

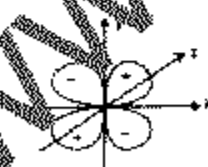
CHEMISTRY

- 1 Consider the following statements
- Total energy of the electron in a hydrogen atom can be calculated by using the Schrodinger equation
 - The values of the spin quantum number, m_s , can be obtained from the solution of the Schrodinger equation.
 - The set of solutions of the Schrodinger equation constitutes the one-electron wave functions

Which of the statements given above is/are correct?

- 1 only
 - 3 only
 - 1 and 3
 - 1 and 2
- 2 The ground state energy of hydrogen atom is -13.6 eV . What is the ground state energy of Li^{2+} ?
- -3.4 eV
 - -13.6 eV
 - -40.8 eV
 - -122.4 eV
- 3 A particle of mass $5 \times 10^{-4} \text{ amu}$ moves with a velocity of $6.62 \times 10^7 \text{ cm}^{-1}$. What is the wavelength of motion of the particle? ($h = 6.62 \times 10^{-27} \text{ ergs}$ and $1 \text{ amu} = 1.66 \times 10^{-24} \text{ g}$)
- 120.5 nm
 - 1205 nm
 - 12050 nm
 - 120500 nm

4



The angular dependence of a hydrogen like orbital is given in the figure above (z -axis is perpendicular to the plane of the paper). Which one of the following is the orbital?

- d_{xy}
- d_{xz}

- d_{yz}
- d_{yz}

- 5 In the reaction $\text{NH}_4\text{Cl (s)} \rightarrow \text{NH}_3 \text{ (g)} + \text{HCl (g)}$, what is the entropy ΔS° ?

- It is less than zero
- It is greater than zero
- It is equal to zero
- It is equal to zero

- 6 After the discovery of element number 112, where would it be placed in the periodic table?

- Among the actinides
- Among the alkali metals
- Among the zero group elements
- Among the group II B elements

r -axis is the inter-nuclear axis of a diatomic molecule A-B, then which one of the following overlaps of orbitals of A and B would form a π bond?

- $p_x + p_x$
- $p_y + p_y$
- $p_z + p_z$
- $s + p_z$

- 8 Consider the following statements

- In POCl_3 and VOCl_3 , the $\{\text{PO}\}$ and $\{\text{VO}\}$ moieties have double bond character
- The double bond in $\{\text{PO}\}$ moiety originates from "O" as donor
- The double bond in $\{\text{VO}\}$ moiety originates from "V" as donor
- Both the processes involved in 2 and 3 are called back bonding

Which of the statements given above is/are correct?

- 1 only
- 1 and 2
- 2 and 3
- 1 and 4

- 9 Match List-I with List-II and select the correct answer using the code given below the lists

List-I (Molecule or Ion)

- A. Br_2
 B. $\text{N}(\text{CH}_3)_3$
 C. $\text{N}(\text{SiH}_3)_3$
 D. BrF_3

List-II (Shape)

1. T-shaped
 2. Planar
 3. Pyramidal
 4. Linear
 a. A1, B2, C3, D4
 b. A1, B3, C2, D4
 c. A4, B2, C3, D1
 d. A4, B3, C2, D1

10. Which one of the following statements is correct?

For an octahedral molecular geometry VSEPR method requires

- a. eight pairs of electrons
 b. six pairs of electrons
 c. five pairs of electrons
 d. four pairs of electrons

11. What is the oxidation state of Fe in brown $[\text{Fe}(\text{H}_2\text{O})_6] \text{NO}] \text{SO}_4$?

- a. -1
 b. -2
 c. -3
 d. 0

12. A drunken person was asked to blow a glass tube packed with acidified potassium dichromate. Consider the following statements:

The change in colour of the material from orange to green confirmed the drinking of alcohol and is due to

1. the oxidation of alcohol with the reduction of dichromate to chromium (II)
 2. complete formation of alcohol and dichromate.
 3. change in the coordination number of chromium.

Which of the statements given above is/are correct?

