BHU M.Sc. Chemistry Entrance -2013

Instructions:

(1) Attempt as many questions as you can. Each question carries 3 marks. One mark will be deducted for each incorrect answer. Zero mark will be answered for each unattempted questions.

(2) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

1. Figures defining precision do not include
   (a) absolute standard deviation (b) relative standard deviation
   (b) coefficient of variance (d) limit of detection

2. Which of the following statements is false?
   (a) A precise measurement may be inaccurate
   (b) An accurate measurement is always precised.
   (c) Accuracy applies only to attribute data whereas precision to attribute both simple data and geographic data.
   (d) High accuracy and high precision are both expensive and difficult to aquire

3. Absorption chromatography is also known as
   (a) Liquid-liquid chromatography (b) Liquid-gas chromatography
   (c) Liquid-solid chromatography (d) Paper chromatography

4. Adsorption chromatography is the best separation technique for
   (a) charged species (b) non-polar compounds
   (c) compounds bearing lone pair (d) compounds bearing halide groups

5. Which one of the following is 2-D chromatography?
   (a) Gas chromatography (b) HPLC
   (c) Paper chromatography (d) Ion-exchange chromatography

6. Which one of the following is not a planar chromatography?
   (a) High performance liquid chromatography
   (b) High performance thin layer chromatography
   (c) Paper chromatography
   (d) Electrochromatography

7. The precision of the mean of a series of N measurements can be beter represented as
   (a) $S/\sqrt{N}$ (b) S/N (c) $S/\sqrt{N-1}$ (d) S/N – 1

8. The efficiency of a chromatographic column can be increased by
   (a) increasing plate height (b) decreasing plate height
   (c) increasing length of the column (d) decreasing length of the column

9. The number of plates (N) can be computed in terms of the retention time of a peak t_R and the width of the peak at its base W by the relationship
   (a) $N = 16\left(\frac{W}{t_R}\right)^2$ (b) $N = 16\left(\frac{t_R}{W}\right)^2$ (c) $N = 16\left(\frac{t_R}{W}\right)^{1/2}$ (d) $N = 16\left(\frac{W}{t_R}\right)^{1/2}$

10. EDTA stands for
    (a) ethylene diamine tetraacetic acid
    (b) disodium salt of ethylene diamine tetraacetic acid
    (c) tetrasodium salt of ethylene diamine tetraacetic acid
    (d) ethylene diamine.

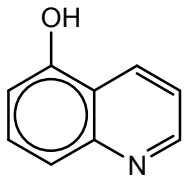
11. Liquid-liquid chromatography is also called as
(a) ion-exchange chromatography (b) affinity chromatography
(c) adsorption chromatography (d) partition chromatography

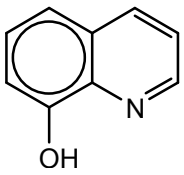
12. The reverse-phase chromatography is one
(a) In which the stationary phase is polar and mobile phase is non-polar
(b) In which the stationary phase is non-polar and mobile phase is polar
(c) In which both phase are non-polar
(d) In which both phases are polar

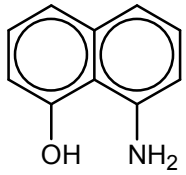
13. The solute polarities are in the order A > B > C. In reverse-phase chromatography the order of elution will be
(a) A > B > C (b) C > B > A (c) B > C > A (d) B > A > C

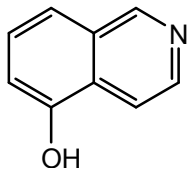
14. Which statement(s) are true?
(a) Cation-exchange resins have primary amine groups
(b) Cation-exchange resins have sulfonic acid groups.
(c) Anion-exchange resins have tertiary amine groups
(d) Anion-exchange resins have carboxylic acid groups
Answer codes:
(a) [A] and [D] (b) [B] and [C] (c) [A] and [C] (d) [B] and [C]

15. Which statement is correct?
(a) Ion-exchange and ion-exclusion chromatography are same techniques
(b) Ion-exchange and ion-chromatography are same technique
(c) Adsorption and partition chromatography as same techniques
(d) Ion-paired and ion-exclusion chromatography are same techniques

16. Identify the structure of oxine
(a) 

(b) 

(c) 

(d) 

17. Oxine forms complexes with metal ions in
(a) deprotonated state (b) protonated state
(c) neutral state (d) zwitterionic state

18. One mole of potassium bromate in bromate-bromide reaction produces
(a) One mole Br_2 (b) Two moles Br_2 (c) Three moles Br_2 (d) Four moles Br_2.

19. Which one is redox indicator?
(a) Methyl red (b) Fluorescein (c) Ferroin (d) Phenolphthalein

20. Which Ce(IV) solution is stable enough for a year or at 100ºC temperature?
(a) Basic Ce(IV) solution (b) Acidic Ce(IV) solution
(c) Neutral Ce(IV) solution (d) Complex form of Ce(IV) solution

21. As(III) oxide is used in standardizing reagent as a primary standard. The best method to prepare a standard solution of As (III) oxide is
(a) dissolving weighed amount of As_2O_3 in water
(b) dissolving weighed amount of As_2O_3 in acidic water
(c) dissolving weighed amount of As_2O_3 in a basic water followed by neutralisation with an acid.
(d) dissolving weighed amount of As_2O_3 in acid followed by neutralisation with a base.

