BHU M.Sc. CHEMISTRY ENTRANCE - 2016

1. Oxine is a precipitating reagent. How can you easily determine this reagent quantitatively at trace level?

   (a) Precipitation method

   (b) Spectrophotometric method

   (c) Conductometric method

   (d) $BrO_3^- - Br^-$ reaction method

2. Quadrivalent cerium is best oxidizing reagent because:

   (a) it is easily available

   (b) it is aqueous solution is highly stable at high temperature

   (c) it is cheaper

   (d) it does not require any primary standard for standardization

3. Which metal is responsible for the manifestation of itai itai diseases?

   (a) As   (b) Pb   (c) Hg   (d) cd

4. The pH of sea water is constant as:

   (a) 7.0   (b) 8.1   (c) 6.5   (d) 10.2

5. El Nino is due to:

   (a) warming of waters of the Eastern Pacific ocean

   (b) cooling of waters of the Eastern Pacific ocean

   (c) warming of waters of the Western Pacific ocean

   (d) cooling of waters of the Western Pacific ocean

6. Which one is man culprite to contribute greenhouse effect?

   (a) CH_4 (b) O_3 (c) CFC   (d) CO_2

7. Atmospheric window which do not allow to escape of infrared radiation emitting from the earth is in between

   (a) 4000-8000 nm

   (b) 8000-16000 nm

   (c) 16000-20000 nm (d) 20000-24000 nm
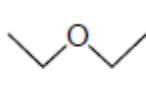
8. Which one does **not** affect the Ozone detoriation?

(a) HO   (b) NO   (c) O   (d) H_2

9.   Van Allen belts are:

(a) Consisted of two belts of ionizing particles encircling the earth

(b) Consisted of two belts of ionizing particles encircling the moon

(c) Consisted of more than two belts of ionizing particles encircling the sun

(d) Consisted of a single belt of ionizing particle encircling the uncharged particulates

10.   Aitken particles are actually:

(a) aerosols with diameter more than $0.2\,\mu$

(b) aerosols with diameter less than $0.2\,\mu$

(c) aerosols with diameter more than $2.0\,\mu$

(d) aerosols with diameter less than $2.0\,\mu$

11.   The altitude range of troposphere is

(a) 0-11 Km   (b) 11-50 Km   (c) 50-85 Km   (d) 85-500 Km

12.   Which reaction represents the process of respiration?

(a) $CO_2 + H_2O + h\upsilon = (CH_2O) + O_2$ (b) $(CH_2O) + O_2 = CO_2 + H_2O + CO_2$

(c) $CH_4 + 2O_2 = CO_2 + 2H_2O$ (d) $O_2 + 4FeO = 2Fe_2O_3$

13.   Which one acts as a sink of CO_2 gas?

(a) Ocean   (b) River   (c) Glaciers   (d) Land

14.   Chloramine-T and Eriochrome Black-T are used in chemical analysis because:

(a) both are indicators

(b) both are redox reagents

(c) one is redox reagent and other is an indicator

(d) both are same but called by different names

15.   Metal-EDTA complexation is a pH-controlled process. Can you use an acid indicator if you do not have suitable metal indicator?
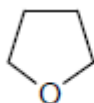
(a) Yes

(b) No

(c) Can not say

(d) wait till arrangement of metal ion indicator is made

16.   Five mole of $KBrO_3$ in bromate-bromide reaction procedures:

(a) one mole Br_2 (b) four mole Br_2 (c) fifteen mole Br_2 (d) no Br_2

17.   Which is main ingradiant of ferrion?

(a) oxin   (b) dithiozone

(c) o-phenaothroline (d) ferrocene

18.   In spectrophotometric analysis, the minimum relative error in the concentration occurs when percent transmittance measured is:

(a) 20%   (b) 80%   (c) 37%   (d) 50%

19.   The unit of specific absorptivity is:

(a) $Cm^{-1} \, mol^{-1} \, L$ (b) $Cm^{-1} \, g^{-1} \, L$ (c) $Cm^{-1} \, mol \, L^{-1}$ (d) $Cm^{-1} \, g \, L^{-1}$

20.   The retention time in column chromatography can be defined as:

(a) the time required for the mobile phase to traverse the column

(b) the time required for the stationary phase to elute the analyte

(c) the time required for the stationary phase to bind the analyte

(d) the time required for the analyte peak to appear

21.   The van Deemter equation is

(a) $HETP = A + \dfrac{\bar{\mu}}{B} + \dfrac{C}{\bar{\mu}}$ (b) $HETP = A\bar{\mu} + B + \dfrac{C}{\bar{\mu}}$

(c) $HETP = A + \dfrac{B}{\bar{\mu}} + C\bar{\mu}$ (d) $HETP = \dfrac{A}{B} + \dfrac{1}{\bar{\mu}} + \dfrac{\bar{\mu}}{C}$

22.   Craig counter current distribution involves:

(a) no extraction   (b) single extraction

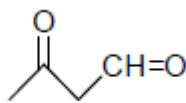(c) Successive extractions   (d) solute dissolution

23. The correlation between distribution ratio (D) and distribution coefficient (K_D) can be represented as:

(a) $D = K_D / \{1 + Ka / \{H^+\}\}$

(b) $K_D = D / \{1 + Ka / \{H^+\}\}$

(c) $K_D = D / \{Ka / [H^+]\}$

(d) $D = K_D / \{Ka / [H^+]\}$

24. The pH of a solution prepared by adding 25 ML of 0.10 M sodium hydroxide to 30 mL of 0.20 M acetic acid $(pK = 476)$ is:

(a) 4.68   (b) 4.61   (c) 4.90   (d) 5.7

25. The pH of 10^{-9} M HCl is:

(a) 9.00   (b) 0.90   (c) 6.00   (d) 6.99

26. How many g/mL of NaCl are contained in a 0.250 M solution?

(a) 0.0146 g/mL   (b) 0.146 g/mL   (c) 14.6 g/mL   (d) 0.00146 g/mL

27. The results of an analysis is 36.97 g compared with the accepted value of 37.06 g. The relative error in parts per thousand (ppt) is:

(a) -2.0 ppt   (b) -2.1 ppt   (c) -2.3 ppt   (d) -2.4 ppt

28. In the following operation $\dfrac{35.63 \times 0.581 \times 0.05300}{1.1689} \times 100\% = 88.5470578\%$ the answer with significant figures is

(a) 88.55%   (b) 88.547%   (c) 88.54705%   (d) 88.5470578%

29. Standard addition calibration is used:

(a) to obtain precised result   (b) to obtain accurate result

(c) to overcome sample matrix effects   (d) to enhance sensitivity of the result

30. Serum is the fluid:

(a) Supernated from the blood

(b) Separated from the clotted blood

(c) Separated from the unclotted blood

(d) Separated from the mixture of clotted blood and unclotted blood

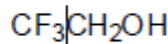**31.** Two of the following four compounds are more acidic than methanol. Which ones?

