrohalogenation to give alkenes even though it has no  $\beta$ -hydrogen. This is due to  
(A) E2 mechanism (B) E1 mechanism  
(C) Rearrangement of carbocations by E1 mechanism  
(D) E1cB mechanism (E) E<sub>i</sub> mechanism
96. The compound which does not lead to nitrile by substitution with NaCN/DMSO is  
(A) benzyl chloride (B) ethyl chloride (C) isopropyl chloride  
(D) chlorobenzene (E) isobutyl chloride
97. Oxidation of 1° alcohols to aldehydes is very successful for the alcohols like  
(A) pent-2-yn-1-ol (B) 1-hexanol (C) *n*-propyl alcohol  
(D) 1-pentanol (E) 1-octanol
98. The compound that does not undergo haloform reaction is  
(A) acetaldehyde (B) ethanol (C) acetone  
(D) acetophenone (E) propiophenone
99. The halogen compound which will not react with phenol to give ethers is  
(A) ethyl chloride (B) methyl chloride (C) benzyl chloride  
(D) vinyl chloride (E) allyl chloride
100. The weakest among the following acids is  
(A) peroxyacetic acid (B) acetic acid (C) chloroacetic acid  
(D) trichloroacetic acid (E) propanoic acid
101. The nitrosation of *N,N*-dimethylaniline takes place through the attack of electrophile  
(A) nitronium ion (B) protonated nitrous acid  
(C) nitrous acid (D) nitrite ion (E) nitrosonium ion

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102. The nitrogenous base present only in RNA is:  
(A) guanine (B) adenine (C) cytosine  
(D) uracil (E) thymine
103. Green fuel is the fuel obtained from:  
(A) bio-waste (B) metal waste (C) plastic waste  
(D) chemical waste (E) electronic waste
104. Barbiturates are potent:  
(A) hypnotics (B) antimicrobials (C) antacids  
(D) antiseptics (E) antiallergics
105. 1 mole of  $\text{FeSO}_4$  (atomic weight of Fe is  $55.84 \text{ g mol}^{-1}$ ) is oxidized to  $\text{Fe}_2(\text{SO}_4)_3$ . Calculate the equivalent weight of ferrous ion:  
(A) 55.84 (B) 27.92 (C) 18.61  
(D) 111.68 (E) 83.76
106. Mass % of carbon in ethanol is:  
(A) 52 (B) 13 (C) 34 (D) 90 (E) 80
107. One mole of ethanol is produced reacting graphite,  $\text{H}_2$  and  $\text{O}_2$  together. The standard enthalpy of formation is  $-277.7 \text{ kJ mol}^{-1}$ . Calculate the standard enthalpy of the reaction when 4 moles of graphite is involved:  
(A) -277.7 (B) -555.4 (C) -138.85 (D) -69.42 (E) -1110.8
108. Which of the following process best describes atomization of  $\text{CH}_4(\text{g})$ ?  
(A) Exothermic (B) Endothermic (C) Non-spontaneous  
(D) Spontaneous (E) Both (B) and (C)

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109. Consider the equilibrium  $X_2 + Y_2 \rightleftharpoons 2P$ . Find the stoichiometric coefficient of the P using the data given in the following table.

$X_2 / \text{mol L}^{-1}$	$Y_2 / \text{mol L}^{-1}$	$P / \text{mol L}^{-1}$
$1.14 \times 10^{-2}$	$0.12 \times 10^{-2}$	$2.52 \times 10^{-2}$
$0.92 \times 10^{-2}$	$0.22 \times 10^{-2}$	$3.08 \times 10^{-2}$

- (A) 1      (B) 2      (C) 3      (D) 0.5      (E) 4
110. Which of the following can help predict the rate of a reaction if the standard Gibbs free energy of reaction ( $\Delta_r G^\circ$ ) is known?
- (A) Equilibrium constant      (B)  $\Delta_r H^\circ$       (C)  $\Delta_r U^\circ$   
(D) Heat liberated during the course of reaction in calorimeter  
(E) Both (B) and (A)
111. Calculate the molarity of a solution containing 5 g of NaOH dissolved in the product of a  $H_2 - O_2$  fuel cell operated at 1 A current for 595.1 hours. (Assume  $1F = 96500 \text{ C/mol}$  of electrons and molecular weight of NaOH as  $40 \text{ g mol}^{-1}$ )
- (A) 0.05 M      (B) 0.025 M      (C) 0.1 M      (D) 0.075 M      (E) 1 M
112. If 1 mole of NaCl solute is dissolved into the 1 kg of water, at what temperature will water boil at 1.013 bar? ( $K_b$  of water is  $0.52 \text{ K kg mol}^{-1}$ )
- (A) 373.15 K      (B) 373.67 K      (C) 374.19 K  
(D) 373.19 K      (E) 375 K

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113. Consider the electrochemical reaction between Ag(s) and Cl<sub>2</sub>(g) electrodes in 1 litre of 0.1 M KCl aqueous solution. Solubility product of AgCl is  $1.8 \times 10^{-10}$  and  $F = 96500 \text{ C/mol}$ . At  $1 \mu\text{A}$  current, calculate the time required to start observing the AgCl precipitation in the galvanic cell
- (A) 173 s (B) 346 s (C)  $1.25 \times 10^6$  s  
(D)  $1.25 \times 10^5$  s (E) 101 s
114. The voltage of the cell consisting of Li(s) and F<sub>2</sub>(g) electrodes is 5.92 V at standard condition at 298 K. What is the voltage if the electrolyte consists of 2 M LiF. ( $\ln 2 = 0.693$ ,  $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$  and  $F = 96500 \text{ C mol}^{-1}$ )
- (A) 5.90 V (B) 5.937 V (C) 5.88 V (D) 4.9 V (E) 4.8 V
115. Consider the galvanic cell, Pt(s)|H<sub>2</sub>(1 bar)|HCl(aq)(1 M)|Cl<sub>2</sub>(1 bar)|Pt(s). After running the cell for sometime, the concentration of the electrolyte is automatically raised to 3 M HCl. Molar conductivity of the 3 M HCl is about  $240 \text{ S cm}^2 \text{ mol}^{-1}$  and limiting molar conductivity of HCl is about  $420 \text{ S cm}^2 \text{ mol}^{-1}$ . If  $K_b$  of water is  $0.52 \text{ K kg mol}^{-1}$ , calculate the boiling point of the electrolyte at the end of the experiment
- (A) 375.6 K (B) 376.3 K (C) 378.1 K (D) 380.3 K (E) 381.6 K
116. The data given below are for the reaction of A and D<sub>2</sub> to form product at 295 K. Find the correct rate expression for this reaction.