22. If you do not have Eriochrome Black-T for complexometric titration, can you perform this titration?
(a) Not at all
(b) Yes, with the use of an alternative indicator like phenolphthalein
(c) Yes, with the use of an alternative indicator like ferroin
(d) Wait until a suitable metallochromic indicator is procured.

23. EDTA often combines with metal ion (regardless the charge on the cation) in the ratio of
(a) 1 : 4 (b) 1 : 3 (c) 1 : 2 (d) 1 : 1

24. Metal ions through oxinate precipitation can be estimated by
(a) bromate titration (b) direct titration
(c) back titration (d) colourimetric titration

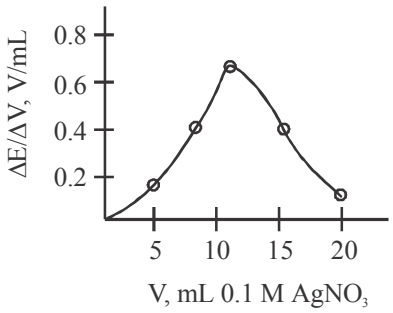
25. EDTA titrations require a buffer of pH
(a) 12 (b) 10 (c) 4 (d) 6

26. In the titratio of iron (II) with cerium (IV), the equivalence point potential (E_{eq}) is

(a) $E_{eq} = E^0_{Fe^{3+}/Fe^{2+}} + E^0_{Ce^{+4}/Ce^{3+}}$ (b) $E_{eq} = \frac{E^0_{Fe^{3+}/Fe^{2+}} + E^0_{Ce^{+4}/Ce^{3+}}}{2}$

(c) $E_{eq} = 2\left(E^0_{Fe^{3+}/Fe^{2+}} + E^0_{Ce^{+4}/Ce^{3+}}\right)$ (d) $E_{eq} = E^0_{Ce^{+4}/Ce^{3+}} - E^0_{Fe^{3+}/Fe^{2+}}$

27. In the following potentiometric titration curve for the determination of chloride with silver nitrate.



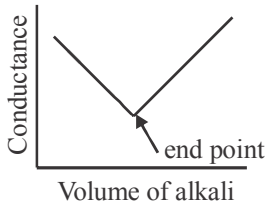
the equivalence point is

(a) 10 mL (b) 20 mL (c) 15 mL (d) 22 mL

28. The equivalence point pH in the titration of acetic acid with standard sodium hydroxide is:
(a) in acidic range (b) in basic range (c) in mild acidic range (d) neutral

29. The pH values at 0, 10, 90 and 100% titration of 50.0 mL of 0.100 M HCl with 0.100 M NaOH are
(a) 1.0, 1.09, 2.28, 7.00 (b) 1.1, 1.20, 2.50, 7.50
(c) 0.1, 0.11, 0.23, 0.70 (d) 1.09, 1.00, 7.00, 2.28

30. The conductometric graph given below



represents a titration involving
(a) strong acid against strong base (b) strong acid against weak base
(c) strong base against weak acid (d) weak base against weak acid.

31. Phenolphthalein ($K_{In} = 1\times10^{-9}$) is used as an indicator when transition pH is in the range of
(a) 1–4 (b) 4–6 (c) 8–10 (d) 10–12

32. Which of the following relationships is correct one?

(a) $\log \%T = \frac{I_t}{I_0}\times100$ (b) $A = 2.0 - \log \%T$

(c) $\log \%T = \frac{I_0}{I_t}\times100$ (d) $\log \%T = 2.0 - A$

33. The unit of 'molar absorptivity' is
(a) L mol cm^{-1} (b) L mol cm
(c) L^{-1} mol^{-1} cm^{-1} (d) L mol^{-1} cm^{-1}

34. Beer's law is obeyed for a complex when it is formed by taking
(a) metal in large excess (b) ligand in large excess
(c) metal : ligand mole ratio 1.0 (d) metal : ligand mole ratio greater than 1.0

35. Beer's law is obeyed in the case of an aqueous solution of a weak acid, if
(a) solution is made acidc (b) solution is made basic
(c) solution is made neutral (d) solution is made dilute

36. A 7.25×10^{-5} M $KMnO_4$ solution has transmittance 10%, when measured in a 2.10 cm cell at a wavelength of 525 nm. The absorbance of this solution is
(a) 2.00 (b) 1.00 (c) 0.20 (d) 0.10

37. The distribution constant (K) for iodine between an organic solvent and water is 85. What is the concentration of I_2 remaining in the aqueous layer after extraction of 50.0 mL of 1.00×10^{-3} M I_2 with the 50.0 mL of the organic solvent?
(a) 1.00×10^{-3} M (b) 5.28×10^{-7} M (c) 1.16×10^{-5} M (d) 5.29×10^{-10} M

38. Green gases responsible for acid rains are
(a) hydrocarbon and CO (b) CO_x and NO_x
(c) NO_x and SO_x (d) CO and CO_2

