



60413

ROLL No.

TEST BOOKLET No.

851

TEST FOR POST GRADUATE PROGRAMMES

CHEMISTRY

Time: 2 Hours

Maximum Marks: 450

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INSTRUCTIONS TO CANDIDATES

1. You are provided with a Test Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil the Answer Sheet. Read carefully all the instructions given on the Answer Sheet.
  2. Write your Roll Number in the space provided on the top of **this page**.  
Also write your Roll Number, Test Code, and Test Subject in the columns provided for the same on the **Answer Sheet**. Darken the appropriate bubbles with a **Ball Point Pen**.
  4. The paper consists of 150 objective type questions. All questions carry equal marks.
  5. Each question has four alternative responses marked **A, B, C** and **D** and you have to **darken** the bubble fully by a **Ball Point Pen** corresponding to the correct response as indicated in the example shown on the Answer Sheet.
  6. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.
  7. Space for rough work is provided at the end of this Test Booklet.
  8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However, you can retain the Test Booklet.
  9. Every precaution has been taken to avoid errors in the Test Booklet. In the event of any such unforeseen happenings, the same may be brought to the notice of the Observer/Chief Superintendent in writing. Suitable remedial measures will be taken at the time of evaluation, if necessary.
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**CHIMISTRY**

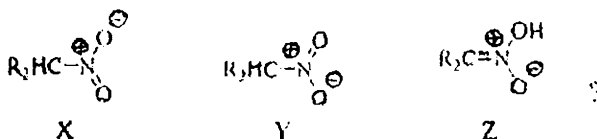
- 1 Nitration of  $C_6H_6$  and  $C_6D_6$  occurs at the same rate. This indicates that
- (A) nitration is a spontaneous process.
  - (B) the reaction follows a first order kinetics.
  - (C) the reaction follows a second order kinetics.
  - (D) C-H bond breaking is not the rate determining step.
2. Which of the following is the correct order of reactivity towards a nucleophile?
- (A) acid anhydride > amide > ester
  - (B) acid anhydride > ester > amide
  - (C) amide > ester > acid anhydride
  - (D) amide > anhydride > ester
- 3 An enantiomerically pure acid is treated with racemic mixture of an alcohol having one chiral C atom. The ester formed will be
- (A) optically active mixture
  - (B) pure enantiomer
  - (C) meso compound
  - (D) racemic mixture
4. The monomer units present in protein molecules are
- (A) hexoses
  - (B) isoprenes
  - (C)  $\alpha$ -amino acids
  - (D)  $\beta$ -lactams
5. The correct order of increasing acidity among the following is:
- (A) benzoic acid < p-methoxybenzoic acid < p-nitrobenzoic acid
  - (B) p-nitrobenzoic acid < p-methoxybenzoic acid < benzoic acid
  - (C) p-methoxybenzoic acid < benzoic acid < p-nitrobenzoic acid
  - (D) benzoic acid < p-nitrobenzoic acid < p-methoxybenzoic acid
6. Which of the following molecules has zero dipole moment?
- (A)  $CHCl_3$
  - (B)  $CH_2Cl_2$
  - (C)  $CH_3Cl$
  - (D)  $CCl_4$



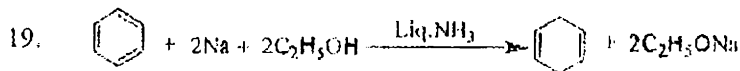
7. On hydrolysis, a molecule of sucrose is converted into
- (A) two molecules of glucose
  - (B) two molecules of fructose
  - (C) two molecules of glucose and one molecule of fructose
  - (D) one molecule of glucose and one molecule of fructose
8. Benzoic acid can be prepared by reacting phenyl magnesium bromide with
- (A) HCHO
  - (B) CO<sub>2</sub>
  - (C) COCl<sub>2</sub>
  - (D) HCOOEt
9. In a normal S<sub>N</sub>2 reaction, the configuration of carbon atom is
- (A) inverted
  - (B) retained
  - (C) racemised
  - (D) can be either inverted or retained
10. The hybridisation of C in CH<sub>3</sub><sup>+</sup> ion is
- (A) sp
  - (B) sp<sup>2</sup>
  - (C) sp<sup>3</sup>
  - (D) None of the above
11. Which of the following compounds reacts least readily in electrophilic substitution reactions?
- (A) Nitrobenzene
  - (B) Phenol
  - (C) Bromobenzene
  - (D) Toluene
12. Conversion of cyclohexene into cyclohexanol can be achieved by the following sequence of reactions:
- (A) NaOH; hydrolysis
  - (B) Br<sub>2</sub>; hydrolysis
  - (C) Hydroboration; oxidation
  - (D) Hydroboration; hydrolysis



17. Which of the following is the correct statement describing the relationship between



- (A) X, Y and Z are tautomers  
 (B) X and Y are resonance structures and Z is a tautomer  
 (C) X, Y and Z are resonance structures  
 (D) X and Y are tautomers and Z is resonance structure
18. The smallest ketone and its next homologue are reacted with  $\text{NH}_2\text{OH}$  to form oxime. In this reaction
- (A) two different oximes are formed  
 (B) three different oximes are formed  
 (C) two oximes are optically active  
 (D) all oximes are optically active



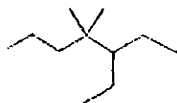
is an example of a

- (A) Birch reduction                      (B) Clemmenson reduction  
 (C) Wolf-Kischner reduction          (D) Hydride reduction
20. When benzene sulfonic acid and p-nitrophenol are treated with  $\text{NaHCO}_3$ , the gases released respectively are
- (A)  $\text{SO}_2$ ,  $\text{NO}_2$                           (B)  $\text{SO}_2$ ,  $\text{NO}$   
 (C)  $\text{SO}_2$ ,  $\text{CO}_2$                           (D)  $\text{CO}_2$ ,  $\text{CO}_2$



26. Which one of the following is the strongest base in aqueous solution?

- (A) Trimethylamine                      (B) Aniline  
(C) Dimethylamine                      (D) Methylamine