D <sub>2</sub> / mol L <sup>-1</sup>	A / mol L <sup>-1</sup>	Initial rate / mol L <sup>-1</sup> s <sup>-1</sup>
0.05	0.05	$1 \times 10^{-3}$
0.15	0.05	$3 \times 10^{-3}$
0.05	0.15	$9 \times 10^{-3}$

- (A)  $k[\text{D}_2][\text{A}]^2$  (B)  $k[\text{D}_2]^2[\text{A}]$  (C)  $k[\text{D}_2]^2[\text{A}]^2$   
(D)  $k[\text{D}_2]^2[\text{A}]$  (E)  $k[\text{D}_2][\text{A}]^2$

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117. Find the unit of the rate constant of a reaction represented with a rate equation,  
 $\text{rate} = k[\text{A}]^{1/2}[\text{B}]^{3/2}$
- (A)  $\text{mol}^{-1} \text{L} \cdot \text{s}^{-1}$                       (B)  $\text{s}^{-1}$                       (C)  $\text{mol L}^{-1} \text{s}^{-1}$   
(D)  $\text{mol}^{-2} \text{L}^2 \text{s}^{-1}$                       (E)  $\text{mol}^{-3} \text{L}^3 \text{s}^{-1}$
118. Under what condition the order of the reaction,  
 $2\text{HI} \xrightarrow{\Delta, \text{catalyst}} \text{H}_2(\text{g}) + \text{I}_2(\text{g})$ , is zero
- (A) At high temperature                      (B) At high partial pressure of HI  
(C) At low partial pressure of HI                      (D) At high partial pressure of  $\text{H}_2$   
(E) At high partial pressure of  $\text{I}_2$
119. Which of the following statement is true about the adsorption?
- (A)  $\Delta H < 0$  and  $\Delta S < 0$                       (B)  $\Delta H > 0$  and  $\Delta S < 0$   
(C)  $\Delta H < 0$  and  $\Delta S > 0$                       (D)  $\Delta H = 0$  and  $\Delta S < 0$   
(E)  $\Delta H = 0$  and  $\Delta S > 0$
120. In  $\text{NH}_3$  synthesis by Haber's process, what is the effect on the rate of the reaction with the addition of Mo and CO, respectively?
- (A) Increases and decreases                      (B) Decreases and decreases  
(C) Decreases and increases                      (D) Both Mo and CO increases the rate  
(E) Both Mo and CO does not affect the rate

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73	C
74	D
75	C
76	D
77	D
78	D
79	B
80	A
81	A
82	A
83	C
84	C
85	A
86	B
87	D
88	E
89	A
90	C
91	A
92	A
93	C
94	C
95	C
96	D
97	A
98	E
99	D
100	A
101	E
102	D
103	A
104	A
105	A
106	A
107	B
108	E
109	B
110	D
111	B
112	C
113	A
114	A
115	A
116	A
117	A
118	B
119	A
120	A

73.  $\text{NO}^+$  has bond order  
(A) 2 (B) 2.5 (C) 3  
(D) 3.5 (E) 4
74. Which hydride amongst the following has the least boiling point?  
(A)  $\text{NH}_3$  (B)  $\text{PH}_3$  (C)  $\text{AsH}_3$   
(D)  $\text{SbH}_3$  (E)  $\text{BiH}_3$
75. Which of the following sets has Lewis acid behaviour for all the components?  
(A)  $\text{BF}_3$  (B)  $\text{BF}_3, \text{SiF}_4, \text{PF}_5$  (C)  $\text{SiF}_4, \text{PF}_5$   
(D)  $\text{BF}_3, \text{PF}_5$  (E) (A) and (B)
76. The carbon atoms in calcium carbide are held by  
(A) Ionic bonds  
(B) Two sigma bonds  
(C) Two sigma and one coordinate bond  
(D) One sigma and two  $\pi$  bonds  
(E) One sigma and one  $\pi$  bond
77. According to the VSEPR theory, the shape of  $\text{ClO}_3^-$  would be  
(A) Linear (B) Triangular planar (C) Pyramidal  
(D) Square planar (E) Angular
78. Acetic acid in liquid ammonia behaves as  
(A) Weaker acid than that in water  
(B) Stronger acid than that in water  
(C) Base acid  
(D) Neutral acid  
(E) (C) and (D)
79. The compound(s) that does(do) not exist is(are)  
(A)  $\text{BiF}_5$  (B)  $\text{PF}_5$  (C)  $\text{AsF}_5$   
(D)  $\text{SbF}_5$  (E) All the compounds exist

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80. Rare gases are sparingly soluble in water because of  
(A) Hydrogen bonding  
(B) Dipole-dipole interaction  
(C) Induced dipole-induced dipole interaction  
(D) Dipole-induced dipole interaction  
(E) (A) and (D)
81. An example of a non-stoichiometric oxide when heated is  
(A) BeO (B) ZnO (C) MgO  
(D) CaO (E) Li<sub>2</sub>O
82. The donor atom in EDTA are  
(A) Two N and two O (B) Two N and four O (C) Four N and two O  
(D) Three N and three O (E) Two N and three O
83. Hard acids prefer to combine with  
(A) Soft bases (B) Soft acids (C) Hard acids  
(D) Hard bases (E) Salts
84. Among the following, which species represents a pseudohalide?  
(A) CN<sup>-</sup> (B) CaO (C) I<sub>2</sub>  
(D) K<sub>2</sub>Hgl<sub>4</sub> (E) BiOCl
85. PCl<sub>3</sub> is stored in a well stoppered bottle since  
(A) It decomposes in the presence of moisture  
(B) It is decomposed by light  
(C) It is highly volatile  
(D) It reacts with air to form POCl<sub>3</sub>  
(E) (A) and (C)
86. An orange solid (A) on heating gives a green residue (B), a colourless gas (C) and water vapours. The dry gas (C) upon passing over heated Mg gave a white solid (D) which upon subsequent reaction with water gave a gas (E) that gave dense white fumes with HCl. Identify (D)  
(A) Fe(NH<sub>3</sub>)Cl<sub>2</sub> (B) CuN<sub>2</sub> (C) Mg<sub>3</sub>N<sub>2</sub>  
(D) NH<sub>4</sub>Cl (E) FeCl<sub>2</sub>