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North Kolkata: 47, Tarak Pramanick Rd Kolkata - 06. (Near Girish Park Metro, GATE No. 3)   ☎ +91 85829 79309
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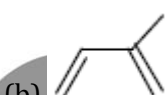
(a) B, C　　　　(b) C, D　　　　(c) D, A　　　　(d) D, B

32. Which of the following conjugated dienes would not react with dienophile in Diels-Alder reaction?
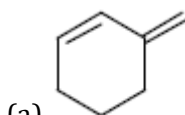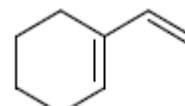

(a)　　　　　(b)　　　　　(c)　　　　　(d)

33. When aniline is heated with glycerol in the presence of sulphuric acid and nitrobenzene, it gives quinolone. This reaction is called:

(a) Chichibabin reaction　　　　　　(b) Skraup synthesis

(c) Fischer synthesis　(d) Bischler-Napieralski synthesis

34. Identify the most reactive compound toward dehydrohalogenation by a strong base:

(a) 1-Bromopentane　(b) 2-Bromopentane

(c) 3-Bromopentane　(d) 2-Bromo-2-methylbutane

35. Naphthalene undergoes nitration with a mixture of conc. HNO_3 and H_2SO_4 at $50°C$ to give mainly:

(a) 1-Nitronaphthalene　　　　　　(b) 2-Nitronaphthalene

(c) 1, 3-Dinitronaphthalene　　　　(d) 1, 8-Dinitronaphthalene

36. The number of chiral carbon atoms present in the D-glucopyranose molecule is
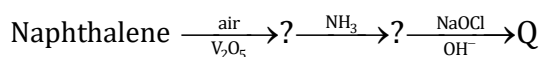
(a) three　　　　(b) four　　　　(c) five　　　　(d) six

37. Which reactive intermediate is involved in the following reaction?
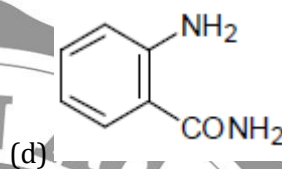
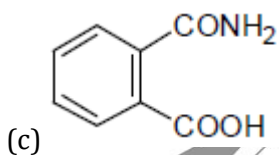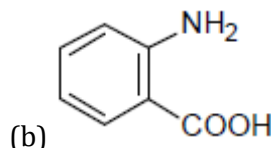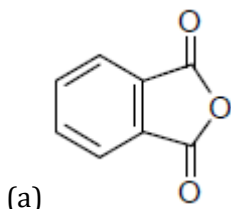2-Methylbutane $\xrightarrow{\frac{Br_2}{h\upsilon}}$ 2-Bromo-3-methylbutane
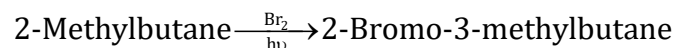
$($not the major product$)$

(a) A secondary radical　　　　　(b) A tertiary radical

(c) A secondary carbocation　　　(d) A tertiary carbocation

38. In the reaction sequence,

Naphthalene $\xrightarrow[V_2O_5]{air}$? $\xrightarrow{NH_3}$? $\xrightarrow[OH^-]{NaOCl}$ Q

the end product Q is:

(a) [phthalic anhydride structure]

(b) [benzene ring with NH₂ and COOH]

(c) [benzene ring with CONH₂ and COOH]

(d) [benzene ring with NH₂ and CONH₂]

39. Which of the following groups are <u>meta</u>-directing in electrophilic aromatic substitution in benzene ring?

$-CONH_2$ (a)　　　$-NHCH_3$ (b)　　　$-NHCOCH_3$ (c)　　　$-\overset{+}{N}(CH_3)_3$ (d)
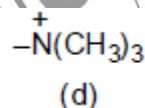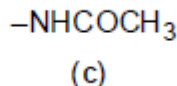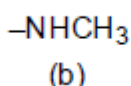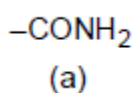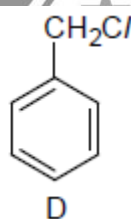
(a) a, c　　　　(b) b, d　　　　(c) a, d　　　　(d) c, d

40. Arrange the compounds in order of decreasing reactivity toward electrophilic substitution:

CCl_3 A　　　CH_3 B　　　$CHCl_2$ C　　　CH_2Cl D
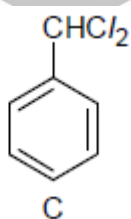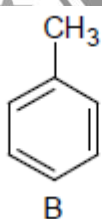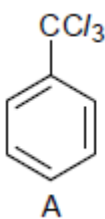
(a) B > D > C > A　　(b) A > C > D > B　　(c) B > C > D > A　　(d) C > D > A > B

41. Which one of the following is classified as a dye from xanthen group?

(a) Malachite green　　　　　　(b) Methyl orange

(c) Indigo　　　　　　　　　　(d) Fluorescein

42. Stereochemically controlled polymers can be made by polymerization process involving:

(a) Anionic mechanism　　　　　(b) Cationic mechanism

(c) Coordination mechanism　　　(d) Free-radical mechanism

43. Teflon is obtained by polymerization of the monomer:

(a) $CH_2 = CF_2$

(b) $CF_2 = CF_2$

(c) $CH_2 = CHF$

(d) $CH_2 = C(CH_3)COOCH_3$

44. Which of the following is a false statement about the alkaloid pipering?

(a) This occurs in black pepper

(b) The molecule has a methylenedioxy group

(c) It is a secondary amide

(d) Piperine can be easily synthesized starting from catechol

**45.** Identify the compounds which fail to undergo Friedel-Crafts reaction:

Naphthalene   Pyridine   Aniline   Phenanthrene

(I)   (II)   (III)   (IV)