39. Which ion is isoelectronic with F^-?
(a) Li^+ (b) Cl^- (c) Ca^{2+} (d) O^{2-}

40. How many protons are there in the nucleus of a ^{15}N atom?
(a) 6 (b) 7 (c) 8 (d) 10

41. Which one of the following elements normally exists in the form of diatomic molecules?
(a) Sodium (b) Aluminium (c) Xenon (d) Iodine

42. From each pair given below identify the ion which is smaler in size

$$\left[Co^{2+}, Co^{3+}\right]\left[K^+, Ca^{2+}\right]\left[Na^+, F^-\right]\left[S^{2-}, Se^{2-}\right]$$

(a) $Co^{2+}, K^+, F^-, S^{2-}$ (b) $Co^{3+}, Ca^{2+}, Na^+, S^{2-}$

(c) $Co^{2+}, Ca^{2+}, F^-, S^{2-}$ (d) $Co^{3+}, K^+, Na^+, Se^{2-}$

43. Which one among the following molecules has a linear structure?
(a) hydrogen sulphide (b) Sulphur dioxide
(c) Ozone (d) Hydrogen cyanide

44. What is the minimum volume of carbon dioxide at STP required to completely convert 1 mole of calcium oxide to calcium carbonate?
(a) 22 L (b) 44 L (c) 56 L (d) 28 L

45. Which molecules form strong H-bonds?
(a) H–F and H–Cl (b) H_2O and HCl (c) H_2O and H_2S (d) HF and H_2O

46. The bond angles in boron trifluride molecule are
(a) 90 degrees (b) 109 degrees (c) 120 degrees (d) 104 degrees

47. Which one of the following sets contains one element each from s-block, p-block, d-block?
(a) Na, Rb, Fe (b) Cs, Ru, Bi (c) B, Br, Sr (d) Sc, Pt, Te

48. What is the maximum volume of oxygen at STP that will evolve when an aqueous solution containing 1 mole of hydrogen peroxide is boiled?
(a) 22 L (b) 11 L (c) 44 L (d) 6 L

49. 10 ml of 0.10 M sodium hydroxide is added to 10 ml 0.10 M sulphuric acid and the resultant solution is titrated against 0.20 M sodium hydroxide. What will be the titre value at the end point?
(a) 5 ml (b) 10 ml (c) 20 ml (d) 30 ml

50. A Lewis base
(a) acts as an electron pair donor (b) acts as an electron pair acceptor
(c) always ionizes to give protons (d) always ionizes to give hydroxide ions

51. What is the formal oxidation number of the element 'E' in the formula $[H_4E_4O_9]^{2-}$?
(a) 2.5 (b) 3 (c) 3.5 (d) 4

52. What is the change (n) on the molecule $[Cr(C_5H_5)_2]_n$, where Cr is in the +2 oxidation state and C_5H_5 is the anion, cyclopentadienyl (–1)?
(a) 0 (b) –1 (c) –2 (d) +1

53. An aqueous solution of a substance gives a white precipitate when a few drops of sodium hydroxide are added. The precipitate dissolves when excess of sodium hydroxide is added. The substance may be
(a) barium chloride (b) aluminium chloride
(c) cadmium chloride (d) calcium chloride

54. Which reagent may be used to precipitate Fe^{2+} ions from aqueous solutions?
(a) sodium chloride (b) Barium chloride
(c) Ammonium chloride (d) Sodium hydroxide

55. Which is the most common oxidation state observed for the lanthanide elements in their compounds?
(a) –1 (b) +2 (c) +3 (d) +4

56. Nickel forms a complex ion having formula $NiCl_4^{2-}$. From among the given statements, pick the correct combination
(i) it is a nickel(II) complex (ii) it is an octahedral complex
(iii) it is paramagnetic (iv) nickel atom has a coordination number 4 in this complex
(a) i, ii, iv (b) ii, iii, iv (c) i, iii, iv (d) i, iv

57. Pick all the gases from the list which dissolve in water to give an acidic solution
(i) nitrogen (ii) carbon dioxide (iii) sulphur dioxide (iv) sulphur trioxide
(v) ozone (vi) hydrogen bromide
(a) i, iii, iv, vi (b) ii, iii, iv, vi (c) ii, iii, vi (d) ii, iv, vi

58. What is the correct word to describe the geometry of XeF_4?
(a) Spherical (b) Octahedral (c) Tetrahedral (d) Planar

59. Which one, among the given atoms, has the least number of unpaired electrons in ground state?
(a) C (b) N (c) O (d) F

60. How many unpaired electrons are there in an atom of zinc in its ground state?
(a) 0 (b) 1 (c) 2 (d) 4

61. For the preparation of PF_3, 3 moles of CaF_2 was reacted with 3 moles of PCl_3. If the isolated yield of PF_3 was 1.8 moles, what is the percentage yield?
(a) 30 (b) 60 (c) 80 (d) 90

62. An element crystallizes in a BCC lattice. How many atoms are there per unit cell?
(a) 1 (b) 2 (c) 4 (d) 9

63. Which one, among the given ions, has the highest polarizing power?
(a) K^+ (b) Na^+ (c) Ba^{2+} (d) Al^{3+}

64. Which compound can act as a Lewis acid as well as a Lewis base?
(a) CO_2 (b) NH_3 (c) $SnCl_2$ (d) BF_3

65. Two isomers are obtained for $Pd(NH_3)_2Cl_2$, while only one isomer is obtained for $Ni(NH_3)_2Cl_2$. This is because
(a) The two complexes differ in the oxidation state of the metal
(b) The two complexes differ in the oxidation state of the metal as well as coordination geometry
(c) The two complexes differ in their coordination geometry
(d) The two complexes differ in their oxidation state of the metal and the number of unpaired electrons.