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87. On passing silent electric discharge through oxygen in an ozonizer, 5.5 mol % of oxygen is converted to ozone. How many moles of  $O_2$  and  $O_3$  result when 35 moles of  $O_2$  is originally present?
- (A) 33.0 (B) 34.4 (C) 35.0  
(D) 31.8 (E) 31.0
88. Carnallite is a mineral containing
- (A) K (B) Na (C) Mg  
(D) Fe (E) (A) and (C)
89. Maximum number of photons emitted by a bulb capable of producing monochromatic light of wavelength 550 nm is \_\_\_\_\_, if 100 V and 1 A is supplied for one hour.
- (A)  $1 \times 10^{24}$  (B)  $5 \times 10^{24}$  (C)  $1 \times 10^{23}$   
(D)  $5 \times 10^{23}$  (E)  $5 \times 10^{22}$
90. Which of the following is the correct unit of angular momentum of an electron in an orbital of an atom?
- (A) J s (B) J / s (C) W / s<sup>2</sup>  
(D) W s (E) J s<sup>2</sup>
91. Consider a *fcc* lattice made of a metal cation ( $M^{n+}$ ) and three oxide anions per unit cell. The resultant structure would have
- (A) 3D network of edge shared octahedra  
(B) 3D network of corner shared octahedra  
(C) 2D network of edge shared octahedra  
(D) 2D network of corner shared octahedra  
(E) 3D network of face shared octahedra

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92. The edge length of a solid possessing cubic unit cell is  $2\sqrt{2}r$  (structure I), based on hard sphere model, which upon subjecting to a phase transition, a new cubic structure (structure II) having an edge length of  $\frac{4r}{\sqrt{3}}$  is obtained, where  $r$  is the radius of the hard sphere. Which of the following statements is true?
- (A) Density of the structure II is lower than structure I  
 (B) Density of structure II is higher than structure I  
 (C) The pore volume in structure I is 1.2 times higher than that of structure II  
 (D) The pore volume of both the structures are equal  
 (E) The octahedral voids in structure I is transformed into tetrahedral voids in structure II
93. An ideal gas "A" having volume of 1 L at 27 °C is kept in a container having movable piston and adiabatic walls in ambient condition. If 1.33 L atm of energy is supplied inside the system, find out the final temperature of the system?
- (A) 399 K                      (B) 499 K                      (C) 599 K  
 (D) 299 K                      (E) 450 K
94. A 5.2 L closed container contains some water and  $N_2(g)$  at 29 °C. The total pressure of the system and water tension are 1 atm and 0.04 atm, respectively. Upon electrolysing the liquid water inside completely, the final pressure of system was at 2 atm. What is number of moles of water that was present inside the container?
- (A)  $\frac{3.46}{RT}$                       (B)  $\frac{5.2}{RT}$                       (C)  $\frac{10.4}{RT}$   
 (D)  $\frac{0.208}{RT}$                       (E)  $\frac{8.0}{RT}$

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95. A solution of methanol in water is 20 % by volume. If the solution and pure methanol have densities of  $0.964 \text{ kg L}^{-1}$  and  $0.793 \text{ kg L}^{-1}$ , respectively, find the per cent of methanol by weight?
- (A) 15.8 (B) 16.45 (C) 20  
(D) 14.8 (E) 17.6
96. The Henry's law constant for  $\text{O}_2$  dissolved in water is  $4.34 \times 10^4 \text{ atm}$  at certain temperature. If the partial pressure of  $\text{O}_2$  in a gas mixture that is in equilibrium with water is  $0.434 \text{ atm}$ , what is the mole fraction of  $\text{O}_2$  in the solution?
- (A)  $1 \times 10^{-5}$   
(B)  $1 \times 10^{-4}$   
(C)  $2 \times 10^{-5}$   
(D)  $1 \times 10^{-6}$   
(E)  $2 \times 10^{-6}$
97. The standard heat of formation of  $\text{CH}_4$ ,  $\text{CO}_2$  and  $\text{H}_2\text{O} (\text{l})$  are  $-76.2$ ,  $-394.8$  and  $-285.82 \text{ kJ mol}^{-1}$ , respectively. Heat of vaporization of water is  $44 \text{ kJ mol}^{-1}$ . Calculate the amount of heat evolved when  $22.4 \text{ L}$  of  $\text{CH}_4$ , kept under normal conditions, is oxidized into its gaseous products
- (A)  $802 \text{ kJ}$  (B)  $878.4 \text{ kJ}$  (C)  $702 \text{ kJ}$   
(D)  $788.4 \text{ kJ}$  (E)  $500 \text{ kJ}$
98. Acetic acid dimerizes when dissolved in benzene. As a result boiling point of the solution rises by  $0.36^\circ\text{C}$ , when  $100 \text{ g}$  of benzene is mixed with "X" g of acetic acid. In this solution, if experimentally measured molecular weight of acetic acid is  $117.8$  and molar elevation constant of benzene is  $2.57 \text{ K kg mol}^{-1}$ , what is the weight % and degree of dissociation (in %) of acetic acid in benzene?
- (A) 1.62 and 98.3 (B) 0.81 and 98.3 (C) 0.5 and 86  
(D) 1 and 98.3 (E) 1.4 and 99
99. At a certain temperature, 2 moles of  $\text{CO}$  and 4 moles of  $\text{Cl}_2$  gases were reacted to form  $\text{COCl}_2$  in a  $10 \text{ L}$  vessel. At equilibrium if one mole of  $\text{CO}$  is present then equilibrium constant for the reaction is
- (A) 4 (B) 3.3 (C) 1  
(D) 2.5 (E) 4.5

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100. The equilibrium constant for the reaction,  $N_2(g) + 3H_2 \rightleftharpoons 2NH_3(g)$  and  $2N_2(g) + 6H_2 \rightleftharpoons 4NH_3(g)$  are  $K_1$  and  $K_2$ , respectively. The relationship between  $K_1$  and  $K_2$  is

- (A)  $K_2 = K_1^2$                       (B)  $K_2 = K_1^{-2}$                       (C)  $K_1 = K_2^2$   
 (D)  $K_2 = \sqrt{K_1}$                       (E)  $K_1 = \sqrt{K_2}$

101. For a first order reaction,  $A(g) \rightarrow B(g)$  at  $35^\circ C$ , the volume of "A" left in the reaction vessel at various times are given below. [Given data:  $\log(5/4) = 0.0969$ ]

$t / \text{minutes}$	0	10	20	30	40
$V / \text{mL}$	25	20	15.7	12.5	9.6

What is the value of rate constant?