- a. 1 only
 b. 2 only
 c. 3 only
 d. 2 and 3

13. Consider the following statements:

1. BCl_3 is a stronger Lewis acid than BF_3 .

2. The partial double bond character of B-F bond in SF_4 is lost in the adduct $\text{H}_3\text{N-SF}_4$.
 3. Stronger Lewis acidity of BF_3 is due to the presence of highly electronegative fluorine atoms.

Which of the statements given above is/are correct?

- a. 2 and 3
 b. 3 only
 c. 1 and 2
 d. 1 only

14. $[\text{AgI}_2]^-$ is stable while $[\text{AgF}_2]^-$ is unstable due to which one of the following reasons?

- a. Noble metal is easily attacked by corrosive fluorine, while soft iodine binds softer easily.
 b. Ag^+ is a soft acid and reacts with soft base I^- giving stable $[\text{AgI}_2]^-$ while hard base F^- gives unstable $[\text{AgF}_2]^-$.
 c. Ag^+ is a hard acid and reacts with a hard base F^- giving unstable product.
 d. F^- cannot react with Ag^+ .

15. Which one of the following acids gives a white precipitate with CaCl_2 that is insoluble in all other acids?

- a. HNO_3
 b. HCl
 c. H_2SO_4
 d. H_3PO_4

16. In the steam reforming process, natural gas (methane) is treated with steam at high temperature in the presence of catalysts for industrial production of which one of the following?

- a. Cooking gas
 b. Methanol
 c. Acetylene
 d. Hydrogen gas

17. Consider the following statements:

1. Nitrogen and phosphorus have +3 and +5 as their most common oxidation states.
 2. In living systems the use of nitrogen is exclusively in +3 oxidation state.
 3. Phosphorus behaves similarly like nitrogen in the biosphere.

Which of the statements given above is/are correct?

- a. 1 only

- b. 2 only
c. 1 and 2
d. 1 and 3
18. The ability of s-block elements to form peroxide or super oxide depends on which one of the following?
a. Increasing cation radius
b. Decreasing cation radius
c. Valency
d. Charge
19. Consider the following statements:
1. All allotropic forms of carbon consist of sp^2 hybridization and are good conductors.
2. The graphite sheet can be folded to form cylinder type in newly discovered carbon nanotubes.
Which of the statements given above is/are correct?
a. 1 only
b. 2 only
c. Both 1 and 2
d. Neither 1 nor 2
20. When iodine (I_2) is dissolved in aqueous solution of KI, which one of the following is formed?
a. I_3^-
b. I_2
c. I^-
d. I
21. Consider the following statements associated with the properties of borate:
1. Borax when dissolved in water releases triangular and tetrahedral boron species.
2. Orthoboric acid is a monohydrated form of metaboric acid
3. The first proof that vitamin B12 contained cobalt was obtained by metaborate bead test.
Which of the statements given above is/are correct?
a. 1, 2 and 3
b. 1 and 2 only
c. 1 only
d. 2 and 3 only
22. Why does anhydrous sulphuric acid conduct electricity?
a. It gets reduced to SO_2
b. It is self ionized into $H_2SO_4^+$ and HSO_4^-
c. It gets oxidized to permonosulphuric acid
d. It gets decomposed to H^+ and SO_4^{2-}
23. Poly tetrafluoro ethane, PTFE, is used in which one of the following?
a. Non-stick cooking pans
b. Bessemer converter
c. Bleaching powder
d. Car engines
24. Which one of the following is not an element of the second transition series?
a. Molybdenum
b. Silver
c. Platinum
d. Zirconium
25. Match List-I with List-II and select the correct answer using the code given below the list:
List-I (Complex Ion)
A. $[Co(NH_3)_6]^{3+}$
B. $[Fe(CN)_6]^{4-}$
C. $[Mn(H_2O)_6]^{2+}$
D. $[Ni(H_2O)_6]^{2+}$
List-II (Spin-only Magnetic Moment)
1. 1.73 BM
2. 5.92 BM
3. 0.0 BM
4. 2.83 BM
a. A4, B1, C2, D3
b. A3, B2, C1, D4
c. A4, B2, C1, D3
d. A3, B1, C2, D4
26. Which one of the following nickel complexes is paramagnetic in nature?
a. $[NiCO_6]$
b. $K_2[Ni(CN)_4]$
c. $K_2[NiCl_4]$
d. $K_2[Ni(\text{ethylene diamine})_2]$
27. Consider the following statements in respect of reactions associated with iron salts:
1. Freshly precipitated green ferrous hydroxide readily changes to brown ferric hydroxide on exposure to air.
2. Ferric hydroxide dissolves in cold dilute HCl to impart a pale yellow colour.