66. Which statement(s) is (are) true?
(i) High spin complexes are always paramagnetic
(ii) Low spin complexes are always diamagnetic
(iii) H_2O is more likely to form a low spin complex than CN^-.
(iv) Tetrahedral complexes are more likely to be low spin than high spin
(a) i, ii, iv (b) i (c) i, ii (d) i, ii and iii

67. What products are formed when sulphur is oxidised by nitric acid?
(a) SO_2, N_2 and H_2O (b) SO_4^{2-}, NO and H_2O
(c) H_2S, NO and H_2O (d) SO_4^{2-}, NO_2 and H_2O

68. If Δ_0 and Δ_t denote respectively, the octahedral and the tetrahedral crystal field splitting for a given metal ion and ligand with the same bond distance, then the ratio Δ_0 / Δ_t is:
(a) 1.0 (b) 0.5 (c) 2.2 (d) 0.44

69. Which among the ions, $\left[Cu(CN)_2\right]^-$, $\left[Ag(NH_3)_2\right]^+$, $\left[Au(CN)_2\right]^-$, $\left[Hg(NH_3)_2\right]^{2+}$ is (are) diamagnetic?
(a) $\left[Cu(CN)_2\right]^-$ and $\left[Au(CN)_2\right]^-$
(b) All four of them
(c) $\left[Cu(CN)_2\right]^-$, $\left[Ag(NH_3)_2\right]^+$ and $\left[Au(CN)_2\right]^-$
(d) $\left[Hg(NH_3)_2\right]^{2+}$

70. In the complexes $\left[Fe(CN)_6\right]^{3-}$ and $\left[Co(en)_3\right]^{3+}$, the coordination numbers of iron and cobalt are, respectively (en = ethylenediamine)
(a) 6 and 6 (b) 12 and 6 (c) 6 and 3 (d) 3 and 3

71. The nuclear reaction in which ^{24}Na is produced from ^{23}Na is a/an
(a) (n, p) reaction (b) (n, γ) reaction
(c) (α, p) reaction (d) (α, γ) reaction

72. The element needed by the human body in small amounts, but which acts as a poison in larger amounts is
(a) silver (b) lead (c) mercury (d) copper

73. When steam is passed through a glass tube containing pieces of nickel, the gas coming out at the end of the of the tube will contain mainly
(a) hydrogen and water vapour (b) hydrogen and oxygen
(c) oxygen and water vapour (d) oxygen

74. What are the products of thermal decomposition of $Ni(CO)_4$?
(a) NiC, C and O_2 (b) Ni and CO_2
(c) Ni and CO (d) $NiCO_3$ and O_2

75. How many unpaired electrons will be there in a f^8 lanthanide ion?
(a) 0 (b) 1 (c) 6 (d) 8

76. Identify a pair of ions from the following list which are more stable than the remaining two

$$\left[CoF_6\right]^{3-}, \left[CoI_6\right]^{3-}, \left[AgF_2\right]^{-}, \left[AgI_2\right]^{-}$$

(a) $\left[CoF_6\right]^{3-}, \left[CoI_6\right]^{3-}$ (b) $\left[CoI_6\right]^{3-}, \left[AgF_2\right]^{-}$
(c) $\left[AgF_2\right]^{-}, \left[AgI_2\right]^{-}$ (d) $\left[CoF_6\right]^{3-}, \left[AgI_2\right]^{-}$

77. Molecular formula of Geraniol is:
(a) $C_{10}H_{16}O$ (b) $C_{10}H_{18}O$ (c) $C_{10}H_{16}O_2$ (d) $C_{10}H_{14}O$

78. Acetaldehyde is the presence of few drops of H_2SO_4 at 0°C gives
(a) aldol (b) paraldehyde (c) metaldehyde (d) crotonaldehyde

79. Molecular formula piperine is
(a) $C_{17}H_{19}NO_3$ (b) $C_{17}H_{19}NO_2$ (c) $C_{17}H_{21}NO_3$ (d) None of these

80. The reagent that differentiates an aldose and a ketose is
(a) Fehling solution (b) Tollen's reagent
(c) Molish test (d) Bromine water

81. Bubbling of chlorine gas in boiling acetaldehyde gives
(a) CH_3COCl (b) CH_3CH_2Cl (c) CCl_3CHO (d) $ClCH_2.CH_2Cl$

82. The reaction of phenylacetylene with sodamide in liquid ammonia gives
(a) styrene (b) 2, 5-dihydrophenylacetylene
(c) 1, 4-dihydrophenylacetylene (d) sodium phenylacetylide