- (A)  $0.02231 \text{ min}^{-1}$                       (B)  $0.04231 \text{ min}^{-1}$                       (C)  $0.06231 \text{ min}^{-1}$   
 (D)  $0.08231 \text{ min}^{-1}$                       (E)  $0.1231 \text{ min}^{-1}$

102.  $E_{\text{cell}}$  of the following cell is



- (A)  $\frac{-2.303RT}{F}$                       (B)  $\frac{2.303RT}{F}$                       (C)  $\frac{-2.303RT}{2F}$   
 (D)  $\frac{2.303RT}{2F}$                       (E)  $\frac{RT}{2F}$

103. In a lead-acid battery, if 1 A current is passed to charge the battery for 1 h, what is the amount of  $PbSO_4$  converted to  $PbO_2$ ? (Given data:  $1 F = 96500 \text{ C mol}^{-1}$ )

- (A) 0.0373 moles                      (B) 0.0186 moles                      (C) 0.0093 moles  
 (D) 0.0268 moles                      (E) 0.0400 moles

Space for rough work

104. A fuel cell operates at constant current, with  $\text{H}_2$  fuel (1 bar) and  $\text{O}_2$  oxidant (1 bar). The electrolyte used is 0.001 M HCl and the product(s) of the reaction are confined inside the fuel cell. Which of the following is true about the electrolyte?
- (A) Boiling point of the electrolyte decreases with increase in the duration of fuel cell operation
  - (B) Boiling point of the electrolyte increases with increase in the duration of fuel cell operation
  - (C) Open circuit voltage of the fuel cell remains constant with increase in duration of operation
  - (D) Open circuit voltage of the fuel cell increases with increase in duration of operation
  - (E) Both (A) and (C)
105. The correct IUPAC name for methylisopropylacetylene is
- (A) 2-methyl-4-pentyne
  - (B) 4-methyl-2-pentyne
  - (C) isopropylmethylacetylene
  - (D) 3-methyl-4-pentyne
  - (E) 2-methyl-3-pentyne
106. Cyclohexylamine and aniline can be distinguished by
- (A) Hinsberg's test
  - (B) Carbylamine test
  - (C) Bromine test
  - (D) Beilstein's test
  - (E) Lassaigne's test
107. The compounds pyridine and planar cyclooctatetraene are \_\_\_\_\_, respectively
- (A) aromatic and non-aromatic
  - (B) aromatic and anti-aromatic
  - (C) aromatic and aromatic
  - (D) anti-aromatic and non-aromatic
  - (E) anti-aromatic and anti-aromatic

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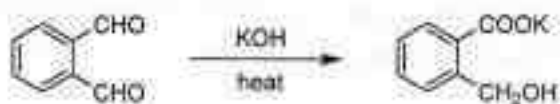
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108. Propylene on treatment with  $\text{HBr}/\text{H}_2\text{O}_2$  provides  
(A) 1-bromopropane (B) 2-bromopropane (C) 1,2-dibromopropane  
(D) 1-bromopropan-2-ol (E) 2-bromopropan-1-ol
109. \_\_\_\_\_ is a potent vasodilator.  
(A) Histamine (B) Serotonin (C) Codeine  
(D) Cimetidine (E) Aspirin
110. An invert sugar is  
(A) Isorotatory (B) Levorotatory (C) Dextrorotatory  
(D) Optically inactive (E) Mutarotatory
111. The strongest base among the following is  
(A)  $\text{NH}_2^-$  (B)  $\text{OH}^-$  (C)  $\text{CH}=\text{C}^-$   
(D)  $\text{CH}_3\text{CH}_2^-$  (E)  $\text{OEt}^-$
112. The neopentyl halide in ethanol yields alkenes by  $\text{E1}$  mechanism due to  
(A) low concentration of solvent  
(B) absence of base  
(C) it is a primary halide  
(D) steric factor which prevents  $\text{E2}$  mechanism  
(E) solvation effect
113. Arylbromides are not good candidates for  
(A) Wurtz-Fittig reaction  
(B) Fittig reaction  
(C) Friedel-Crafts reaction  
(D) Grignard reaction  
(E) Gabriel-phthalimide synthesis
114. Sulfonation of benzene with excess sulfuric acid provides  
(A) benzenesulfonic acid  
(B) *p*-benzenedisulfonic acid  
(C) *o*-benzenedisulfonic acid  
(D) *m*-benzenedisulfonic acid  
(E) decomposition of benzene

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115. The following reaction is named as



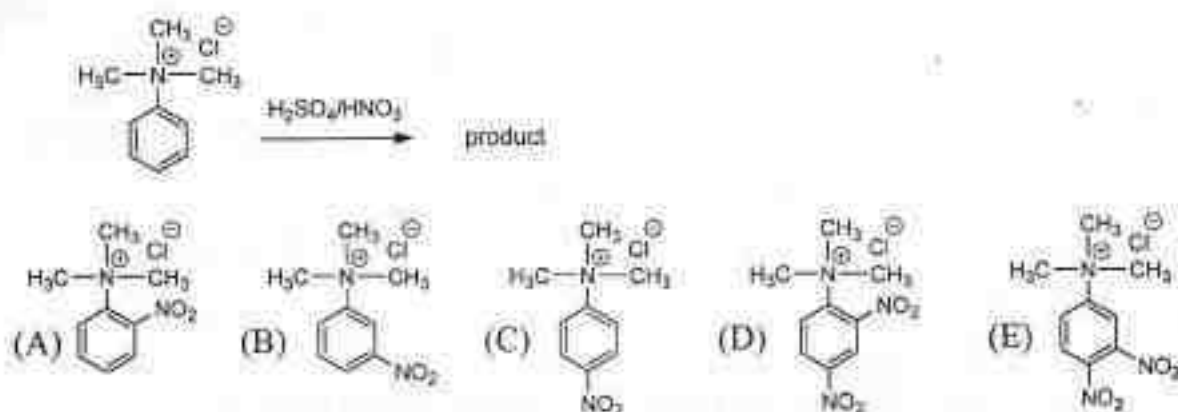
- (A) Reimer-Tiemann
  - (B) Kolbe-Schmitt
  - (C) Cannizzaro
  - (D) Gattermann
  - (E) Aldol
116. When  $C_6H_5COCOC_6H_5$  is reduced with  $LiAlH_4$ , the product formed has \_\_\_\_\_ stereoisomers.
- (A) 2
  - (B) 3
  - (C) 4
  - (D) 6
  - (E) 8
117. The compound which does not lead to benzoic acid by oxidation with  $KMnO_4$  is
- (A) toluene
  - (B) benzyl alcohol
  - (C) *n*-butylbenzene
  - (D) *t*-butylbenzene
  - (E) styrene
118. In the Hofmann rearrangement of primary amides having optically active group with S-configuration, the product amine has
- (A) R-configuration
  - (B) S-configuration
  - (C) Racemic mixture
  - (D) Meso form
  - (E) Achiral nature