27. The IUPAC name of  is

- (A) 1, 1-diethyl-2,2-dimethylpentane  
(B) 4, 4-dimethyl-5, 5-diethylpentane  
(C) 5, 5-diethyl-4, 4-dimethylpentane  
(D) 3-ethyl-4, 4-dimethylhexane

28. Which one of the following conformations of cyclohexane is chiral?

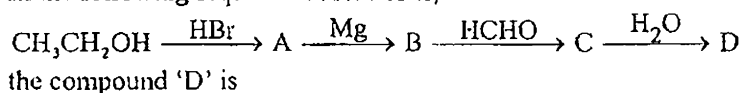
- (A) Twist boat                              (B) True boat  
(C) Chair                                      (D) None of the above

29. Which of the following is the correct order of decreasing  $S_N2$  reactivity?

- (A)  $RCH_2X > R_3CX > R_2CHX$   
(B)  $RCH_2X > R_2CHX > R_3CX$   
(C)  $R_3CX > R_2CHX > RCH_2X$   
(D)  $R_2CHX > R_3CX > RCH_2X$

(X = a halogen)

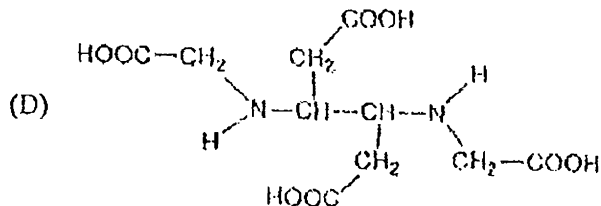
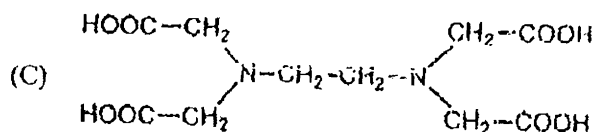
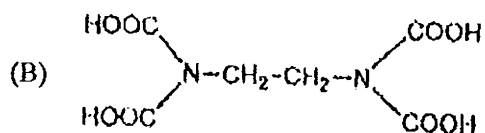
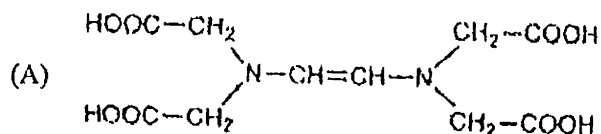
30. In the following sequence of reactions,



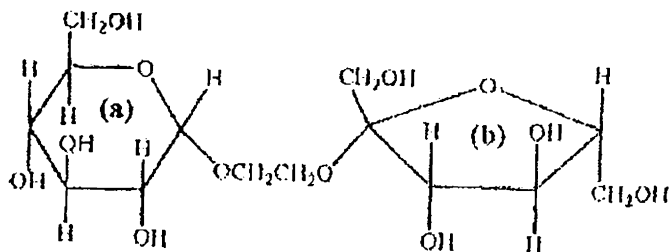
- (A) butanal                                      (B) n-butyl alcohol  
(C) n-propyl alcohol                      (D) propanal



31. The correct structure of ethylenediaminetetraacetic acid (EDTA) is



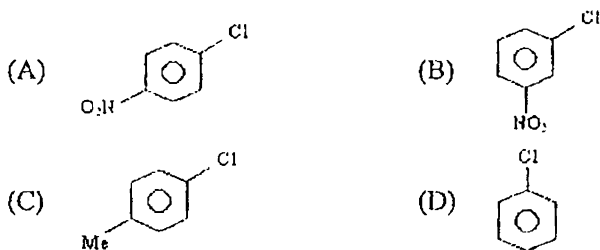
32. The correct statement about the following disaccharide is



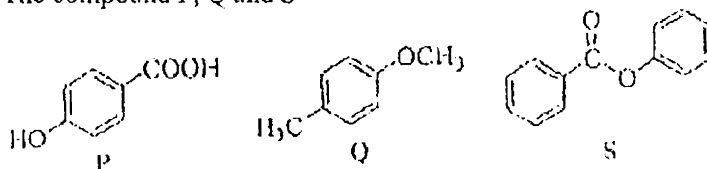
- (A) Ring (a) is pyranose with  $\alpha$ -glycosidic link  
 (B) Ring (a) is furanose with  $\alpha$ -glycosidic link  
 (C) Ring (b) is furanose with  $\alpha$ -glycosidic link  
 (D) Ring (b) is pyranose with  $\beta$ -glycosidic link



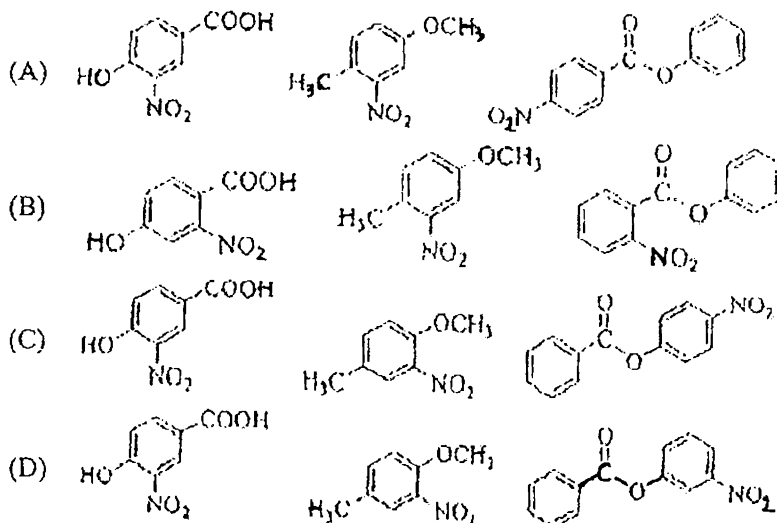
33. Which of the following will be the most reactive towards nucleophilic substitution?