83. In the following reactions

(I) $CH_3 - N = N - CH_3 \xrightarrow{\Delta}$

(II) $CH_2N_2 \xrightarrow{hv}$

(III) $(CH_3)_3C - OH + H^+ \longrightarrow$

(IV) $(CH_3)_3C - Cl + AlCl_3 \longrightarrow$

the reaction intermediates formed will be

	I	II	III	IV
(a)	$\bullet CH_3$	$:CH_2$	$(CH_3)_3C^-$	$(CH_3)_3C^-$
(b)	$^-CH_3$	$:CH_2$	$(CH_3)_3C^+$	$(CH_3)_3C^-$
(c)	$\bullet CH3$	$:CH_2$	$CH_3)_3C^+$	$(CH_3)_3C^+$
(d)	$^-CH_3$	$\bullet CH_2$	$(CH_3)_3C^+$	$(CH_3)_3C^-$

84. Oxidation is associated with
(a) change in molecular weight (b) gain in electron
(c) evolution of gas (d) loss of electron

85. Which one of the reversible reaction in the following?
(a) Sulfonation of benzene (b) Nitration of benzene
(c) Halogenation of benzene (d) Alkylation of benzene

86. The electrophile in oleum in the sulfonation reaction of benzene is

(a) SO_2 (b) SO_3 (c) SO_3^- (d) $\overset{+}{S}O_2$

87. Vulcanisation of rubber is
(a) cross-linking of hydrocarbon chain in crude rubber by sulphur
(b) heating of rubber to mould in the desired shape
(c) decreasing its tensile strength
(d) decreasing its elasticity

88. Polyester is condensation polymer is
(a) phenol – formaldehyde (b) terphthalic acid – ethylene glycol
(c) terphthalic acid–hexamethylene diamine (d) urea–formaldehyde

89. Which one of the phenol derivatives is more steam volatile?
(a) o-Nitrophenol (b) m-Nitrophenol (c) Hydroquinone (d) p-Nitrophenol

90. The compound readily reacts with Lucas reagent at room temperature is
(a) 2-methyl propanol (b) 2-methyl propane-2-ol
(c) 2-butanol (d) 1-butanol

91. The compound which does not reduce Fehlings solution is
(a) formic acid (b) acetaldehyde (c) benzaldehyde (d) fructose

92. The acidity in decreasing order of different acids is
(a) formic acid > chloroacetic acid > acetic acid > propanoic acid
(b) formic acid > propanoic acid > chloroacetic acid > acetic acid
(c) chloroacetic acid > acetic acid > formic acid > propanoic acid
(d) chloroacetic acid > formic acid > acetic acid > propanoic acid.

93. Which one is an example of azo dye?
(a) Malachite (b) Methyl orange (c) Indigo (d) Fluroescein

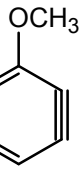
94. The reaction of benzaldehyde with ethyl α -bromopropionate in the presence of zinc is known as
(a) Perkin reaction (b) Knoevenaged reaction
(c) Claisen-Schmidt reaction (d) Reformatsky reaction

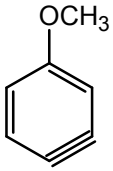
95. The reaction of acetaldehyde with concentrated NaOH gives
(a) yellow resin (b) aldol
(c) metaldehyde (d) paraldehyde

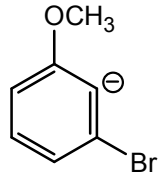
96. Anthracene on oxidation with chromatic acid gives
(a) anthranilic acid (b) anthraquinone
(c) phthalic acid (d) terphthalic acid

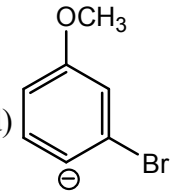
97. The order of each of hydrogenations is
(a) anthracene > naphthalene > benzene (b) benzene > anthracene > naphthalene
(c) benzene > naphthalene > anthracene (d) naphthalene > anthracene > benzene

98. The intermediate in the reaction of m-bromoanisole with sodamide in liquid ammonia has

(a) 

(b) 

(c) 

(d) 

99. α -Naphthol couples with benzenediazonium salt at position.
(a) 2 (b) 4 (c) 5 (d) 8

100. Conversion of aliphatic ketones to esters is known as
(a) Wolf rearrangement (b) Beckmann rearrangement
(c) Baeyer-Villiger oxidation (d) Clemmensen reduction

101. Isoquinoline on reduction with tin and hydrochloric acid gives
(a) octahydroisoquinoline (b) 1, 2, 3, 4-dihydroisoquinoline
(c) 1, 4-dihydroisoquinoline (d) 1, 2-dihydroisoquinoline

102. The reaction of pyridine with acyl chloride in the cold gives
(a) 1-acylpyridinium chloride (b) 3-acylpyridine
(c) 4-acylpyridine (d) None of the above

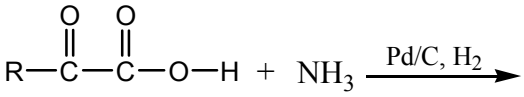
103. Which one is least stable carbanion?
(a) $C_6H_5{}^-CH_2$ (b) $(CH_3)_3{}^- C$ (c) $^-CCl_3$ (d) $^-CH_3$