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119. Benzonitrile can be prepared from benzaldehyde on treatment with

- (A)  $\text{NH}_3$
- (B)  $\text{NH}_3$  followed by hydrogenation with Ni
- (C)  $\text{NH}_2\text{OH}$
- (D)  $\text{NH}_2\text{OH}$  followed by dehydration with acetic anhydride
- (E) Hydrogen cyanide

120. The product formed in the below reaction is



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		91	B
		92	A
		93	A
		94	A
		95	B
		96	A
		97	A
		98	A
		99	B
		100	A
		101	A
		102	A
73	C	103	B
74	B	104	A
75	A	105	B
76	D	106	C
77	C	107	B
78	B	108	A
79	A	109	A
80	D	110	B
81	A	111	D
82	B	112	D
83	D	113	E
84	A	114	D
85	A	115	C
86	D	116	B
87	B	117	D
88	E	118	B
89	A	119	D
90	A	120	B

61	A	91	B
62	B	92	C
63	C	93	H
64	F	94	A
65	F	95	A
66	B	96	B
67	E	97	D
68	B	98	D
69	A	99	E
70	A	100	D
71	A	101	C
72	A	102	B
73	B	103	D
74	E	104	B
75	A	105	D
76	A	106	B
77	B	107	C
78	A	108	B
79	A	109	A
80	A	110	D
81	B	111	C
82	A	112	B
83	A	113	A
84	A	114	D
85	B	115	A
86	A	116	B
87	A	117	D
88	A	118	A
89	B	119	A
90	A	120	D

61	C	91	E
62	B	92	D
63	A	93	C
64	C	94	B
65	D	95	D
66	C	96	B
67	B	97	D
68	B	98	B
69	B	99	C
70	C	100	B
71	D	101	A
72	B	102	D
73	B	103	C
74	A	104	B
75	A	105	A
76	A	106	D
77	B	107	A
78	A	108	B
79	A	109	D
80	A	110	A
81	B	111	A
82	A	112	D
83	B	113	B
84	C	114	E
85	B	115	A
86	A	116	A
87	A	117	B
88	B	118	A
89	D	119	A
90	D	120	A

61	B	91	B
62	A	92	A
63	E	93	D
64	C	94	A
65	D	95	B
66	D	96	D
67	C	97	A
68	B	98	A
69	D	99	D
70	B	100	B
71	E	101	E
72	D	102	A
73	A	103	A
74	A	104	B
75	B	105	A
76	D	106	A
77	D	107	A
78	E	108	B
79	D	109	A
80	C	110	A
81	B	111	A
82	D	112	B
83	B	113	A
84	D	114	A
85	B	115	A
86	C	116	B
87	B	117	A
88	A	118	B
89	D	119	C
90	C	120	B

73. Which one of the following will have the largest number of atoms?  
(A) 1g Au(s)                      (B) 1g Na(s)                      (C) 1g Li(s)  
(D) 1g of Cl<sub>2</sub>(g)                      (E) 1g of O<sub>2</sub>(g)
74. An organic compound contains 24% carbon, 4% hydrogen and remaining chlorine. Its empirical formula is  
(A) CHCl                      (B) CH<sub>2</sub>Cl                      (C) CHCl<sub>2</sub>  
(D) CH<sub>3</sub>Cl                      (E) CH<sub>2</sub>Cl<sub>2</sub>
75. The IUPAC name of an element is Unbinilium. Its atomic number is  
(A) 102                      (B) 110                      (C) 120  
(D) 106                      (E) 100
76. The number of electrons, protons and neutrons in a species are equal to 10, 11 and 12 respectively. The proper symbol of the species is  
(A)  ${}_{11}^{22}\text{Na}^+$                       (B)  ${}_{11}^{22}\text{Na}$                       (C)  ${}_{10}^{23}\text{Ne}$                       (D)  ${}_{11}^{23}\text{Na}^+$                       (E)  ${}_{11}^{23}\text{Na}^{2+}$

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77. Which one of the following element is represented as Eka-Silicon in Mendeleev's periodic table?
- (A) Gallium                      (B) Germanium                      (C) Aluminium  
(D) Tin                              (E) Arsenic
78. The correct match among the following is
- (a) Lithium, Sodium, Potassium                      (i) Alkaline earth metals  
(b) Beryllium, Magnesium, Calcium                      (ii) Semi-metals  
(c) Oxygen, Sulphur, Selenium                      (iii) Alkali metals  
(d) Silicon, Germanium, Arsenic                      (iv) Chalcogens
- (A) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)  
(B) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)  
(C) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)  
(D) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)  
(E) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)
79. Which one of the following molecules is formed by  $sp^3d$  hybridisation?
- (A)  $BrF_5$                       (B)  $PF_5$                       (C)  $SF_6$                       (D)  $[Co(NH_3)_6]^{3+}$                       (E)  $[PtCl_4]^{2-}$
80. The correct order of bond energy (in kJ/mol) of the following molecules is
- (A)  $O_2 < B_2 < C_2 < N_2$                       (B)  $B_2 < C_2 < O_2 < N_2$                       (C)  $C_2 < O_2 < B_2 < N_2$   
(D)  $B_2 < O_2 < C_2 < N_2$                       (E)  $B_2 < O_2 < N_2 < C_2$
81. The type of attractive forces that operate between gaseous HCl molecules is
- (A) dipole-dipole forces                      (B) dispersion forces  
(C) ion-dipole forces                      (D) dipole-induced dipole forces  
(E) electrostatic forces