3. Addition of a colourless KI solution into the pale yellow solution changes the resultant colour brown.

4. The brown colour can be extracted in CCl_4 to produce a violet coloration.

Which of the statements given above are correct?

- 3 and 4 only
- 1 and 2 only
- 2, 3 and 4 only
- 1, 2, 3 and 4

28. Consider the following statements:

1. The size of the lanthanide M^{3+} ions decreases as the atomic number of M increases

2. Electronic spectra of lanthanides show very broad bands.

3. As with transition metals, coordination number six is very common in lanthanide complexes.

Which of the statements given above are correct?

- 1 only
- 1 and 2
- 1 and 3
- 3 only

29. Which one of the following statements is correct? In the metallurgy of sodium, the electrolysis, excess of calcium chloride is mixed with sodium chloride.

- make the latter a good conductor
- make the latter soft
- generate more energy for the electrolytic cell
- assist in reduction of the latter at a much lower temperature

30. Consider the following statements.

1. Wrought iron is malleable and ductile

2. Pig iron can be melted to produce cast irons of desired shapes

3. Wrought iron is obtained by heating pig iron with iron oxide in a furnace.

Which of the statements given above are correct?

- 1 only
- 1 and 2
- 2 and 3
- 3 only

31. Mond's process for extracting nickel in the pure form uses which one of the following?

- Vapour phase refining
- Zone refining
- Electrolysis
- Solvent extraction

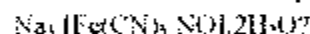
32. Which one of the following statements is correct? Enrichment of fissile uranium is to

- Increase $\text{U}^{235}:\text{U}^{238}$ ratio
- eliminate thorium from uranium
- refine naturally occurring uranium
- decrease $\text{U}^{235}:\text{U}^{238}$ ratio

33. Fast breeder reactors are based on which one of the following?

- Conversion of U^{238} to Pu^{239} and removing the moderator
- Conversion of Th^{232} to Pu^{239} and using moderator
- Conversion of Th^{232} to U^{235} and removing the coolant
- Conversion of U^{238} to U^{235} and removing the control rods

34. Which one of the following is the correct IUPAC name of the compound



- Sodium nitroprusside dehydrate
- Trisodium nitroprusside dehydrate
- Sodium pentacyanonitrosyl ferrate (II) dehydrate
- Trisodium pentacyanonitroso iron (II) dihydrate

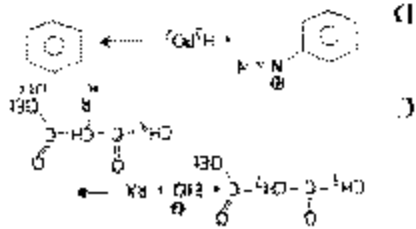
35. Which one of the following coordination compounds is used as an anti-cancer drug for treatment of malignant tumors?

- $\text{K}[\text{PtCl}_2(\text{H}_2\text{O})_2]$
- $\text{K}_2[\text{Pt}(\text{CN})_4]\cdot 3\text{H}_2\text{O}$
- trans $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$
- cis $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

36. Which one of the following ions has zero CFSE in octahedral field?

- Fe^{3+} (low spin)
- Fe^{3+} (high spin)
- Co^{2+} (low spin)
- Co^{2+} (high spin)

37. Inorganic pollutants arising from Mathura refinery mainly comprise which of the following?



List-II (Intermediate involved)

- 1 Free radical
- 2 Carbanion
- 3 Carbanium ion
- 4 Carbene
- 5 Benzene

- a A1, B2, C3, D1
 - b A3, B2, C4, D1
 - c A4, B3, C2, D1
 - d A5, B, C, D1
43. Consider the following statements

1. Br is a poor leaving group
 2. the geometry of the molecule does not permit formation of carbonium ion at bridgehead.
 3. the geometry of the molecule does not permit backside attack by O^- , at the bridgehead.
 Which of the statements given above is/are correct?