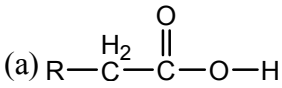
104. Which of the alkyl halides undergoes most readily for nucleophilic substitution reaction?
(a) CH_3CH_2Br (b) CH_3CH_2F (c) CH_3CH_2I (d) CH_3CH_2Cl

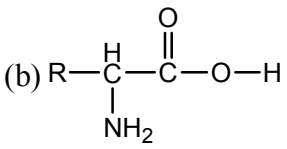
105. The reaction of ethanolic KOH on 1, 1-dichloropropane gives
(a) propanaldehyde (b) propyne
(c) propan-1, 1-diol (d) propanone

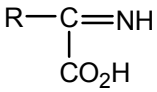
106. An axial methyl at position 1 in methylcyclohexane is closer to
(a) 2a, 4e hydrogens (b) 2e, 6e hydrogens
(c) 1e, 3a hydrogens (d) 3a, 5a hydrogens

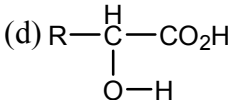
107. Predict the product of the following reaction



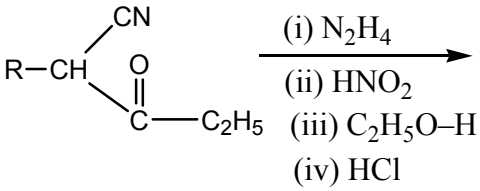
(a) 

(b) 

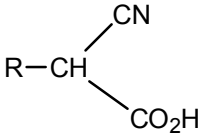
(c) 

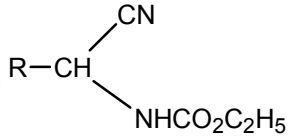
(d) 

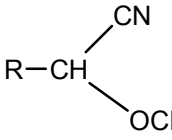
108. Predict the product of the following reaction

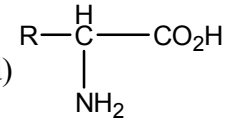


(i) N_2H_4
(ii) HNO_2
(iii) $C_2H_5O–H$
(iv) HCl

(a) 

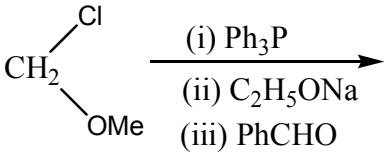
(b) 

(c) 

(d) 

109. A dilute solution of D(+)–glucose in presence of sodium hydroxide is converted into an almost optically inactive mixture which contains.
(a) D(+)–glucose, D(–)–arabinose and D(+)–mannose
(b) D(+)–glucose and D(+)–mannose
(c) D(+)-glucose, D(+)–mannose and D(–)-fructose
(d) D(+)–mannose and D(–)fructose

110. Predict the product of the following reaction

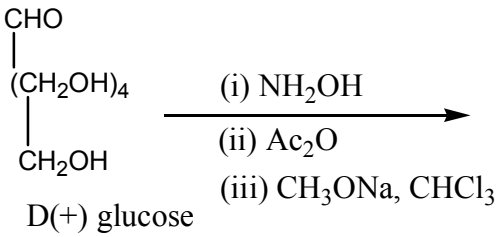


(i) Ph_3P
(ii) C_2H_5ONa
(iii) PhCHO
(iv) H^+

(c) Ph_3P = CHOMe (b) Ph–CH_2CHO (c) Ph–CH = CHOMe (d) Ph–CH_2–CH_2–OH

111. Which aldoses and ketoses form same osazone when treated with excess of phenylhydrazine?
(a) D(+)–glucose, D(–)–mannose and D(+)–ribose
(b) D(+)–glucose , D(+)–mannose, D(–)-fructose
(c) D(+)-glucose, L(+)–arabinose
(d) D(+)–glucose, D(–)-arabinose

112. Predict the product of the following reaction



(a) D(–)-arabinose (b) Gluconic acid
(c) Glucose penta acetate (d) D(+)-ribose

113. Which pair of the following pair of sugars is epimers?
(a) D(+)–glucose, D(–)–fructose (b) D(+)–glucose, D(–)–arabinose
(c) D(+)-glucose, D(+)-mannose (d) D(–)–fructose, D(+)-mannose

114. The orbital angular momentum for a 3p electron is

(a) $\frac{h\sqrt{5}}{2\pi}$ (b) $\frac{h\sqrt{3}}{2\pi}$ (c) $\frac{h\sqrt{2}}{2\pi}$ (d) $\frac{h\sqrt{7}}{2\pi}$

115. Which one of the following atomic spectral transitions is forbidden?

(a) $3d \rightarrow 4f$ (b) $2p \rightarrow 3s$ (c) $3p \rightarrow 3d$ (d) $4p \rightarrow 5f$

116. According to quantum mechanics, the energy levels of a free partial are
(a) continuous (b) discrete and equally distant
(c) discrete but not equally distant (d) energy is always zero.