(a) II and III   (b) II, III and IV   (c) I, II and IV   (d) II and IV

46. What is the IUPAC name of the following compound?

$$(CH_3)_2CCO_2CH(CH_3)_2$$
with F substituent

(a) Isopropyl 2-fluoro-3-mthylbutanote

(b) 1-Methylethyl 2-fluorobutyrate

(c) 2-Fluoroisopropyl isopropanoate

(d) 1-Methylethyl 2-fluoro-2-methylpropanoate

47. Bakelite is formed by the condensation of:

(a) Formaldehyde and urea

(b) Phenol and formaldehyde

(c) Phthalic anhydride and glycerol

(d) Methyl terephthalate and ethylene glycol

48. Bakelite is formed by the condensation of:

$(A) NH_3$ $(B) CH_3NH_2$ $(CH_3)_4 N^+NO_3^-$

(a) $B > C > A$ (b) $C > A > B$ (c) $C > B > A$ (d) $B > A > C$

49. Which one of the following rearrangements involves an electron deficient oxygen atom?

(a) Baeyer – villiger rearrangement   (b) Pinacol – pinacolone rearrangement (c) Hofmann rearrangement   (d) Wolff rearrangement

50. Which one of the following is most likely to undergo free-radical addition to an alkene?

(a) HF   (b) HCl   (c) HBr   (d) HI

51. Which one of α-D-glucose and β-D-glucose in aqueous solution is known as:

(a) inversion   (b) epimerization   (c) racemization   (d) mutarotation

52. Which of the following alkenes have E-configuration?
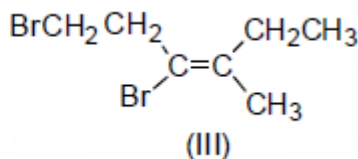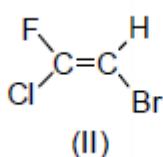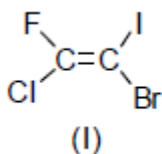
(a) I and II   (b) I and III   (c) II and III   (d) All I, II and III

53. The major product obtained on treatment of 2-bromobutane with alcoholic KOH is:

(a) 1-butane   (b) cis-2-butane   (c) trans-2-butane   (d) 2-butanol

54. One of the following structures is that of α-Terpineol. Which one?

(a)   (b)   (c)   (d)
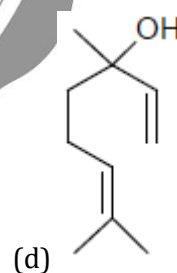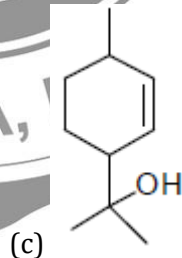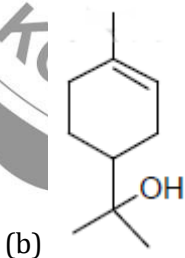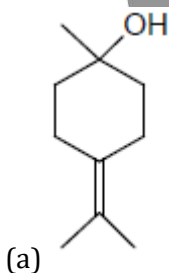
55. In the following reaction

the major product is:

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(a) [structure: phenyl-CH(Br)CH₂CH₃]

(b) [structure: phenyl-CH₂CHBrCH₃]

(c) [structure: phenyl-CH₂CH₂CH₂Br]

(d) [structure: 4-Br-phenyl-CH₂CH₂CH₃]
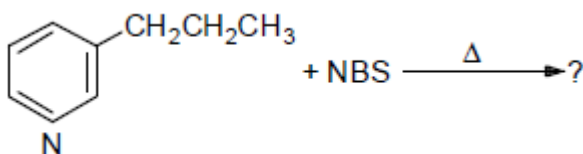
56. The decreasing order of reaction rate of the following benzyl alcohols with HBr is:

(I) $C_6H_5CH_2OH$

(II) $p-NO_2C_6H_4CH_2OH$

(III) $p-CH_3OC_6H_4CH_2OH$

(IV) $p-ClC_6H_4CH_2OH$
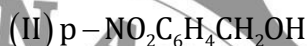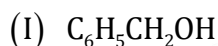
(a) $III > IV > I > II$ (b) $III > I > IV > II$ (c) $III > I > II > IV$ (d) $I > III > IV > II$

57. Give the product of the following reaction:

[reaction: pyridine + CH_3CCl (with =O) $\xrightarrow{CH_3OH}$?]

(a) 2-acetylpyridine

(b) 3-acetylpyridine

(c) 4-acetylpyridine

(d) CH_3COCH_3
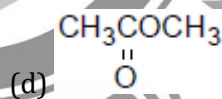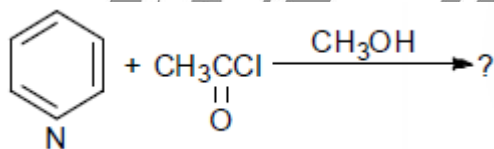
58. When heated with acetic anhydride in pyridine solution, α-aminoacids are converted into:

(a) [structure: RCH with $NHCOCH_3$ and $COOH$]

(b) [structure: RCH with NH_2 and $COCH_3$]

(c) [structure: RCH with $NHCOCH_3$ and $COCH_3$]

(d) [structure: RCH with NH and $C=O$ (ring)]
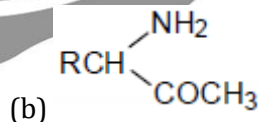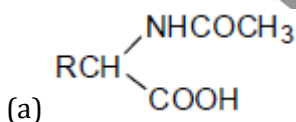
59. The reagent 'X' in the following reaction is:

$$CH_3COCH_3 \xrightarrow{X?} (CH_3)_2C-CH_2COCH_3$$
$$\qquad\qquad\qquad\qquad\qquad\quad |$$
$$\qquad\qquad\qquad\qquad\qquad OH$$
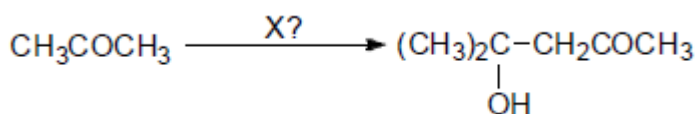
(a) HCl   (b) $Ba(OH)_2$ (c) H_2SO_4 (d) $NaBH_4$