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82. Schottky defect is shown by
- (A) ionic substances in which the size of the cation is smaller than that of the anion
  - (B) ionic substances in which the cation and anion are of almost similar sizes
  - (C) ionic substances in which the size of the cation is larger than that of the anion
  - (D) non-stoichiometric inorganic solids
  - (E) non-ionic substances
83. In which one of the following reactions, entropy decreases?
- (A) Sodium chloride is dissolved in water
  - (B) Water is heated from 303K to 353K
  - (C) Sodium bicarbonate is decomposed to  $\text{Na}_2\text{CO}_3(\text{s})$ ,  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O}(\text{g})$
  - (D) Water crystallizes into ice
  - (E) Dihydrogen molecule is decomposed into hydrogen atoms
84. The standard enthalpies of formation of  $\text{H}_2\text{O}(\text{l})$  and  $\text{CO}_2(\text{g})$  are respectively  $-286 \text{ kJ mol}^{-1}$  and  $-394 \text{ kJ mol}^{-1}$ . If the standard heat of combustion of  $\text{CH}_4(\text{g})$  is  $-891 \text{ kJ mol}^{-1}$ , then the standard enthalpy of formation of  $\text{CH}_4(\text{g})$  is
- |                                |                                 |                                |
|--------------------------------|---------------------------------|--------------------------------|
| (A) $-75 \text{ kJ mol}^{-1}$  | (B) $+75 \text{ kJ mol}^{-1}$   | (C) $-211 \text{ kJ mol}^{-1}$ |
| (D) $+211 \text{ kJ mol}^{-1}$ | (E) $-1571 \text{ kJ mol}^{-1}$ |                                |

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85. The equilibrium constant for the equilibrium  $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$  at a particular temperature is  $2 \times 10^{-2} \text{ mol dm}^{-3}$ . The number of moles of  $\text{PCl}_5$  that must be taken in a one-litre flask at the same temperature to obtain a concentration of 0.20 mol of chlorine at equilibrium is
- (A) 2.0                      (B) 2.2                      (C) 1.8                      (D) 0.2                      (E) 0.1
86. The pH of the resultant solution obtained by mixing 20mL of 0.01M HCl and 20mL of 0.005M  $\text{Ca}(\text{OH})_2$  is
- (A) 2                      (B) 0                      (C) 1                      (D) 7                      (E) 5
87.  $\text{CH}_4(\text{g}) + 4\text{Cl}_2(\text{g}) \rightarrow \text{CCl}_4(\text{l}) + 4\text{HCl}(\text{g})$   
In the above reaction, the change of oxidation state of carbon is
- (A) from +4 to -4                      (B) from +1 to +4                      (C) from -4 to +4  
(D) from -1 to +1                      (E) from -4 to -1
88. How many moles of platinum will be deposited on the cathode when 0.40 F of electricity is passed through a 1.0 M solution of  $\text{Pt}^{4+}$ ?
- (A) 0.60 mol                      (B) 1.0 mol                      (C) 0.40 mol  
(D) 0.45 mol                      (E) 0.10 mol

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89. When the same amount of the solute 'P' and 'Q' are separately dissolved in 500g water, the  $\Delta T_f$  values are 0.15K and 0.30K respectively. If the molecular weight of 'P' is  $80 \text{ g mol}^{-1}$ , then the molecular weight of 'Q' is
- (A)  $30 \text{ g mol}^{-1}$                       (B)  $60 \text{ g mol}^{-1}$                       (C)  $40 \text{ g mol}^{-1}$   
(D)  $45 \text{ g mol}^{-1}$                       (E)  $160 \text{ g mol}^{-1}$
90. A solution is prepared by dissolving 20g NaOH in 1250 mL of a solvent of density 0.8 g/mL. Then the molality of the solution is
- (A)  $0.2 \text{ mol kg}^{-1}$                       (B)  $0.08 \text{ mol kg}^{-1}$                       (C)  $0.25 \text{ mol kg}^{-1}$   
(D)  $0.0064 \text{ mol kg}^{-1}$                       (E)  $0.5 \text{ mol kg}^{-1}$
91. The rate constant of a first order reaction is  $231 \times 10^{-3} \text{ s}^{-1}$ . How long will 4 g of this reactant reduce to 2 g?
- (A) 310 s                      (B) 300 s                      (C) 210 s                      (D) 30.1 s                      (E) 230.3 s
92. An endothermic reaction  $A \rightarrow B$  has an activation energy of  $13 \text{ kJ mol}^{-1}$  and the enthalpy change for the reaction is  $2 \text{ kJ mol}^{-1}$ . The activation energy of the reaction  $B \rightarrow A$  is
- (A)  $15 \text{ kJ mol}^{-1}$                       (B)  $11 \text{ kJ mol}^{-1}$                       (C)  $2 \text{ kJ mol}^{-1}$   
(D)  $-15 \text{ kJ mol}^{-1}$                       (E)  $26 \text{ kJ mol}^{-1}$

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93. Adsorption is accompanied by
- (A) decrease in enthalpy and decrease in entropy
  - (B) increase in enthalpy and decrease in entropy
  - (C) decrease in enthalpy and increase in entropy
  - (D) increase in enthalpy and increase in entropy
  - (E) no change in enthalpy and entropy
94. In the coagulation of a positive sol, the flocculating power of the ions  $\text{PO}_4^{3-}$ ,  $\text{SO}_4^{2-}$  and  $\text{Cl}^-$  decreases in the order
- (A)  $\text{PO}_4^{3-} > \text{Cl}^- > \text{SO}_4^{2-}$
  - (B)  $\text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{Cl}^-$
  - (C)  $\text{Cl}^- > \text{SO}_4^{2-} > \text{PO}_4^{3-}$
  - (D)  $\text{Cl}^- > \text{PO}_4^{3-} > \text{SO}_4^{2-}$
  - (E)  $\text{SO}_4^{2-} > \text{PO}_4^{3-} > \text{Cl}^-$
95. Which one of the following nitrates does not give the corresponding metallic oxide, nitrogen dioxide and oxygen on heating?
- (A) Lithium nitrate
  - (B) Beryllium nitrate
  - (C) Magnesium nitrate
  - (D) Calcium nitrate
  - (E) Potassium nitrate