117. The quantum number which is not derived from the solution of the Schrodinger wave equation for hydrogen atom is
(a) azimuthal quantum number (b) principal quantum number
(c) magnetic quantum number (d) spin quantum number

118. The d-orbital which has a maximum probability density lying along two axes is knwon as

(a) $d_{x^2-y^2}$ (b) d_{z^2} (c) d_{xy} (d) d_{xz}

119. Which one of the following molecules has the highest bond energy?

(a) F_2 (b) Cl_2 (c) Br_2 (d) I_2

120. The translational partition function has the unit of

(a) V (b) 1/V (c) P (d) a number

121. The fundamental relation in Helmholtz free energy (A) and molecular partition function q is

(a) $A = NkT \ln q$ (b) $A = -NkT \ln q$

(c) $A = NkT\Sigma \exp\left(-\frac{\varepsilon_i}{kT}\right)$ (d) $A = -NkT\Sigma \exp\left(-\frac{\varepsilon_i}{kT}\right)$

122. For an ideal monatomic gas, the particle partition function 'q' is

(a) $\left(\frac{8\pi mkT}{h^2}\right)^{3/2} V$ (b) $\left(\frac{2\pi mkT}{h^2}\right)^{3/2} V$ (c) $\left(\frac{h^2}{8\pi mkT}\right)^{3/2} V$ (d) $\left(\frac{h^2}{2\pi mkT}\right)^{3/2} V$

123. If 'ν' is the fundamental frequency, μ is the reduced mass and k is the force constant, then for a harmonic oscillator.

(a) $k = \frac{1}{2\pi}\sqrt{\frac{\nu}{\mu}}$ (b) $\nu = 4\pi^2 k^2 \mu$ (c) $\nu = \frac{1}{2\pi}\sqrt{k/\mu}$ (d) $\nu = \frac{k}{\mu}\sqrt{1/2\pi}$

124. The Maxwell-Boltzmann distribution function of speed is

(a) $f(v) = 4\pi\left(\frac{2\pi kT}{m}\right)^{3/2} v^2 \exp\left(-\frac{2kT}{mv^2}\right)dv$

(b) $f(v) = 4\pi\left(\frac{m}{2\pi kT}\right)^{3/2} v^2 \exp\left(-\frac{mv^2}{2kT}\right)dv$

(c) $f(v) = \frac{2}{\sqrt{\pi}}\left(\frac{2\pi kT}{m}\right)^{3/2} v^2 \exp\left(-\frac{mv^2}{2kT}\right)dv$

(d) $f(v) = \frac{2}{\sqrt{\pi}}\left(\frac{m}{2\pi kT}\right)^{1/2} v^2 \exp\left(-\frac{2kT}{mv^2}\right)dv$

125. The difference between the magnitude of the magnetic fields at which 'free' nuclei and molecular nuclei resonate is called
(a) chemical shift (b) magnetic shift (c) screening constant (d) anisotropy in g-value

126. When a transition between states of the same multiplicity occurs without emitting light, the process is called
(a) fluorescence (b) internal conversion (IC)
(c) quenching (d) intersystem crossing (ISC)

127. Rotational spectra are observed in the
(a) near infrared region (b) visible region
(c) far infrared region (d) UV region

128. Which one of the following is adopted as the primary reference electrode, assigned standard electrode, potential equal to zero?
(a) Hg/KCl solution (aq) (b) $Cu/CuSO_4$ solution.
(c) $Ag/AgCl/Cl^-$ (d) $-Pt/H_2(g, 1\ atm)/H^+(aq)\ (a_{H^+} = 1)$

129. The reverse of a photochemical reaction is called
(a) chemiluminescence (b) phosphorescence
(c) fluorescence (d) photosensitization

130. A 5.0×10^{-3} M solution of K_2CrO_4 has optical density of 1.5 at 680 mμ using a 10 mm cell. Its extinction coefficient in the unit of L mol^{-1} cm^{-1} is:
(a) 0.75 (b) 300.00 (c) 7.50 (d) 30.00

131. For reversible isothermal expansion of a perfect (ideal) gas, which particular set of the following statements is correct?
(a) $q > 0$, $w > 0$, $\Delta U = 0$ and $\Delta H = 0$ (b) $q > 0$, $w < 0$, $\Delta U = 0$ and $\Delta H > 0$
(c) $q > 0$, $w < 0$, $\Delta U = 0$ and $\Delta H = 0$ (d) $q > 0$, $w < 0$, $\Delta U < 0$ and $\Delta H = 0$

132. "Fugacity of a gas in a mixture is equal to the product of its mole fraction in the mixture of its fugacity in the pure state at a total pressure of the mixture." This is in accordance with
(a) Lewis-Randall rule
(b) Konovalov's first law
(c) Konovalov's second law
(d) Mathematical form od Duhem-Margules equation

133. Which one of the following is not true for real gases?

(a) $\Delta G = nRT \ln\left(\frac{f_2}{f_1}\right)$
(b) $\lim_{P\to 0}\left(\frac{f}{p}\right) = 1$
(c) $\gamma = \frac{a}{P}$
(d) $\Delta G = nRT \ln\left(\frac{P_2}{P_1}\right)$