- a 1 and 2
 - b 2 and 3
 - c 2 only
 - d 3 only
44. Which one of the following is an electrophilic reagent?
- a. RO^+
 - b. BF_3
 - c. NH_3
 - d. KOH

Which of the following pairs are correctly matched for the number of monochlorinated products (ignoring stereoisomers) obtained from the listed isomeric hexanes?

- a. RO^+
- b. BF_3
- c. NH_3
- d. KOH

Products
 Isomer / Number of Monochlorinated

- a Fluoride, sulphate, arsenate and nitrate
- b Sulphide, mixed nitric oxides and silicon dioxide
- c Hydrogen fluoride, hydrogen sulphide and arsenous acid
- d Hydrogen sulphide and sulphur dioxide

38. Which one of the following is not correct about an acceptable wave function?

- a It is continuous
- b It is single valued
- c It indicates the probability
- d It is square integrable

39. Which one of the following orders of +I effect for the groups H, C_2H_5 , CH_3 , C_6H_5 is correct?

- a $\text{H} < \text{C}_6\text{H}_5 < \text{C}_2\text{H}_5 < \text{CH}_3$
- b $\text{C}_6\text{H}_5 < \text{C}_2\text{H}_5 < \text{CH}_3 < \text{H}$
- c $\text{H} < \text{C}_2\text{H}_5 < \text{CH}_3 < \text{C}_6\text{H}_5$
- d $\text{C}_6\text{H}_5 < \text{CH}_3 < \text{H} < \text{C}_2\text{H}_5$