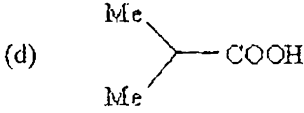
34. The compound P, Q and S



were separately subjected to nitration using  $\text{HNO}_3/\text{H}_2\text{SO}_4$  mixture. The major product formed in each case respectively, is



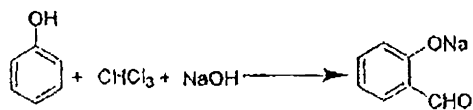


35. The increasing order of the rate of HCN addition to compounds a – d is  
 (a) HCHO (b)  $\text{CH}_3\text{COCH}_3$  (c)  $\text{PhCOCH}_3$  (d)  $\text{PhCOPh}$
- (A)  $a < b < c < d$  (B)  $d < b < c < a$   
 (C)  $d < c < b < a$  (D)  $c < d < b < a$
36. The pyrimidine bases present in DNA are
- (A) cytosine and adenine (B) cytosine and guanine  
 (C) cytosine and thymine (D) cytosine and uracil
37. Among the following mixtures, dipole-dipole as the major interaction, is present in
- (A) benzene and ethanol  
 (B) acetonitrile and acetone  
 (C) KCl and water  
 (D) benzene and carbon tetrachloride
38. Fluorobenzene ( $\text{C}_6\text{H}_5\text{F}$ ) can be synthesised in the laboratory
- (A) by heating phenol with HF and KF  
 (B) from aniline by diazotisation followed by heating the diazonium salt with  $\text{HBF}_4$   
 (C) by direct fluorination of benzene with  $\text{F}_2$  gas  
 (D) by reacting bromobenzene with NaF solution
39. Provide the correct order of increasing acid strength of the following compounds
- (a)  $\text{CH}_3\text{CO}_2\text{H}$   
 (b)  $\text{CF}_3\text{COOH}$   
 (c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$   
 (d) 
- (A)  $b < d < a < c$  (B)  $d < a < c < b$   
 (C)  $d < a < b < c$  (D)  $d < c < a < b$



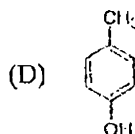
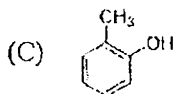
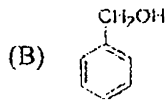
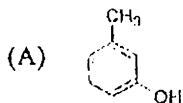


40.

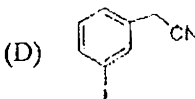
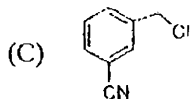
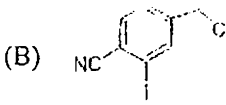
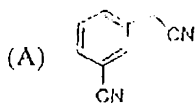
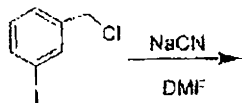


The electrophile involved in the above reaction is

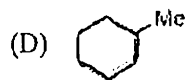
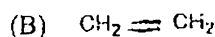
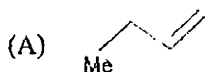
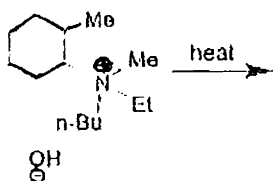
- (A) dichloromethyl cation ( $\text{CHCl}_2^+$ )  
 (B) dichlorocarbene ( $:\text{CCl}_2$ )  
 (C) trichloromethyl anion ( $\text{CCl}_3^-$ )  
 (D) formyl cation ( $\text{CHO}^+$ )
41. The structure of the compound that gives a tribromo derivative on treatment with bromine water is



42. Provide the structure of the major product formed in the following reaction



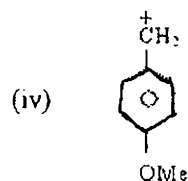
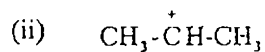
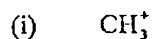
43. Predict the product of the following reaction



44. 2-Methylbutane on reacting with bromine in the presence of sunlight gives mainly
- (A) 1-bromo-2-methylbutane      (B) 2-bromo-2-methylbutane  
(C) 2-bromo-3-methylbutane      (D) 1-bromo-3-methylbutane
45. Tertiary alkyl halides are practically inert to substitution by  $\text{SN}^2$  mechanism because of
- (A) insolubility      (B) instability  
(C) inductive effect      (D) steric hindrance
46. Which one of the following methods is neither meant for the synthesis nor for separation of amines?
- (A) Hinsberg method      (B) Hofmann method  
(C) Wurtz reaction      (D) Curtius reaction
47. Which one of the following types of drugs reduces fever?
- (A) Analgesic      (B) Antipyretic  
(C) Antibiotic      (D) Tranquilliser



48. Which of the following is a fully fluorinated polymer?
- (A) Neoprene (B) Teflon  
(C) Thiokol (D) PVC
49. Alkyl halides react with dialkyl copper reagents to give
- (A) alkenes (B) alkyl copper halides  
(C) alkanes (D) alkenyl halides
50. Arrange the following carbocations (i) to (iv) in the decreasing order of stability.



- (A)  $\text{iv} > \text{ii} > \text{iii} > \text{i}$  (B)  $\text{iv} > \text{iii} > \text{ii} > \text{i}$   
(C)  $\text{i} > \text{ii} > \text{iv} > \text{iii}$  (D)  $\text{iii} > \text{iv} > \text{i} > \text{ii}$
51. Which of the following statements is true?
- (A)  $\text{H}_3\text{PO}_3$  is a stronger acid than  $\text{H}_2\text{SO}_3$   
(B) In aqueous medium  $\text{HF}$  is a stronger acid than  $\text{HCl}$   
(C)  $\text{HClO}_4$  is a weaker acid than  $\text{HClO}_3$   
(D)  $\text{HNO}_3$  is a stronger acid than  $\text{HNO}_2$