60. Proteins on heating with cone. HNO_3 produce yellow colour. This is known as:

(a) Millon's test   (b) Hopkin's test

(c) Ninhydrin test   (d) Xanthoproteic test

61. Which of the following statements is wrong about citral?

(a) The molecule has two double bonds

(b) An aldehyde group is present

(c) One of the products obtained from ozonolysis of citral is acetone

(d) It is an optically active compound

62. Bimolecular reduction of acetone in the presence of Mg amalgam in ether gives:

(a) Isopropanol   (b) Propane-1, 2-diol

(c) Pinacol   (d) Propane

63. The decreasing order of stability of the following carbocations is:
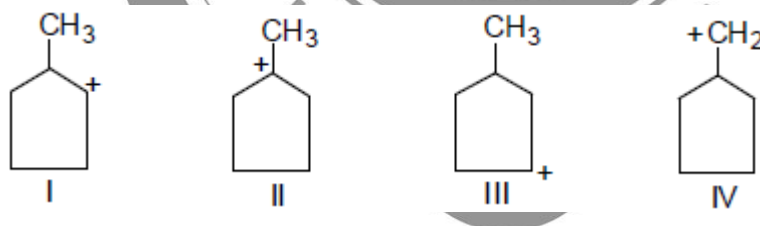
(a) $I > II > III > IV$ (b) $II > III > I > IV$ (c) $II > I > III > IV$ (d) $III > I > II > IV$

64. Conversion of cyclohexanone oxime to caprolactam can be effected by:

(a) Beckmann rearrangement   (b) Hofmann rearrangement

(c) Claisen rearrangement   (d) Claisen condensation

65. When heated with n-butyl lithium $100°$C pyridine forms:

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(a) [structure: pyridine with Bu at position 2]

(b) [structure: pyridine with Bu at position 3]

(c) [structure: pyridine with Bu at position 4]

(d) [structure: pyridine with two Bu groups]

66. List the following compounds in order of decreasing acidity:

FCH_2CH_2OH (I) CH_3CH_2OH (II) $CH_3\underset{|}{\overset{F}{C}}HOH$ (III) $ClCH_2CH_2OH$ (IV)

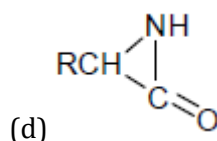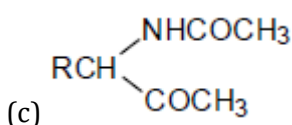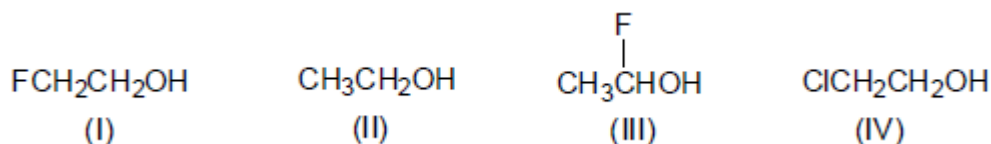(a) $I > III > IV > II$ (b) $III > IV > I > II$ (c) $III > I > IV > II$ (d) $I > IV > II > III$

67. The $S_N 2$ mechanism best applies to the reaction between:

(a) cyclopropane and H_2

(b) methane and Cl_2

(c) 2-chloro-2-methylpropane and dilute OH^-

(d) 1-chlorobutane and aqueous NaOH

68. The designation $\underline{D}$ or $\underline{L}$ before the name of a monosaccharide indicates:

(a) The length of the carbon chain in the sugar

(b) the direction of rotation of polarized light

(c) the position of the –OH group on the carbon chain next to the primary alcohol group

(d) The position of the chiral carbon atoms in the carbohydrate

69. The stereochemical outcome of the SN^2 reaction on an optically active substrate will be:

(a) Inversion in configuration   (b) Retention in configuration

(c) Partial racemization   (d) Complete racemization

70. Which of the following species is formed when both atoms/groups are eliminated from the same carbon?

(a) carbocation   (b) carbene   (c) carbanion   (d) ketene

71. The following two equations are given:

$$(a) Na(g) \rightleftharpoons Na^+(g) + e^- \ldots\ldots \Delta H = +495 \, KJ/mol$$

$$(b) Cl^-(g) \rightleftharpoons Cl(g) + e^- \ldots\ldots \Delta H = 348.9 \, KJ/mol$$
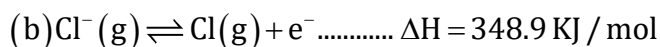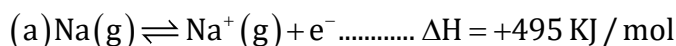
The reactions (a) and (b) respectively are known as:

(a) Electron affinity of sodium and electron affinity of Cl^- ion

(b) Ionization energy of sodium and Ionization energy of Cl^- ion

(c) Ionization energy of sodium and Electron affinity of Cl^- ion

(d) Electron affinity of Na and Ionization energy of $Cl^-(g)$

72. The third conization energy of the first transition series show a sharp drop at $Fe^{2+}, (3d^6)$ ion. The reason for this drop is due to:

(a) Increased electron-electron repulsion energy caused due to pairing of d-electorns

(b) drop in effective nuclear change

(c) the presence of large number of electrons

(d) increased electronegativity of Fe^{2+} ion

73. In $Li_3 N,$ nitrogen is present as (A) and (B) than Li^+ ion. Pick up the correct alternative from the following alternatives. Here (A) and (B) respectively are:

(a) N_2^-, N_2^- is greater than

(b) N^{3-}, N^{3-} is greater

(c) N^{3-}, N^{3-} is smaller

(d) N_3^-, N_3^- is smaller

74. For a given legand, the order of metal ions producing increasing 10Dq value of octahedral complexes is (A) and for a given metal ion, the order of legands producing increasing 10Dq for octahedral complexes is (B). Here (A) and (B):

(a) Both (A) and (B) constant

(b) (A) - changes and B = constant

(c) (A) - constant and B = changes

(d) Both (A) and (B) = changes

75. C_2, BN, BeO and LiF molecules are isoelectronic and their valence electron orbital energies are quite different. The difference between orbital energies of A and B of AB

type molecules increases from carbon to Li – F. It implies that the degree of overlap of the parent orbitals $(A \text{ and } B)$:

(a) decreases

(b) Increases

(c) Zero in C_2 and infinite in LiF

(d) Zero in LiF and infinite in C_2

76. What is (A) in the following equation $(Ti_3 N_4)_5 + H_2O \rightarrow (A) + TiO_2$. Here A is:

(a) NH_2OH (b) NH_3 (c) $N_2O + NH_3$ (d) $N_2H_4 + H_2O_2$

77. Arrange the following oxygen molecular ions and the molecule in order of increasing bond energy or in decreasing order of $(O-O)$ bond length. The molecular ions and the molecule are: $O_2^{2+}, O_2^{+}, O_2, O_2^{-}$ and O_2^{2-}. The possible orders are given below. Choose the correct one:

(a) $O_2 < O_2^{+} < O_2^{-} < O_2^{2+} < O_2^{2-}$

(b) $O_2^{2-} < O_2^{-} < O_2 < O_2^{+} < O_2^{2+}$

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

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

78. Out of C, Si, Sn, Pb and B_1 the element with the highest atomization energy and the element with the lowest atomization energy are:

(a) Carbon and Tin   (b) B and Pb   (c) C and Pb   (d) B and Sn

79. SO_3, exists in three forms which have the molecular formula SO_3, S_3O_9 and $(SO_3)_n$. Their structures belong to three of the following ones. The structures of these forms respectively are.