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96. Which of the following statement is incorrect about beryllium?  
(A) Beryllium hydroxide is amphoteric.  
(B) Beryllium compounds are largely covalent.  
(C) Beryllium is not easily attacked by acids.  
(D) Beryllium exhibit coordination number of six.  
(E) Beryllium hydroxide dissolves in excess of alkali to give a beryllate ion.
97. The oxyacid of phosphorus that contains one P-OH, two P-H and one P=O bonds is  
(A) Phosphinic acid (B) Phosphoric acid  
(C) Pyrophosphoric acid (D) Hypophosphoric acid  
(E) Pyrophosphorous acid
98. Choose the correct statements about diborane  
I. It is prepared by the oxidation of sodium borohydride with iodine.  
II. It undergoes cleavage reactions with Lewis bases to give borane adducts.  
III. It is produced on an industrial scale by the reaction of  $\text{BF}_3$  with  $\text{LiAlH}_4$ .  
IV. It is readily hydrolysed by water to give borazine.  
V. It burns in oxygen and gives boron trioxide.  
(A) I, II, III (B) I, II, V (C) I, II, IV (D) II, III, IV (E) I, III, V
99. Which one of the following actinoid has no electron in 6d orbital?  
(A) Pa (B) Np (C) Lr (D) Cm (E) Pu

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Space for rough work

100. The catalyst used in the Wacker process of oxidation of ethyne to ethanal is  
 (A) Silver (B) Nickel (C) PdCl<sub>2</sub>  
 (D) V<sub>2</sub>O<sub>5</sub> (E) Ziegler catalyst
101. The correct formula of dichlorobis (triphenylphosphine) nickel(II) is  
 (A) [NiCl<sub>2</sub>(PPh<sub>3</sub>)<sub>2</sub>]Cl (B) [NiCl<sub>2</sub>(PPh<sub>3</sub>)<sub>2</sub>] (C) [NiCl<sub>2</sub>(PPh<sub>3</sub>)<sub>3</sub>]  
 (D) [NiCl(PPh<sub>3</sub>)<sub>2</sub>]Cl (E) [NiCl<sub>2</sub>(PPh<sub>3</sub>)<sub>2</sub>]
102. Which one of the following is an ambidentate ligand?  
 (A) Cl<sup>-</sup> (B) H<sub>2</sub>O (C) H<sub>2</sub>NCH<sub>2</sub>CH<sub>2</sub>NH<sub>2</sub>  
 (D) SCN<sup>-</sup> (E) C<sub>2</sub>O<sub>4</sub><sup>2-</sup>
103. Which one is not correctly matched?
- | Ore            | Composition   |
|----------------|---|
| (A) Siderite   | - FeCO <sub>3</sub>   |
| (B) Calamine   | - ZnCO <sub>3</sub>   |
| (C) Sphalerite | - ZnS   |
| (D) Kaolinite  | - [Al <sub>2</sub> (OH) <sub>4</sub> Si <sub>2</sub> O <sub>5</sub> ] |
| (E) Cuprite    | - CuCO <sub>3</sub> ·Cu(OH) <sub>2</sub>                              |
104. Which one of the following is a benzenoid aromatic compound?  
 (A) Cyclooctatetraene (B) Hexyne (C) Cyclohexane  
 (D) Toluene (E) Cyclopentadiene
105. The products obtained by the ozonolysis of 2-methylbut-1-ene are  
 (A) propanone and ethanal (B) propanone and methanal  
 (C) butanone and methanal (D) ethanal and propanal  
 (E) butanone and methanol

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Space for rough work

106. Which one of the following is not an isomer of 3-methylbut-1-yne?  
(A) 2,3-Dimethylbuta-1,3-diene      (B) Pent-1-yne      (C) Pent-2-yne  
(D) Penta-1,3-diene      (E) 2-Methylbuta-1,3-diene
107. The compound that does not undergo hydrolysis by  $S_N1$  mechanism is  
(A)  $C_6H_5CH_2Cl$       (B)  $C_6H_5CH(CH_3)Cl$       (C)  $C_6H_5Cl$   
(D)  $CH_3CH_2Cl$       (E)  $C_6H_5CH(C_6H_5)Cl$
108. Which one of the following is a secondary alcohol?  
(A) 2-methylbutan-2-ol      (B) 3-methylbutan-1-ol      (C) 2-methylbutan-1-ol  
(D) 3-methylbutan-2-ol      (E) 2,2-dimethylbutan-1-ol
109. An organic compound 'A' with molecular formula  $C_7H_6O$  forms 2,4-DNP derivative and reduces Tollens' reagent. When 'A' is heated with conc. KOH, it gives sodium benzoate and compound 'B'. The compound 'B' is  
(A) Benzene      (B) Toluene      (C) Acetophenone  
(D) Benzaldehyde      (E) Benzyl alcohol

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Space for rough work

110. Which one of the following compounds would undergo Cannizaro reaction?  
(A) 2-Methylpentanal (B) Cyclohexanone (C) 2,2-Dimethylbutanal  
(D) 1-Phenylpropanone (E) Phenylacetaldehyde
111. Which one of the following can be prepared by Gabriel phthalimide synthesis?  
(A) 2-Aminotoluene (B) Aniline (C) 4-Bromoaniline  
(D) Allylamine (E) N-Methylethanamine
112. The reagent that is used to distinguish between a secondary amine and a tertiary amine is  
(A) p-toluenesulphonyl chloride (B) dil. HCl (C) dil. NaOH  
(D)  $\text{CHCl}_3$  and alc. KOH (E) bromine water
113. Choose the correct statement of the following  
(A) Cellulose is also known as animal starch.  
(B) A linkage between two monosaccharide units through oxygen atom is called oxide linkage.  
(C) Glucose on oxidation with bromine water gives n-hexane.  
(D) Carbohydrates are used as storage molecules as starch in animals.  
(E) Water insoluble component of starch is amylopectin.
114. Among the following which one is a non-reducing sugar?  
(A) Lactose (B) Glucose (C) Sucrose (D) Maltose (E) Fructose

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Space for rough work

115. Which one of the following polymer is a copolymer formed by condensation polymerisation?  
(A) Buna-S (B) Neoprene (C) Polythene  
(D) Melamine-formaldehyde (E) Buna-N
116. Which one of the following sets forms the biodegradable polymer?  
(A) 3-Hydroxybutanoic acid and 3-hydroxypentanoic acid.  
(B) Acrylonitrile and 1,3-butadiene.  
(C) Urea and formaldehyde.  
(D) Ethylene glycol and terephthalic acid.  
(E) Adipic acid and hexamethylene diamine.
117. The antimicrobial drug that contains arsenic is:  
(A) Prontosil (B) Salvarsan (C) Sulphapyridine  
(D) Ofloxacin (E) Sulphanilamide
118. Which one of the following statements is **not** correct?  
(A) All monosaccharides are reducing sugars.  
(B) Lactose is commonly known as milk sugar.  
(C) Glucose pentaacetate does not react with hydroxylamine.  
(D) Glucose does not give 2,4- DNP test.  
(E) Glucose on oxidation with bromine water, gives saccharic acid.
119. Which one of the following is an antifertility drug?  
(A) Bithionol (B) Ofloxacin (C) Norethindrone  
(D) Aspartame (E) Terpineol
120. Which one of the following is a greenhouse gas?  
(A) Methane (B) Ethane (C) Hydrogen sulphide  
(D) Acetylene (E) Ethylene

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Space for rough work.