52. The dissociation energy of the  $O_2^+$  is more than that of  $O_2$  molecule. This is because
- (A)  $O_2^+$  is paramagnetic
  - (B)  $O_2^+$  carries a positive charge
  - (C)  $O_2^+$  has one electron less in the antibonding orbital
  - (D)  $O_2^+$  has stronger van der Waal's forces
53. Copper sulfate solution gets decolourised on addition of KCN. The product is
- (A)  $[Cu(CN)_4]^{2-}$
  - (B)  $Cu^{2+}$  get reduced to form  $[Cu(CN)_4]^{3-}$
  - (C)  $Cu(CN)_2$
  - (D)  $CuCN$
54. If the CO bond length in carbon monoxide is 1.128 Å, then what is the value of CO bond length in  $Fe(CO)_5$  ?
- (A) 1.15 Å
  - (B) 1.128 Å
  - (C) 1.72 Å
  - (D) 1.118 Å
55. Larger number of oxidation states are exhibited by the actinoids than those by the lanthanoids, the main reason being
- (A) 4f orbitals more diffused than the 5f orbitals
  - (B) lesser energy difference between 5f and 6d than that between 4f and 5d orbitals
  - (C) more energy difference between 5f and 6d than that between 4f and 5d orbitals
  - (D) more reactive nature of the actinoids than the lanthanoids
56. Which one of the following is the correct statement?
- (A) Boric acid is a protonic acid
  - (B) Beryllium exhibits coordination number of six
  - (C) Chlorides of both beryllium and aluminium have bridged chloride structures in solid phase
  - (D)  $B_2H_6 \cdot 2NH_3$  is known as 'inorganic benzene'



57. Amount of oxalic acid present in a solution can be determined by its titration with  $\text{KMnO}_4$  solution in the presence of  $\text{H}_2\text{SO}_4$ . The titration gives unsatisfactory result when carried out in the presence of  $\text{HCl}$ , because  $\text{HCl}$
- (A) gets oxidised by oxalic acid to chlorine
  - (B) furnishes  $\text{H}^+$  ions in addition to those from oxalic acid
  - (C) reduces permanganate to  $\text{Mn}^{2+}$
  - (D) oxidises oxalic acid to carbon dioxide and water
58. The IUPAC name for the complex  $[\text{Co}(\text{NO}_2)(\text{NH}_3)_5]\text{Cl}_2$  is
- (A) nitrito-N-pentaamminecobalt(III) chloride
  - (B) nitrito-N-pentaamminecobalt(II) chloride
  - (C) pentaamminenitrito-N-cobalt(II) chloride
  - (D) pentaamminenitrito-N-cobalt(III) chloride
59. Which one of the following sets of ions represents a collection of isoelectronic species?
- (A)  $\text{K}^+$ ,  $\text{Cl}^-$ ,  $\text{Ca}^{2+}$ ,  $\text{Sc}^{3+}$
  - (B)  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{K}^+$ ,  $\text{S}^{2-}$
  - (C)  $\text{N}^{3-}$ ,  $\text{O}^{2-}$ ,  $\text{F}^-$ ,  $\text{S}^{2-}$
  - (D)  $\text{Li}^+$ ,  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$
60. In  $\text{Fe}(\text{CO})_5$ , the  $\text{Fe}-\text{C}$  bond possesses
- (A)  $\pi$ -character only
  - (B) both  $\sigma$  and  $\pi$  characters
  - (C) ionic character
  - (D)  $\sigma$ -character only
61. Most favourable conditions for the formation of ionic bonds are
- (A) small cation and small anion
  - (B) small cation and large anion
  - (C) large cation and large anion
  - (D) large cation and small anion



62. Following statements regarding the periodic trends of chemical reactivity of the alkali metals and the halogens are given. Which of these statements gives the correct picture?
- (A) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group
  - (B) In both the alkali metals and the halogens the chemical reactivity decreases with increase in atomic number down the group
  - (C) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens
  - (D) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group
63. The ionic mobility of alkali metal ions in aqueous solution is maximum for
- (A)  $K^+$
  - (B)  $Rb^+$
  - (C)  $Li^+$
  - (D)  $Na^+$
64. How many EDTA (ethylenediaminetetraacetic acid) molecules are required to make an octahedral complex with a  $Ca^{2+}$  ion?
- (A) Six
  - (B) Three
  - (C) One
  - (D) Two
65. Which of the following oxides is amphoteric in character?
- (A)  $CaO$
  - (B)  $CO_2$
  - (C)  $SiO_2$
  - (D)  $SnO_2$
66. How do the d orbitals split in a square planar ligand field?
- (A)  $d_{x^2-y^2} > d_{xy} > d_{xz} = d_{yz} > d_{z^2}$
  - (B)  $d_{x^2-y^2} > d_{xz} = d_{yz} > d_{xy} > d_{z^2}$
  - (C)  $d_{x^2-y^2} > d_{xy} > d_{z^2} > d_{xz} = d_{yz}$
  - (D)  $d_{xy} > d_{x^2-y^2} > d_{xz} = d_{yz} > d_{z^2}$



67. Lattice energy of an ionic compound depends upon
- (A) charge on the ion only
  - (B) size of the ion only
  - (C) packing of ions only
  - (D) charge on the ion and size of the ion
68. Which of the following is the correct electronic configuration for  $\text{Fe}^{3+}$  ion?
- (A)  $[\text{Ar}]4s^2 3d^3$
  - (B)  $[\text{Ar}]3d^5$
  - (C)  $[\text{Ar}]3d^6$
  - (D)  $[\text{Ar}]4s^1 3d^4$
69. Which of the following has the greatest mass?
- (A) 200 molecules of water
  - (B) 100 atoms of Fe
  - (C) 200 molecules of  $\text{O}_2$
  - (D) 200 molecules of  $\text{CH}_4$
70. The purple colour of permanganate ion is due to
- (A) L to M charge transfer
  - (B) M to L charge transfer
  - (C) d-d transition
  - (D) f-f transition
71. Nickel ( $Z = 28$ ) combines with a uninegative monodentate ligand  $\text{X}^-$  to form a paramagnetic complex  $[\text{NiX}_4]^{2-}$ . The number of unpaired electron(s) in the nickel and geometry of this complex ion are, respectively
- (A) one, tetrahedral
  - (B) two, tetrahedral
  - (C) one, square planar
  - (D) two, square planar