40. Which one of the following is the most polar molecule?

- a CH_3Cl
- b CCl_4
- c CH_2Cl_2
- d $\text{C}_2\text{H}_5\text{Cl}$

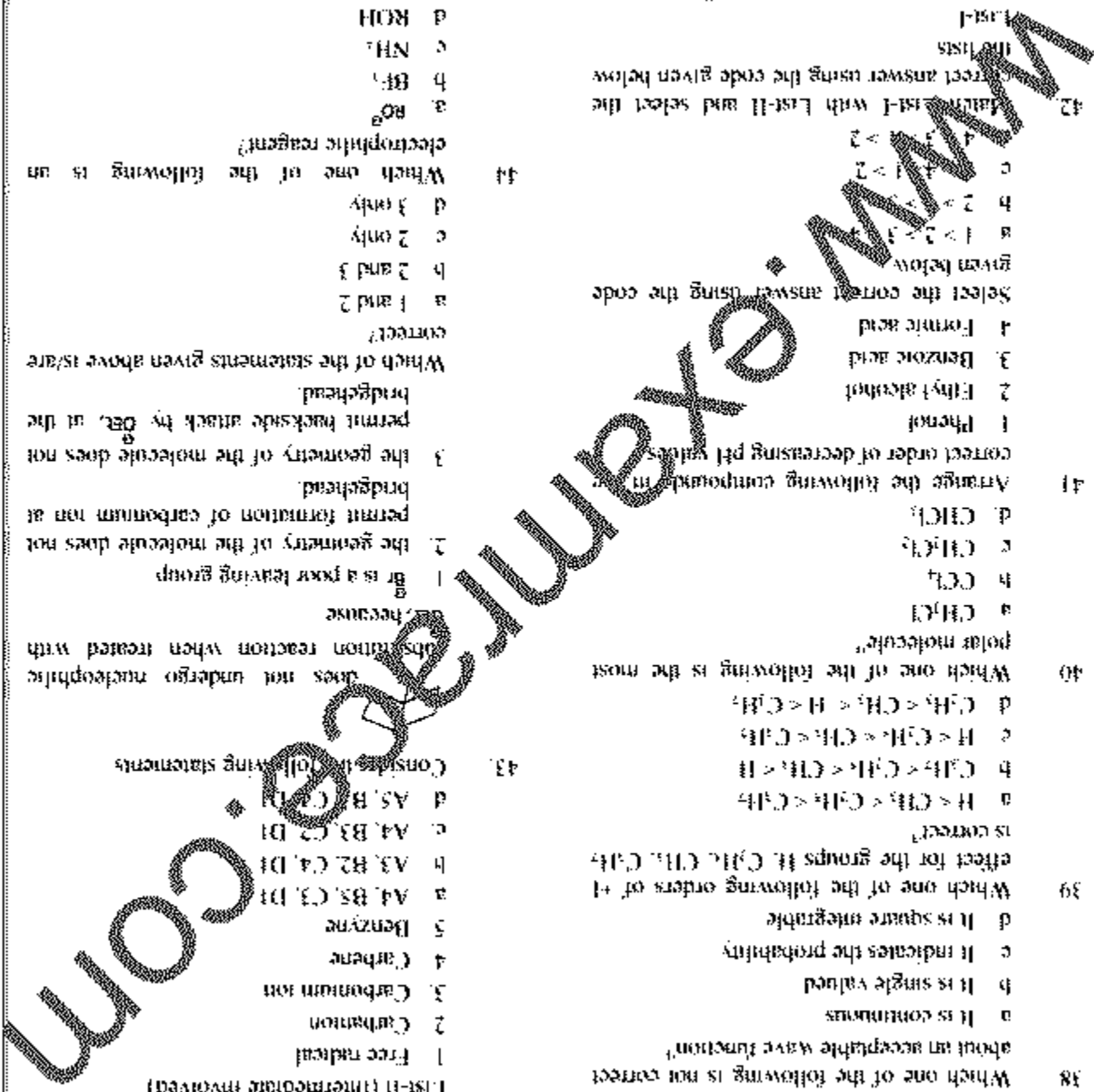
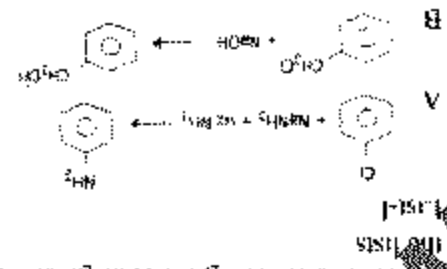
41. Arrange the following compound in correct order of decreasing pK values.

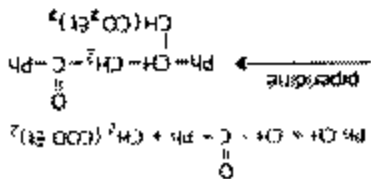
- 1 Phenol
- 2 Ethyl alcohol
- 3 Benzoic acid
- 4 Formic acid

Select the correct answer using the code given below.

- a 1 > 2 > 3 > 4
- b 2 > 3 > 4 > 1
- c 4 > 1 > 2 > 3
- d 3 > 4 > 1 > 2

42. Match List-I with List-II and select the correct answer using the code given below.





What is this reaction called?

- Aldol condensation
- Perkin condensation
- Diels-Alder reaction
- Michael addition

Acid catalyzed dehydration reaction of 2-methyl-1-butanol yields which one of the following?

- 2-methyl-1-butene only
- 2-methyl-2-butene only
- A mixture of 2-methyl-1-butene and 2-methyl-2-butene
- mainly 2-methyl-1-butene and 2-ethyl-1-butene

Which one of the following compounds undergoes predominantly S_N2 reaction using NaOH in polar aprotic solvents?

- Clc1ccc(O)cc1
- CC1=CC=C(C)C=C1
- CC1=CC=C(C)C=C1
- Nc1ccc(O)cc1

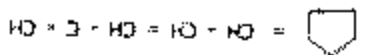
Consider the following compounds.

- CC(O)C
- CC(O)C
- CC(O)C
- CC(O)C

Which one of the following is the correct order of acidic strength for the compounds given above?