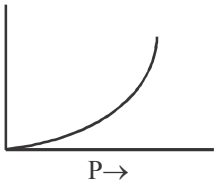
134. In osmotic pressure method, molecular mass of polymers can be obtained from the intercept of the graph of

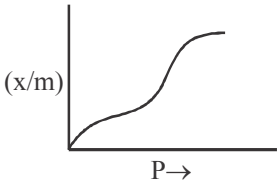
(a) π vs C
(b) $\left(\frac{\pi}{C}\right)$ vs. C
(c) $\frac{C}{\pi}$ vs. C
(d) $\frac{C}{\pi}$ vs. $\sqrt{C}$

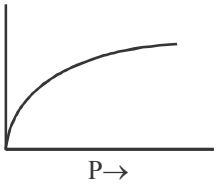
135. The half-life of a given reaction was halved as the initial concentration was doubled. What is the order of the reaction?
(a) Zero order
(b) Pseudo first order
(c) Second order
(d) Third order

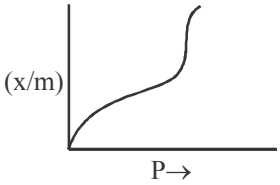
136. Which of the following ions has the highest ionic mobility in aqueous solution?
(a) Li^+
(b) Rb^+
(c) Na^+
(d) K^+

137. Which of the following isotherms was successfully explained by Langmuirs unimolecular layer theory?

(a) 

(b) 

(c) 

(d) 

138. The oscillator strength of a spectral transition has the units of
(a) mol s m^{-2}
(b) dm^3 mol^{-1} cm^{-1} s^{-1}
(c) cm^{-1}
(d) dimensionless quantity

139. According to Debye-Huckel theory of strong electrolytes, an ion while moving in particular direction under the influence electric field experiences a drag due to the presence of ionic atmosphere of excess oppositely charged ions around moving ion. This effect is known as
(a) asymmetric effect
(b) electrophoretic effect.
(c) Brownian effect
(d) concentration effect.

140. Which one of the following statements is wrong?
(a) $^{14}_{6}C$ is a redioactive isotope of carbon
(b) $^{60}_{27}Co$ is an unstable radio isotope of cobalt
(c) Radioactive disintegration follows second-order kinetics
(d) Superconducting materials are diamagnetic.

141. The violet colour of $Na_{(1+\delta)}Cl$ crystal is due to
(a) Frenkel defects (b) Schottky defect
(c) Interstitials (d) F centres

142. The difference between the potential of the electrode when gas evolution is actually observed and the theoretical reversible potential value for the same reaction is called
(a) concentration polarization (b) Overvoltage
(c) Dorn effect (d) Sedimentation potential

143. Sulfur can exist in
(a) One phase (b) Two phase (c) Three phases (d) Four phases

144. A first-order chemical reaction is 10% complete in 10 minutes. Its half-life is (given log 3 = 0.48)
(a) 50.50 minutes (b) 7.5 minutes (c) 95.6 minutes (d) 75.2 minutes

145. The half-life of a second-order chemical reaction $2A \rightarrow$ products whose initial concentration was 0.01 mol L^{-1}, was found to be 300 minutes. Its rate constant is
(a) 0.36 mol L^{-1} min^{-1} (b) 3.6 mol L^{-1} min^{-1}
(c) 0.63 mol L^{-1} min^{-1} (d) 0.036 mol L^{-1} min^{-1}

146. For a reversible chemical reaction $A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} X$ in which both the forward and reverse reactions are first order and the intial concentration of A is a_0 and the equilibrium concentratin of X is x_e, the value of k_{-1} in terms of k_1 is given by
(a) $k_1(a_0 - x_e)$ (b) $k_1 a / x_e$ (c) $k_1(a_0 - x_e)/x_e$ (d) $k_1 x_e/(a_0 - x_e)$

147. A consecutive chemical reaction, $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ is first order at both the stages with rate constants as k_1 and k_2. The time required to attain the maximum concentration of B is given by
(a) $\dfrac{0.693}{(k_1 + k_2)}$ (b) $\dfrac{(\ln k_1 - \ln k_2)}{(k_1 + k_2)}$ (c) $\dfrac{(\ln k_1 + \ln k_2)}{(k_1 + k_2)}$ (d) $\dfrac{(k_1 + k_2)}{(k_1 - k_2)}$

148. The energy of activation for the decompostion of NO_2 into NO and O_2 is negative which may be due to one of the following
(a) Increase in entropy on decomposition of NO_2
(b) Formation of stable intermediates
(c) Formation of free radicals
(d) Decrease in enthalpy on formation of NO and O_2.

149. True activation energy of a unimolecular surface reaction is obtained by measuring the temperature dependence of rate constants at one of the following.
(a) Low presures (b) Low temperatures (c) Constant volume (d) High pressures

150. The rate constants, k_1, k_{-1} and k_2 for the enzyme catalysed reaction

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_2} E + P$$

are 0.1, 0.01 and 0.05 s^{-1} respectively. The Michaelis constant for the reaction is
(a) 0.6 (b) 1.6 (c) 0.066 (d) 2.25