(a) atomic

(b) molecular

(c) oligomeric $(\text{linear, cyclic, cluster})$

(d) Polymer $(\text{one dimensional chain})$

Which one out of the three you will expect to be a gas your choices are the following. Pick up the right choice?

(a) monomeric molecular, Oligomeric (Chain), polymer $(\text{linear})(SO_2)$

(b) atomic, polymeric (Cyclic), 3-dimensional polymeric (S_3O_9)

(c) molecular, polymer (Cyclic), polymer $(3-\text{dimensional})(S_3O_9)$

(d) molecular $(monomeric)$, polymer $(chain)$, polymer $(3-dimensional)SO_3$

80. What product one forms by absorbing nitrous acid fumes in Na_2CO_3 aqueous solution?

(a) $NaNO_3$ (b) $NaNO_2$ (c) $H_2N_2O_2$ (d) $NO+N_2O$

81. Which one of the following M, O.'s of $(HF_2)^-$ is correct?

(a)   (b)

(c)   (d)
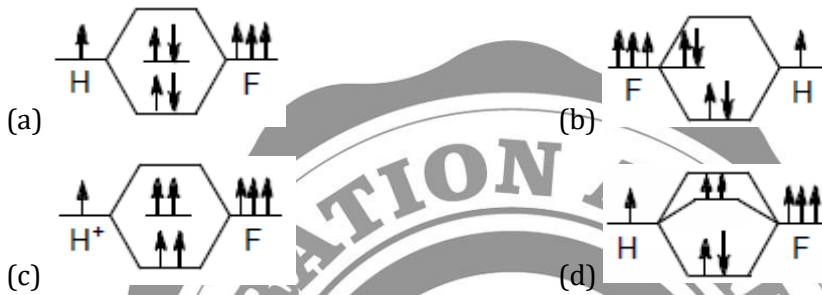
82. What happens when in the absence of air B_2H_6 is heated to $100°C$? It:

(a) decomposes to B and H_2

(b) explodes and gives a number of products

(c) forms $B_{10}H_{14}$

(d) forms $(BH_4)^-$, $B+H_2$

83. Which one of the following molecules will show optical isomerism?

(a) $\left[Co(en)_3\right]^3$ (octahedral)

(b) $\left[Mn(CN)(NO_2)(H_2O)(NH_3)\right]$ (tetrahedral)

(c) $\left[Co(en)Cl_3Br\right]$ (octahedral)

(d) $Cis\left[Co(en)_2Cl_2\right]$ (octahedral) (trans)

84. In compounds containing X-H and X-D bonds, which one $(X-H \text{ or } X-D)$ will be stronger and why?

(a) $(X-D)$ because of higher contribution of covalency in X-H bond

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(b) $(X-H)$ because of greater mobility of H compared to D

(c) $(X-H)$ because of its lower zero point energy compared to that of X-D

(d) $(X-D)$ because of its lower zero point energy compared to that of X-H

85. The oxidizing and the reducing agent in the following redox reactions respectively are:

$(A) 2H CuCl \rightleftharpoons Cu + Cu^{2+} + 4Cl^- + 2H^+$

$(B) Cl_2 + 2OH^- \rightarrow ClO^- + Cl^- + H_2O$

$(C) CaCO_3 \rightarrow CaO + CO_2$

(a) $(Cu^+, Cu^{+1}), (Cl^0, Cl^0), none$　　　　(b) $(H^+, Cu^+), (Cl^0, OH^-), (Ca^{2+}, O_3^{2-})$

(c) $(Cu^+, Cl^-), (Cl^0, OH^-), (Ca^{2+}, CO_3^{2-})$　　(d) $(Cu^+, Cl), (Cl^0, OH^-), (Ca^{2+}, O^{2-})$

86. Arrange the single bond energy of the following fluorides in increasing order:

$N-F, P-F, As-F, Sb-F.$

(a) $N-F < Sb-F < As-F < P-F$　　　　(b) $Sb-F < As-F < P-F < N-F$

(c) $AS-F < Sb-F < P-F < N-F$　　　　(d) $As-F < N-F < P-F < Sb-F$

87. Lewis acidity of silicon tetrahalides $[SiF_4, SiCl_4, SiBr_4, SiI_4]$ decreases in the order

(a) $SiI_4 > SiBr_4 > SiCl_4 > SiF_4$　　　　(b) $SiI_4 > SiCl_4 > SiBr_4 > SiF_4$

(c) $SiF_4 > SiCl_4 > SiBr_4 > SiI_4$　　　　(d) $SiF_4, SiBr_4, SiI_4, SiCl_4$

88. According to M.O. theory, the bond order of diatomic molecules can be (A) which is not so according to valence bond theory. Here (A) is:

(a) Integral　　　(b) Two　　　(c) Three　　　(d) Fractional

89. In octahedral complexes of d^1 metal ions, the net total energy of the d-electron in the complex as compared to that in the free ion:

(a) increases with respect to unbonded state

(b) varies with the nature of ligands, sometimes increase and some times decreases

(c) remains the same

(d) Increases with respect to a state when only <u>metal</u> <u>bond</u> <u>energy</u> is considered with no <u>electronic effects</u> of the ligands $\left(\text{i.e. repulsion due to ligand electrons}\right)$

90. Arrange the hydrides CH_4, H_2O, GeH_4, H_2Se in order of increasing acid strength. Which one is correct order in the following given orders:

(a) $CH_4 < H_2Se < H_2O < GeH_4$

(b) $CH_4 < GeH_4 < H_2O < H_2Se$

(c) $GeH_4 < CH_4 < H_2Se < H_2O$

(d) $GeH_4 < CH_4 < H_2O < H_2Se$

91. HF in liquid state self-ionizes as:

(a) $HF(liq) \rightleftharpoons H^+ + F^-$

(b) $2HF(liq) \rightleftharpoons \left(H_2F\right)^+ + F^-$

(c) $3HF(liq) \rightleftharpoons \left(H_2F\right)^+ + \left(HF_2\right)^-_{(Solvated)}$