SEAL

*M/S*  
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		81	<b>A</b>	101	<b>E</b>
		82	<b>B</b>	102	<b>D</b>
		83	<b>D</b>	103	<b>E</b>
		84	<b>A</b>	104	<b>D</b>
		85	<b>B</b>	105	<b>C</b>
		86	<b>D</b>	106	<b>A</b>
		87	<b>C</b>	107	<b>C</b>
		88	<b>E</b>	108	<b>D</b>
		89	<b>C</b>	109	<b>E</b>
		90	<b>E</b>	110	<b>C</b>
		91	<b>B</b>	111	<b>D</b>
		92	<b>B</b>	112	<b>A</b>
73	<b>C</b>	93	<b>A</b>	113	<b>E</b>
74	<b>B</b>	94	<b>B</b>	114	<b>C</b>
75	<b>C</b>	95	<b>E</b>	115	<b>D</b>
76	<b>D</b>	96	<b>D</b>	116	<b>A</b>
77	<b>B</b>	97	<b>A</b>	117	<b>B</b>
78	<b>C</b>	98	<b>B</b>	118	<b>E</b>
79	<b>B</b>	99	<b>E</b>	119	<b>C</b>
80	<b>D</b>	100	<b>C</b>	120	<b>A</b>

61	<b>E</b>	81	<b>B</b>	101	<b>D</b>
62	<b>C</b>	82	<b>B</b>	102	<b>A</b>
63	<b>B</b>	83	<b>A</b>	103	<b>E</b>
64	<b>C</b>	84	<b>B</b>	104	<b>C</b>
65	<b>A</b>	85	<b>E</b>	105	<b>D</b>
66	<b>B</b>	86	<b>D</b>	106	<b>A</b>
67	<b>D</b>	87	<b>A</b>	107	<b>B</b>
68	<b>B</b>	88	<b>B</b>	108	<b>E</b>
69	<b>C</b>	89	<b>E</b>	109	<b>C</b>
70	<b>C</b>	90	<b>C</b>	110	<b>A</b>
71	<b>C</b>	91	<b>E</b>	111	<b>C</b>
72	<b>E</b>	92	<b>D</b>	112	<b>B</b>
73	<b>D</b>	93	<b>E</b>	113	<b>C</b>
74	<b>A</b>	94	<b>D</b>	114	<b>D</b>
75	<b>B</b>	95	<b>C</b>	115	<b>B</b>
76	<b>D</b>	96	<b>A</b>	116	<b>C</b>
77	<b>C</b>	97	<b>C</b>	117	<b>B</b>
78	<b>E</b>	98	<b>D</b>	118	<b>D</b>
79	<b>C</b>	99	<b>E</b>	119	<b>A</b>
80	<b>E</b>	100	<b>C</b>	120	<b>B</b>

**& CHEMISTRYVersion-A3**

61	<b>A</b>	81	<b>D</b>	101	<b>B</b>
62	<b>A</b>	82	<b>E</b>	102	<b>C</b>
63	<b>E</b>	83	<b>D</b>	103	<b>D</b>
64	<b>A</b>	84	<b>C</b>	104	<b>B</b>
65	<b>B</b>	85	<b>A</b>	105	<b>C</b>
66	<b>D</b>	86	<b>C</b>	106	<b>B</b>
67	<b>E</b>	87	<b>D</b>	107	<b>D</b>
68	<b>D</b>	88	<b>E</b>	108	<b>A</b>
69	<b>C</b>	89	<b>C</b>	109	<b>B</b>
70	<b>E</b>	90	<b>D</b>	110	<b>D</b>
71	<b>D</b>	91	<b>A</b>	111	<b>A</b>
72	<b>A</b>	92	<b>E</b>	112	<b>B</b>
73	<b>B</b>	93	<b>C</b>	113	<b>D</b>
74	<b>E</b>	94	<b>D</b>	114	<b>C</b>
75	<b>D</b>	95	<b>A</b>	115	<b>E</b>
76	<b>A</b>	96	<b>B</b>	116	<b>C</b>
77	<b>B</b>	97	<b>E</b>	117	<b>E</b>
78	<b>E</b>	98	<b>C</b>	118	<b>B</b>
79	<b>C</b>	99	<b>A</b>	119	<b>B</b>

61	<b>E</b>	81	<b>E</b>	101	<b>B</b>
62	<b>A</b>	82	<b>C</b>	102	<b>D</b>
63	<b>D</b>	83	<b>D</b>	103	<b>C</b>
64	<b>D</b>	84	<b>A</b>	104	<b>E</b>
65	<b>A</b>	85	<b>B</b>	105	<b>C</b>
66	<b>C</b>	86	<b>E</b>	106	<b>E</b>
67	<b>B</b>	87	<b>C</b>	107	<b>B</b>
68	<b>A</b>	88	<b>A</b>	108	<b>B</b>
69	<b>E</b>	89	<b>C</b>	109	<b>A</b>
70	<b>A</b>	90	<b>B</b>	110	<b>B</b>
71	<b>B</b>	91	<b>C</b>	111	<b>E</b>
72	<b>A</b>	92	<b>D</b>	112	<b>D</b>
73	<b>C</b>	93	<b>B</b>	113	<b>A</b>
74	<b>A</b>	94	<b>C</b>	114	<b>B</b>
75	<b>C</b>	95	<b>B</b>	115	<b>E</b>
76	<b>D</b>	96	<b>D</b>	116	<b>C</b>
77	<b>E</b>	97	<b>A</b>	117	<b>E</b>
78	<b>C</b>	98	<b>B</b>	118	<b>D</b>
79	<b>D</b>	99	<b>D</b>	119	<b>E</b>
80	<b>A</b>	100	<b>A</b>	120	<b>D</b>