77. In which of the following arrangements the order is NOT according to the property indicated against it?
- (A)  $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$  (increasing ionic size)  
(B)  $\text{B} < \text{C} < \text{N} < \text{O}$  (increasing first ionisation energy)  
(C)  $\text{I} < \text{Br} < \text{F} < \text{Cl}$  (increasing electron affinity with negative sign)  
(D)  $\text{Li} < \text{Na} < \text{K} < \text{Rb}$  (increasing metallic radius)
78. Which of the following species exhibits the diamagnetic behaviour?
- (A)  $\text{O}_2^{2-}$  (B)  $\text{O}_2$   
(C)  $\text{O}_2$  (D)  $\text{NO}$
79. Which of the following compounds shows optical isomerism?
- (A)  $[\text{Cu}(\text{NH}_3)_4]^{+2}$  (B)  $[\text{ZnCl}_4]^{-2}$   
(C)  $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{-3}$  (D)  $[\text{Co}(\text{CN})_6]^{-3}$
80. Complete the following nuclear equation.  
 ${}_{11}\text{Na}^{23} + ? \longrightarrow {}_{11}\text{Na}^{24} + {}_1\text{H}^1$
- (A)  ${}_{-1}\beta^0$  (B)  ${}_2\text{He}^4$   
(C)  ${}_0n^1$  (D)  ${}_1\text{H}^2$
81. The structure of diborane ( $\text{B}_2\text{H}_6$ ) contains
- (A) four 2c-2e bonds and two 3c-2e bonds  
(B) two 2c-2e bonds and four 3c-2e bonds  
(C) two 2c-2e bonds and two 3c-3e bonds  
(D) four 2c-2e bonds and four 3c-2e bonds
82. Which of the following molecules would you expect to be most stable?
- (A)  ${}_{33}\text{As}^{82}$  (B)  ${}_{93}\text{Np}^{237}$   
(C)  ${}_{84}\text{Po}^{214}$  (D)  ${}_{50}\text{Sn}^{118}$



83. The hybridisation which leads to square planar geometry is
- (A)  $sp^3$  (B)  $sd^3$   
(C)  $sp^2d$  (D)  $spd^2$
84. The coordination number and oxidation state of the metal ion in  $[PtCl_3(C_2H_4)]^-$  are respectively
- (A) 6 and 3 (B) 6 and 2  
(C) 4 and 2 (D) 4 and 4
85. The metal present in Vitamin B<sub>12</sub> is
- (A) Fe (B) Zn  
(C) Cu (D) Co
86. Which of the following set of lanthanides exhibit a stable +2 oxidation state?
- (A) Eu and Yb (B) Er and Pr  
(C) La and Ce (D) Sm and Nd
87. Metallic copper and iron have respectively FCC and BCC structures at room temperature. The coordination numbers of Cu and Fe in their structures are
- (A) Cu 12 and Fe 8 (B) Cu 8 and Fe 12  
(C) Cu 6 and Fe 8 (D) Cu 6 and Fe 6
88. The complexes  $[Cu(NH_3)_4][PtCl_4]$  and  $[Pt(NH_3)_4][CuCl_4]$  are an example of
- (A) ionisation isomerism (B) linkage isomerism  
(C) coordination isomerism (D) geometric isomerism
89. The CFSE will be the highest for
- (A)  $[CoF_6]^{3-}$  (B)  $[Co(CNS)_4]^{2-}$   
(C)  $[Co(NH_3)_6]^{3+}$  (D)  $[Mn(H_2O)_6]^{2+}$



90. For a transition metal ion having eight electrons in its d-orbitals, the effective magnetic moment will be
- (A)  $\sqrt{18}$  B.M                      (B)  $\sqrt{8}$  B.M  
(C)  $\sqrt{9}$  B.M                        (D)  $\sqrt{10}$  B.M
91. Among ionic bond, covalent bond, metallic bond and hydrogen bond, the weakest one is
- (A) ionic bond                        (B) covalent bond  
(C) hydrogen bond                    (D) metallic bond
92. Which one of the following combinations is likely to yield a stable molecule of the type  $XY_7$ ?
- (A) X = F, Y = I                      (B) X = Cl, Y = F  
(C) X = Br, Y = Cl                    (D) X = I, Y = F
93. The oxidation state of Fe in  $Fe_3O_4$  is
- (A)  $+8/3$                                 (B) +3 and +2 in the ratio 2:1  
(C) +3 and +2 in the ratio 1:2      (D) 0 and +8 in the ratio 2:1
94. The degree of hydration is expected to be maximum for
- (A)  $Mg^{2+}$                                 (B)  $Na^+$   
(C)  $Ba^{2+}$                                 (D)  $K^+$
95. The decreasing order of the ionic nature of the following compounds is
- (A)  $LiI > NaBr > KCl > CsF$       (B)  $NaBr > CsF > LiI > KCl$   
(C)  $CsF > KCl > NaBr > LiI$       (D)  $CsF > NaBr > KCl > LiI$
96. In Inorganic qualitative analysis,  $H_2S$  in acidic medium will NOT precipitate
- (A)  $HgS$                                 (B)  $CuS$   
(C)  $CdS$                                 (D)  $ZnS$