(d) $4HF(liq) \rightleftharpoons \left(H_3F_2\right)^+ + \left(HF_2\right)^-$

92. $\left(N_5\right)^+$ cationic species exists in compounds $\left[N_5^+\right]\left[Sb_2F_{11}\right]^-$ or in $\left(N_5\right)^+\left[A_5F_6\right]^-$. The structure of $\left(N_5\right)^+$ in these compounds is:

(a) linear

(b) Angular

(c) Cyclopentadienyl type

(d) Square planar with N- N^+ side chain

93. What is $\left(A\right)$ in the following reaction:

$$NaNO_3 + Na_2O \xrightarrow[\substack{\text{crucible }300° \\ \text{for two days}}]{\text{Silver}} \left(A\right)$$
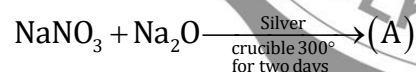
(a) $N_2O_5 + $ Some Sodium Salt

(b) No reaction

(c) $Na_3NO_4\left(\text{orthonitrate}\right)$

(d) $N_2O_3 + N_2 + Na_2NO_2$

94. What is $\left(A\right)$ in the following reaction:

$$4HNO_3 + P_4O_{10} \xrightarrow{-10°C} 2N_2O_5 + \left(A\right)$$
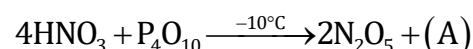
(a) H_3PO_4 (b) H_3PO_3 (c) HPO_3 (d) P_2O_3

95. The magnetic moment of $Mn^{2+}\left(d^5 \text{ case}\right)$ complexes of weak field ligands $\left(\text{Octahedra and Tetrahedral}\right)$ is:

(a) Very close to spin only value

(b) Spin only value plus a large orbital contribution

(c) Spin only value plus variable orbital contribution

(d) Spin only value of one electron

96. The following three reactions give one common molecule $\left(A\right)$. What is $\left(A\right)$?

(A) $\left(NH_4\right)_2 Cr_2O_7 \xrightarrow[\text{decomposition}]{\text{thermal}}$

(B) $NH_3 + Br_2 \longrightarrow$

(C) $NH_3 + CuO \xrightarrow[\text{Temperature}]{\text{High}}$
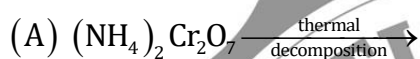
Pick the correct choice out of the following:

(a) N_2O (b) NO (c) $N_2\left(\text{nitrogen}\right)$ (d) NH_3

97. The reason for $\left(A\right)P_2$ which is similar to N_2 molecule is not stable because $\left(\text{what is}\left(A\right)\right)$:

(a) The bond energy of three $\left(P-P\right)$ bonds is more than $\left(P-P\right)$ triple bond as opposed to $N\equiv N$ bond energy which is more than three $\left(N-N\right)$ bond energy $\left(A-\text{gaseous}\right)$

(b) Lattice energy of $P-P$ is more than $N-N$ bond energy $\left(A=\text{Solid state}\right)$

(c) Lone pairs of electrons in $\ddot{P}\equiv\ddot{P}$ is kinetically more reactive than those present on N_2 in $\ddot{N}\equiv\ddot{N}\left(A-\text{solid state}\right)$

(d) Kinetically $P-P$ bond is more reactive than $N-N$ bond $\left(A=\text{liquid}\right)$

98. $\left(Ln\right)^{2+}$ ions are largely coloured while $\left(Ln\right)^{3+}$ are not. The colour of $\left(Ln\right)^{2+}$ is due to:

(a) $f \rightarrow f$ transition

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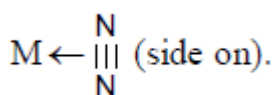**Website:** www.aspirationacademy.in **|** Email: info@aspirationacademy.in **|**   **P a g e | 17**

(b) $d \rightarrow d$ transition

(c) $f \rightarrow d$ transition

(d) Charge transfer from anions or solvent to $(Ln)^{2+}$

**99.** Transition metal ions form complexes with N_2 molecules in two modes of linkages.

(I) $M-N \equiv N(\text{end on})$ and

(II) $M \leftarrow \overset{N}{\underset{N}{|||}}$ (side on). The bond strengths of these $M-(N_2)$ bonds are (Relative strengths)

(a) Both weak   (b) Both strong

(c) End-on stronger than side-on   (d) Side-on stronger than end-on

100. Uranium, thorium and plutonium dissolve in:

(a) Conc. HNO_3 (b) Conc. $HNO_3 + F^-$ ions

(c) Conc. $HNO_3 + NaCl$ (d) Dil. HNO_3

101. On hydrolysis $(CH_3 - Li)_4$ gives:

(a) $LiOH + CH_4$ (b) $C_2H_6 + LiCH_3 + Li(OH)$

(c) $CH_3OH + LiOH + LiH$ (d) $C_2H_5OH + LiOH + LiH$

102. The structures of two forms of N_2F_2 out of the following four structures are:

F−N=N−F
(A)

N=N with F, F
(B)

F, N=N, F
(C)
(Planar)

F, N=N, F
(D)
(N-F bonds in different planes)
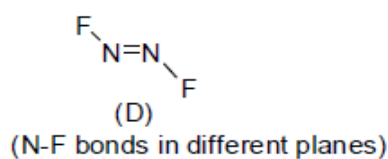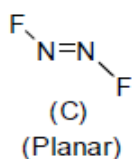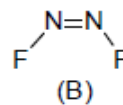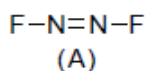
Pick the correct choice out of the following ones

(a) A and B　　　　　(b) A and C　　　　　(c) B and C　　　　　(d) C and D

103. It is possible to prepare a complex $(\text{Octahedral or tetrahedral})$ of d^6 metal ion with a magnetic moment of 2.6 B.M. under the following conditions. Which one of the following alternative is correct?

(a) An Octahedral complex of d^6 metal ion with weak field legands.

(b) A tetrahedral complex of d^6 metal ion with weak field legands.