97. The correct order of spin-only magnetic moments (in B.M.) among the following is
- (A)  $[\text{Fe}(\text{CN})_6]^{4-} > [\text{CoCl}_4]^{2-} > [\text{MnCl}_4]^{2-}$   
(B)  $[\text{MnCl}_4]^{2-} > [\text{Fe}(\text{CN})_6]^{4-} > [\text{CoCl}_4]^{2-}$   
(C)  $[\text{Fe}(\text{CN})_6]^{4-} > [\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-}$   
(D)  $[\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-} > [\text{Fe}(\text{CN})_6]^{4-}$
98. In which of the following, the product species has a fractional bond order?
- (A)  $\text{NO} \rightarrow \text{NO}^+$                       (B)  $\text{O}_2^+ \rightarrow \text{O}_2$   
(C)  $\text{N}_2 \rightarrow \text{N}_2^-$                       (D)  $\text{O}_2 \rightarrow \text{O}_2^{2-}$
99. The number of  $90^\circ$  and  $180^\circ$  F-S-F bonds in  $\text{SF}_4$  are respectively
- (A) 4 and 1                              (B) 4 and 2  
(C) 4 and 4                              (D) 2 and 2
100. When iodine reacts with hot concentrated alkali, the difference between the oxidation states of iodine in the products formed and the reactant is
- (A) +6                                      (B) +4  
(C) -1                                      (D) +5
101. A radioactive element gets spilled over the floor of a room. Its half-life period is 30 days. If the initial activity is ten times the permissible value, after how many days will it be safe to enter the room?
- (A) 1000 days                              (B) 300 days  
(C) 10 days                                (D) 100 days
102. Identify the correct statement regarding a spontaneous process
- (A) For a spontaneous process in an isolated system, the change in entropy is positive  
(B) Endothermic processes are never spontaneous  
(C) Exothermic processes are always spontaneous  
(D) Lowering of energy in the reaction process is the only criterion for spontaneity



103. The unit of rate constant (k) for the zero order reaction is
- (A)  $s^{-1}$  (B)  $L mol^{-1} s^{-1}$   
(C)  $mol L^{-1} s^{-1}$  (D)  $L mol s^{-1}$
104. The first and second dissociation constants of an acid  $H_2A$  are  $1.0 \times 10^{-5}$  and  $5.0 \times 10^{-10}$  respectively. The overall dissociation constant of the acid will be
- (A)  $5.0 \times 10^{-5}$  (B)  $5.0 \times 10^{15}$   
(C)  $5.0 \times 10^{-15}$  (D)  $0.0 \times 10^{15}$
105. Hydrogen bomb is based on the principle of
- (A) nuclear fission (B) natural radioactivity  
(C) nuclear fusion (D) artificial radioactivity
106. Which one of the following aq. solutions has the highest boiling point?
- (A) 0.1 M  $BaCl_2$  (B) 0.1 M urea  
(C) 0.1 M NaCl (D) 0.1 M glucose
107. Among the following aqueous solution has the highest electrical conductivity.
- (A) 0.1 M acetic acid (B) 0.1 M chloroacetic acid  
(C) 0.1 M fluoroacetic acid (D) 0.1 M difluoroacetic acid
108. Consider an endothermic reaction,  $X \rightarrow Y$ . The activation energies are  $E_b$  and  $E_f$  for the backward and forward reactions respectively. In general,
- (A)  $E_b < E_f$   
(B)  $E_b > E_f$   
(C)  $E_b = E_f$   
(D) There is no definite relation between  $E_b$  and  $E_f$



109. Which one of the following statements is not true about the effect of an increase in temperature on the distribution of molecular speeds in a gas?
- (A) The most probable speed increases.
  - (B) The fraction of the molecules with the most probable speed increases.
  - (C) The distribution becomes broader.
  - (D) The area under the distribution curve remains the same as under the lower temperature.
110. Benzene and toluene form nearly ideal solutions. At 20°C, the vapour pressure of benzene is 75 torr and that of toluene is 22 torr. The partial vapour pressure of benzene at 20°C for a solution containing 78 g of benzene and 46 g of toluene in torr is
- (A) 50
  - (B) 25
  - (C) 37.5
  - (D) 53.5
111. Two solutions of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5 M first solution + 520 ml of 1.2 M second solution. What is the molarity of the final?
- (A) 1.20 M
  - (B) 1.50 M
  - (C) 1.344 M
  - (D) 2.70 M
112. Hydrogen ion concentration in mol/L in a solution of pH = 5.4 will be
- (A)  $3.98 \times 10^9$
  - (B)  $3.88 \times 10^6$
  - (C)  $3.68 \times 10^{-6}$
  - (D)  $3.98 \times 10^{-6}$
113. A reaction involving two different reactants can never be
- (A) unimolecular reaction
  - (B) first order reaction
  - (C) second order reaction
  - (D) bimolecular reaction
114. During the process of electrolytic refining of copper, some metals present as impurity settle as 'anode mud'. These are
- (A) Sn and Ag
  - (B) Pb and Zn
  - (C) Ag and Au
  - (D) Fe and Ni



115. The disperse phase in colloidal iron(III) hydroxide and colloidal gold is positively and negatively charged, respectively. Which of the following statements is not correct?
- (A) Magnesium chloride solution coagulates, the gold sol more readily than the iron (III) hydroxide sol.
  - (B) Sodium sulphate solution causes coagulation in both sols.
  - (C) Mixing the sols has no effect.
  - (D) Coagulation in both sols can be brought about by electrophoresis.
116. What should be the age of fossil for meaningful determination of its age?
- (A) 6 years
  - (B) 6000 years
  - (C) 60,000 years
  - (D) Any age
117. What is the conjugate base of  $\text{OH}^-$ ?
- (A)  $\text{O}_2$
  - (B)  $\text{H}_2\text{O}$
  - (C)  $\text{O}^-$
  - (D)  $\text{O}^{2-}$
118. Which of the following is correct for lyophilic sols?
- (A) They are irreversible.
  - (B) They are formed by inorganic substances.
  - (C) They are readily coagulated by addition of electrolytes.
  - (D) They are self stabilised.
119. Equimolar solutions in the same solvent have
- (A) same boiling point but different freezing point
  - (B) same freezing point but different boiling point
  - (C) same boiling and same freezing points
  - (D) different boiling and different freezing points

120. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is
- (A) +4 (B) +6  
(C) +2 (D) +3
121. Calomel ( $\text{Hg}_2\text{Cl}_2$ ) on reaction with ammonium hydroxide gives
- (A)  $\text{HgNH}_2\text{Cl}$  (B)  $\text{NH}_2\text{-Hg-Hg-Cl}$   
(C)  $\text{Hg}_2\text{O}$  (D)  $\text{HgO}$
122. If we consider that  $\frac{1}{6}$  mass of carbon atom, in place of  $\frac{1}{12}$  mass of carbon atom, is taken to be the relative atomic mass unit, the mass of one mole of a substance will
- (A) decrease twice  
(B) increase two fold  
(C) remain unchanged  
(D) be a function of the molecular mass of the substance
123. For a spontaneous reaction the  $\Delta G$ , equilibrium constant (K) and  $\Delta S$  will be respectively
- (A)  $-ve, > 1, +ve$  (B)  $+ve, > 1, -ve$   
(C)  $-ve, < 1, -ve$  (D)  $-ve, > 1, -ve$
124. Consider the reaction:  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ , carried out at constant temperature and pressure. If  $\Delta H$  and  $\Delta U$  are the enthalpy and internal energy changes for the reaction, which of the following expressions is true?
- (A)  $\Delta H = 0$  (B)  $\Delta H = \Delta U$   
(C)  $\Delta H < \Delta U$  (D)  $\Delta H > \Delta U$





125. Which of the following option is correct?
- (A) In living organisms, circulation of  $^{14}\text{C}$  from atmosphere is high so the carbon content is constant in organism.
  - (B) Carbon dating can be used to find out the age of Earth crust and rocks.
  - (C) Radioactive absorption due to cosmic radiation is equal to the rate of radioactive decay, hence the carbon content remains constant in living organism.
  - (D) Carbon dating cannot be used to determine concentration of  $^{14}\text{C}$  in dead beings.
126. A reaction was found to be second order with respect to the concentration of carbon monoxide. If the concentration of carbon monoxide is doubled, with everything else kept as the same, the rate of reaction will
- (A) remain unchanged
  - (B) triple
  - (C) increase by a factor of 4
  - (D) double
127. In Langmuir's model of adsorption of a gas on a solid surface
- (A) the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered.
  - (B) the adsorption at a single site on the surface may involve multiple molecules at the same time.
  - (C) the mass of gas striking a given area of surface is proportional to the pressure of the gas.
  - (D) the mass of gas striking a given area of surface is independent of the pressure of the gas.
128. Each of the two 1.0 L steel cylinders contains 1.0 mole of gas at  $0^\circ\text{C}$ . One cylinder contains  $\text{CO}_2$ , and the other contains  $\text{O}_2$ . Both cylinders
- (A) have the same pressure
  - (B) have the same mass
  - (C) have the same density
  - (D) are at STP



129. Which one of the following is not a basic postulate of the kinetic theory of gases?
- (A) Molecules in a gas have negligible volume
  - (B) Particles of a gas repel each other
  - (C) The gas particles have no attractive forces
  - (D) Pressure of a gas originates from the collision of the gas particles against the vessel walls
130. 500 mL of a solution of pH = 2 is mixed with 500 mL of a solution of pH = 3. Which of the following best describes the resulting mixture?
- (A) Acidic
  - (B) Alkaline
  - (C) Basic
  - (D) Neutral
131. Limestone (calcium carbonate) is decomposed by heat to make lime (calcium oxide). In a closed system equilibrium is established:
- $$\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$$
- Which of the following statements is true?
- (A) Addition of more  $\text{CaCO}_3(\text{s})$  at constant temperature will shift the equilibrium to the right.
  - (B) Addition of more  $\text{CaO}(\text{s})$  will shift the equilibrium to the left.
  - (C) Increasing the surface area of the  $\text{CaO}(\text{s})$  will shift the equilibrium to the left.
  - (D) Increasing the pressure of  $\text{CO}_2$  will shift the equilibrium to the left.
132. Which one of the following statements is true?
- (A)  $\text{H}_2\text{O}$  has a greater dipole moment than  $\text{H}_2\text{S}$
  - (B)  $\text{H}_2\text{O}$  is polar, but  $\text{H}_2\text{S}$  is non-polar
  - (C) The molecules  $\text{H}_2\text{S}$  and  $\text{H}_2\text{O}$  are both linear
  - (D) The molecules  $\text{H}_2\text{S}$  and  $\text{H}_2\text{O}$  both have zero dipole moment



133. What is the mass of one molecule of nitrogen gas  $N_2$ ?
- (A)  $14.0 / (2 \times 6.02 \times 10^{23}) g$       (B)  $14.0 / (6.02 \times 10^{23}) g$   
(C)  $2 \times 14.0 / (6.02 \times 10^{23}) g$       (D)  $6.02 \times 10^{23} / 28 g$
134. Which radioactive isotope is used in geological dating?
- (A) uranium-238      (B) iodine-131  
(C) cobalt-60      (D) technetium-99
135. Which particle cannot be accelerated in a magnetic field?
- (A) Alpha particle      (B) Beta particle  
(C) Neutron      (D) Proton
136. The angular momentum of an electron in an orbital is given by
- (A)  $n(h/2\pi)$       (B)  $l(h/2\pi)$   
(C)  $\sqrt{l(l+1)} (h/2\pi)$       (D)  $m(h/2\pi)$
137. A dilute aqueous solution of sodium sulphate is electrolysed using Pt electrodes. The products formed at the cathode and anode are, respectively
- (A)  $H_2$  and  $O_2$       (B) Na and  $S_2O_8^{2-}$   
(C) Na and  $O_2$       (D)  $H_2$  and  $S_2O_8^{2-}$
138. The half life of a radioactive element is 140 days. After 560 days, one gram of element will reduce to
- (A)  $\frac{1}{2} g$       (B)  $\frac{1}{4} g$   
(C)  $\frac{1}{8} g$       (D)  $\frac{1}{16} g$
139. The plot of  $\log k$  versus  $1/T$  is linear with a slope of
- (A)  $E_a/R$       (B)  $-E_a/R$   
(C)  $E_a/2.303 R$       (D)  $-E_a/2.303 R$



140. For the first order decomposition reaction of  $N_2O_5$  written as  
 $2 N_2O_5(g) \rightarrow 4NO_2 + O_2(g)$ , rate =  $k[N_2O_5]$   
and  $N_2O_5(g) \rightarrow 2NO_2 + 1/2O_2(g)$ , rate =  $k'[N_2O_5]$ ,  
k and k' are related as
- (A)  $k = k'$  (B)  $\frac{1}{2} k = k'$   
(C)  $2k = k'$  (D)  $k = 1/k'$
141. An alloy of gold and copper crystallizes in a cubic lattice with gold atoms occupying the corners of the cube and the copper atoms at the centres of each the cubic faces. The empirical formula of the alloy is
- (A) AuCu (B) AuCu<sub>3</sub>  
(C) Au<sub>2</sub>Cu<sub>3</sub> (D) Au<sub>3</sub>Cu
142. In a diffraction experiment, Bragg reflections are observed for an FCC lattice only when
- (A) h,k,l values are all odd or all even  
(B) h,k,l values are all odd  
(C) h,k,l values are all even  
(D) h+k+l values are even
143. According to band theory of solids, conduction occurs in metals because
- (A) valence band is full  
(B) band gap has a finite value  
(C) the valence and conduction band overlap  
(D) transition occurs between valence and conduction band
144. In the electrolysis of a concentrated brine solution, amount of chlorine gas produced by passage of 2 Faraday of electricity is
- (A) 0.25 mol (B) 0.5 mol  
(C) 1 mol (D) 2 mol

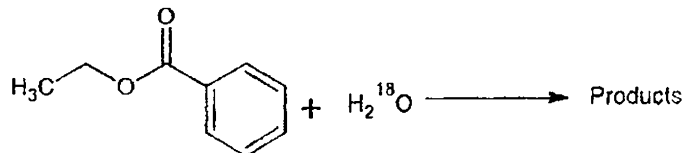


145.  $\Delta H_f^\circ$  for  $\text{CO}_2(\text{g})$ ,  $\text{CO}(\text{g})$  and  $\text{H}_2\text{O}(\text{g})$  are  $-393.5$ ,  $-110.5$  and  $-241.8$   $\text{kJ mol}^{-1}$  respectively. The standard enthalpy change (in  $\text{kJ mol}^{-1}$ ) for the reaction  $\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})$  is
- (A) 41.2 (B) -41.2  
(C) -262.5 (D) 524.1
146. Combination of  $\text{NaCl} + \text{KBr} + \text{H}_2\text{O}$  forms an example for component system.
- (A) 1 (B) 2  
(C) 3 (D) 4
147. Optimum cell potential (OCV) of dry (Laclanch) cell is
- (A) 1.5 V (B) 1.2 V  
(C) 2.1 V (D) 1.1 V
148. Pick the correct statement from the following:
- (A) Fuel cell is not a storer  
(B) Primary battery is reversible  
(C) Secondary battery is irreversible  
(D) Mg - dry cell is reversible
149. An example for the formation of complete series of solid solution is
- (A) water - ethanol (B)  $\text{O}_2 - \text{N}_2$   
(C) gold - platinum (D)  $\text{NaCl} - \text{CuSO}_4$
150. BET adsorption is related to
- (A) monolayer adsorption  
(B) multilayer adsorption  
(C) multilayer absorption  
(D) not at all related to adsorption

13. Which among the following will undergo self addition under basic conditions to give aldol?

- (A) Acetaldehyde (B) Benzaldehyde  
(C) Formaldehyde (D) o-hydroxybenzaldehyde

14. Consider the reaction

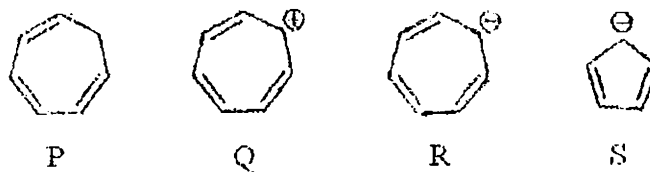


The products are

- (A) Ph-C(O)OH + C<sub>2</sub>H<sub>5</sub>OH (B) Ph-C(O)<sup>18</sup>OH + C<sub>2</sub>H<sub>5</sub>OH  
(C) Ph-C(O)<sup>18</sup>OH + C<sub>2</sub>H<sub>5</sub><sup>18</sup>OH (D) Ph-C(O)OH + C<sub>2</sub>H<sub>5</sub><sup>18</sup>OH
15. Toluene reacts with bromine in the presence of UV light to give

- (A) o-bromotoluene (B) p-bromotoluene  
(C) both o-and p-bromotoluene (D) benzyl bromide

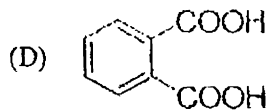
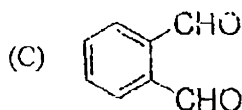
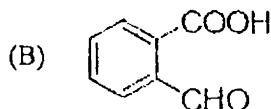
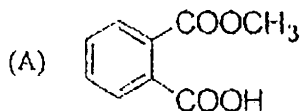
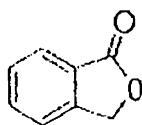
16. Which of the following are aromatic?



- (A) P and Q (B) Q and R  
(C) Q and S (D) P and S



21. Which of the following reactants on reaction with conc. NaOH followed by acidification gives the following lactone as the only product?



22. The secondary structure of protein refers to
- $\alpha$ -helical backbone
  - hydrophobic interactions
  - sequence of  $\alpha$ -amino acids
  - fixed configuration of the polypeptide backbone
23. The reaction of toluene with  $\text{Cl}_2$  in presence of  $\text{FeCl}_3$  gives predominantly
- benzoyl chloride
  - benzyl chloride
  - o*- and *p*-chlorotoluene
  - m*-chlorotoluene
24. Presence of a nitro group in a benzene ring
- activates the ring towards electrophilic substitution
  - renders the ring basic
  - deactivates the ring towards nucleophilic substitution
  - deactivates the ring towards electrophilic substitution
25. Which of the following hydrogen bonds is the strongest?
- $\text{O}-\text{H}\cdots\text{N}$
  - $\text{F}-\text{H}\cdots\text{F}$
  - $\text{O}-\text{H}\cdots\text{O}$
  - $\text{O}-\text{H}\cdots\text{F}$