(c) An Octahedral complex of d^6 metal ion with strong field legands

(d) A tetrahedral complex of d^6 metal ion with strong field legands.
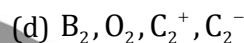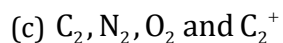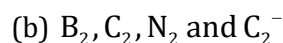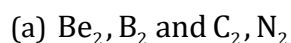
$$\left(10D_q^T \gg \text{Pairing energy}\right)$$

104. H_3PO_3 and $H_3A_5O_3$ are:

(a) both tribasic

(b) H_3PO_3 dibasic and $H_3A_5O_3$ tribasic

(c) H_3PO_3 tribasic and $H_3A_5O_3$ dibasic

(d) Both are dibasic in which H^+ is bonded to P and As

105. Iodine in (A) oxidation state is easily stabilized by complexation as in $\left[ICl_2\right]^{+1}$ ion which is stable in concentrated HCl. In concentrated and strong acids $\left[I_2\right]^+$ is (B) cation dimerizing to (C) species $\left(I_4\right)^+$. Here $(A), (B)$ and (C) are respectively:

(a) -1, unstable, paramagnetic　　　　(b) $+1$, paramagnetic, diamagnetic

(c) -1, diamagnetic, paramagnetic　　　(d) $+1$, diamagnetic, stable

106. Which one of the following reactions saves us from the damaging effect of solar u.v. radiations?

(a) $O_2 + h\upsilon \rightleftharpoons 2O_2$　　　　　　(b) $O_3 + h\upsilon = O_2 + O$

$$O + O_2 \rightleftharpoons O_3$$

(c) Chloro fluoro carbon $+ h\upsilon \rightleftharpoons Cl^{\bullet}$　　(d) $HClO + h\upsilon \rightleftharpoons OH^{\bullet} + Cl^{\bullet}$
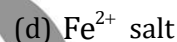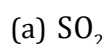
$$Cl^{\bullet} + O_3 \rightarrow ClO + O_2 \qquad\qquad Cl^{\bullet} + O_3 \rightleftharpoons ClO^{\bullet} + O_2$$
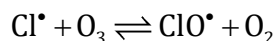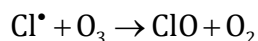
107. Out of the following diatomic molecules, the paramagnetic ones are

$(A) Be_2$ $(B) B_2$ $(C) C_2$ $(D) N_2$

$(E) O_2$ $(F) F_2$ $(G) C_2^{+}$ $(H) C_2^{-}$

(a) Be_2, B_2 and C_2, N_2 (b) B_2, C_2, N_2 and C_2^{-}

(c) C_2, N_2, O_2 and C_2^{+} (d) $B_2, O_2, C_2^{+}, C_2^{-}$

Pick the correct choice out the above four choices.

108. The laughing gas can be prepared from HNO_2 by adding:

(a) SO_2 (b) NH_2OH (c) H_2O_2 (d) Fe^{2+} salt

109. Hot aqueous solution of $(NH_4)NO_2$ decomposes to give N_2 gas and water. But a very small amount of two compounds (A) and (B) are also formed as impurities which are removed by passing the gas in water. Here (A) and (B) are:

(a) NO and $H_2N_2O_2$ (b) NO and HNO_3 (c) N_2O and NO_2 (d) NH_3 and N_2O
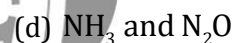
110. Which one of the following compounds forms $(3c-3e)$ bond?

(a) XeF_2 (b) Al_2Cl_6 (c) $Mg(CH_3)_2$ (d) $Be(NO_3)_2$
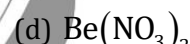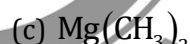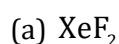
111. Which of the following molecule will show pure rotational spectrum?

(a) CH_4 (b) H_2O (c) C_6H_6 (d) Cl_2
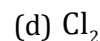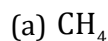
112. A what field would methyl radical come into resonance in spectrometer operating at 9.5 GHz $(g = 2.0026)$?

(a) 0.34 T   (b) 0.68 T   (c) 1.02 T   (d) 0.17 T
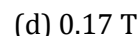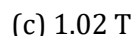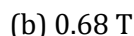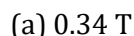
113. The number of NMR signals in the spectrum of

 $-CH_2CH_3$ are:

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

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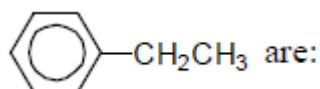
114. Assuming that the force constant for $c \equiv c, c = c, c - c$ are in ratio $3:2:1$ and normal range of $c = c$ sketch absorption is 1630-1690 cm^{-1}, what range would you expect for $c \equiv c$ stretch vibration?

(a) $1152 - 1195 \, cm^{-1}$

(b) $1195 - 2005 \, cm^{-1}$

(c) $2005 - 2080 \, cm^{-1}$

(d) $3260 - 3380 \, cm^{-1}$

115. Radius of orbit in Bohr's hydrogen atom is:

(a) $r = \dfrac{n^2 h^2}{4\pi e^2 m}$ (b) $r = \dfrac{n^2 h^2}{4\pi e m^2}$ (c) $r = \dfrac{n^2 h^2}{8\pi^2 e^2 m^2}$ (d) $r = \dfrac{n^2 h^2}{4\pi^2 e^2 m}$

116. The energy of a particle in a 1-dimensional box is given by:

(a) $\dfrac{n^2 h^2}{mL^2}$ (b) $\dfrac{nh^2}{4mL^2}$ (c) $\dfrac{n^2 h^2}{8m^2 L^2}$ (d) $\dfrac{n^2 h^2}{8mL^2}$

117. The term symbols for M_n and T_i atoms are:

(a) $^6S_{3/2}$ and $^3F_2$ (b) $^6S_{5/2}$ and $^3F_2$ (c) $^6S_{1/2}$ and $^3F_{3/2}$ (d) $^6S_{3/2}$ and $^3F_{1/2}$

118. The equivalent conductance of a IN solution of an electrolyte is nearly:

(a) 10^3 times more than specific conductance

(b) 10^{-3} times its specific conductance

(c) 100 times its specific conductance

(d) 110 times its specific conductance

119. Which of the following has a bond order 2.5:

(a) HCl   (b) CO   (c) NO   (d) N_2

120. The law which relates the solubility of a gas to its pressure is called:

(a) Roult's Law

(b) Distribution Law

(c) Henry's Law

(d) Ostwald's Law

121. The difference between the incident and scattered frequencies in the Raman spectrum is called:

(a) Stoke's line

(b) Anti Stoke's line

(c) Raman frequency (d) p-branch

122. The selection rule for transition in rotational energy levels in Raman spectrum is

(a) $\Delta J = \pm 1$ (b) $\Delta J = +1$ (c) $\Delta J = +2$ (d) $\Delta J = \pm 2$

123. What will be the ESR frequency of a free electron in a magnetic field of 0.34 T. Given that $g = 2.0023$ and $\beta = 9.273 \times 10^{-24} JT^{-1}$, $h = 6.626 \times 10^{-34} JS$:

(a) 20.0 GHz   (b) 09.50 GHz   (c) 19.0 GHz   (d) 09.50 MHz

124. How many normal modes are possible for water molecule?

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

125. If the value of $\dfrac{r_c}{r_a}$ (radius ratio of cation and anion) is equal to 0.213 then coordination number of cation is:

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

126. The pH of a solution by mixing 50 cc of 0.2 M HCl and 50 cc of 0.1 M NaOH will be:

(a) 1.8   (b) 2.4   (c) 1.3   (d) 4.2

127. The spin only magnetic moment is given by:

(a) $\sqrt{4S(S+1)}$ (b) $\sqrt{S(S+1)}$ (c) $\sqrt{2S(S+1)}$ (d) $\sqrt{S(S+3)}$

128. The relation between e.m.f. and concentration for a cell is:

(a) Linear   (b) Exponential   (c) Logarithmic   (d) no relation

129. Maximum number of α and β particles emitted when $^{238}_{92}U$ changes to $^{206}_{82}Pb$ are:

(a) 6α and 8β (b) 8α and 8β (c) 6α and 6β (d) 8α and 6β

130. If Weiss indices of a face of a crystal are $1, \infty, \infty$, then its Miller indices will be:

(a) 1, 0, 0   (b) 0, 1, 1   (c) 0, 1, 0   (d) 1, 0, 1

131. The decrease in free energy is equal to

(a) mechanical work   (b) maximum work

(c) net work   (d) zero

132. The energy of a rigid rotator is:

(a) $E = \dfrac{n^2 h^2}{2m} J$ (b) $E = \dfrac{h^2}{2\pi I} J(J+1)$ (c) $E = \dfrac{n^2 h^2}{2ma^2}$ (d) $E = \dfrac{h^2}{\pi I} J(J+1)$

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133. The energy of an atom is the first Bohr orbit of hydrogen is 13.6 eV. The possible energy value in the excited state for electron in the Bohr orbit of hydrogen atom is:

(a) $-3.4\,\text{eV}$ (b) $-4.2\,\text{eV}$ (c) $-6.8\,\text{eV}$ (d) 6.8 eV

134. The wave mechanical model of atom depends on:

(a) deBroglie equation   (b) Heisenberg, uncertainty principle   (c) Schrodinger's wave equation (d) All of the above

135. Electro-osmotic flux is the mass flux due to difference of:

(a) Potential   (b) Temperature   (c) Concentration   (d) Pressure

136. Canonical ensebles have same:

(a) T, P, N   (b) T, μ, N (c) T, V, N   (d) E, V, N

137. Ziegler Natta catalyst is used in .... Polymerization:

(a) Free radical   (b) Anionic   (c) Cationic   (d) Coordination

138. Which of the following is correct for most of the glasses?

(a) $T_g = T_m$ (b) $T_g = \dfrac{1}{2}T_m$ (c) $T_g < T_m$ (d) $T_g > T_m$

139. Which of the following is correct expression for Helmholtz free energy (A) in terms of partition function:

(a) $A = -k \ln \theta$ (b) $A = kT \ln \theta$ (c) $A = -kT^2 \ln \theta$ (d) $A = -kT \ln \theta$

140. Which of the following partition function has largest value:

(a) Vibrational   (b) Translational   (c) electronic   (d) rotational

141. Absolute entropy of a substance can be calculated using:

(a) Zeroth Law of thermodynamics   (b) First Law of thermodynamics

(c) Second Law of thermodynamics   (d) Third Law of thermodynamics

142. At constant temperature, the change of chemical potential with change in pressure is equal to

(a) entropy   (b) partial molar enthalpy

(c) partial molar volume   (d) Free energy

143. In any crystal ratio of Weiss indices of the face is 2:4:3, then the Miller indices would be

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(a) 6 3 4   (b) 3 4 6   (c) 4 3 6   (d) 6 4 3

144. The activation energy of a reaction can be calculated from the slope of the following graph:

(a) $\ln k$ vs T (b) $\ln k$ vs $\dfrac{1}{T}$ (c) $\dfrac{\ln k}{T}$ vs $\dfrac{1}{T}$ (d) $\dfrac{T}{\ln k}$ vs $\dfrac{1}{T}$

145. The half-time period of a second order reaction is 90 minutes. Calculate the time required for completion for completion of 60% of the reaction:

(a) 270 minutes   (b) 135 minutes   (c) 180 minutes   (d) 90 minutes

146. If velocity constant of a reaction is $2.0 \times 10^{-4} \ sec^{-1}$ and rate of reaction is $8.0 \times 10^{-4} \ moles \ lit^{-1} \ sec^{-1}$, then the concentration of reactant will be:

(a) $2.0 \times 10^{-4} \ moles \ lit^{-1}$ (b) $1.0 \ mole \ lit^{-1}$

(c) $4.0 \ moles \ lit^{-1}$ (d) $8.0 \ moles \ lit^{-1}$

147. The maximum probability distribution in Fermi-Dirac statistics is equal is:

(a) $\alpha = \dfrac{1}{e^{(\alpha + \beta \in i)}}$ (b) $\alpha = \dfrac{1}{e^{(\alpha + \beta \in i)} + 1}$ (c) $\alpha = \dfrac{1}{e^{(\alpha + \beta \in i)} - 1}$ (d) $\alpha = \dfrac{1}{e^{(\alpha - \beta \in i)} + 1}$

148. The total change in entropy 'ds' for an irreversible process is given by:

(a) $ds = d_e s - d_i s$ (b) $ds = d_e s + d_i s$ (c) $ds = 0$ (d) $ds = -d_e s - d_i s$

Where $d_e s$ = entropy exchanged with surroundings

$d_i s$ = entropy generated by irreversible process irr the system.

149. In a three component system of phase equilibrium the maximum number of degree of freedom can be:

(a)   (b)   (c)   (d)

150. Which of the following sets of quantum numbers is possible for an electron is '4f' orbital:

(a) $n = 4, l = 3, m = 4, s = +\dfrac{1}{2}$ (b) $n = 4, l = 4, m = +4, s = +\dfrac{1}{2}$

(c) $n = 4, l = 3, m = +1, s = -\dfrac{1}{2}$ (d) $n = 4, l = 2, m = 2, s = +\dfrac{1}{2}$

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