- 4 > 3 > 1 > 2
- 2 > 1 > 4 > 3
- 2 > 4 > 1 > 3
- 3 > 1 > 4 > 2

What is the number of cis-trans isomers possible for the following compound?



- 0
- 1
- 2
- 4

- 2,3-dimethylbutane - Two
 - 2,2-dimethylbutane - Three
 - 3-methylpentane - Five
- Select the correct answer using the code given below
- 1, 2 and 3
 - 1 and 2 only
 - 2 and 3 only
 - 1 and 3 only

Which one of the following statements is correct? The dehydration of n-butanol with acid gives

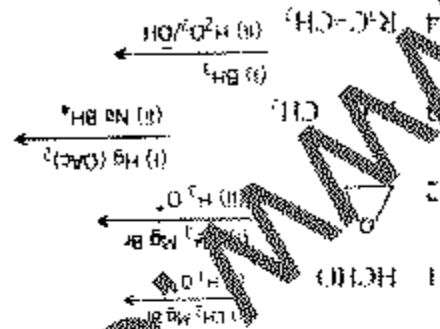
- a mixture of 1- and 2-butenes in equal amount
- 1-butene as the major product
- involving primary carbocation as the intermediate
- 2-butene as the major product

- involving a proton shift to form a more stable secondary carbocation
- 2-butene as the major product
- involving hydride shift to form a more stable secondary carbocation

Hydrochlorination of a compound X (C₁₁H₁₆) gives 2-chloropentane as the major product. What is the final product of the ozonolysis reaction of X?

- 1-pentene
- butanal + methanal
- 2-pentene
- propanal + ethanal

In which of the following reactions, is the final product a primary alcohol?

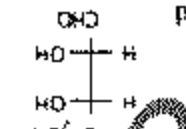
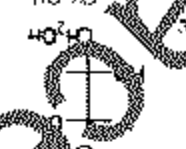
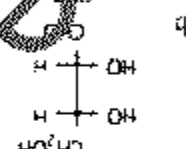
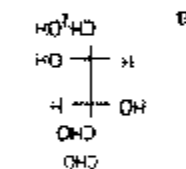
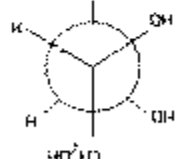


Select the correct answer using the code given below

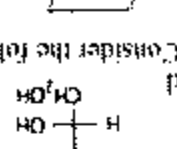
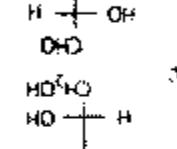
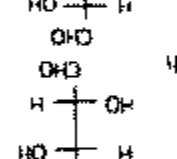
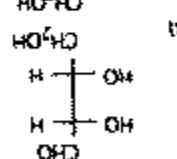
- 1, 2 and 3
- 1, 2 and 4
- 2, 3 and 4
- 4 only

Consider the following reaction

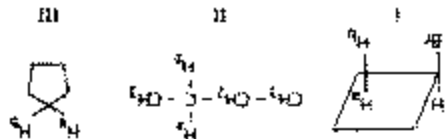
What is the correct Fischer projection formula of the represented by the following Newman conformation?



84 What is the correct Fischer projection formula of the 2R, 3R-tetrose?



85 Consider the following compounds



86 Identify H_a and H_b hydrogens in the above compounds

- a) Diastereotopic, respectively enantiomeric
- b) Enantiomeric, homotopic, respectively
- c) Homotopic, diastereotopic, respectively
- d) Diastereotopic, enantiomeric, diastereotopic, respectively

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Which one of the following compounds exhibits geometrical isomerism?

- a) 2-butene
- b) 2-methyl propene
- c) Propene
- d) 2-methyl-1-butene

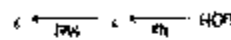
Consider the following molecules

- 1 trans-1,2-dichlorocyclopropane
- 2 cis-1,2-dichlorocyclopropane
- 3 1,1,2-trichlorocyclopropane

In which of the above molecules is the set(s) of methylene hydrogens diastereotopic?

- a) 1 only
- b) 1 and 3
- c) 2 and 3
- d) 2 only

(Typically pure 2(S)-butanol is subjected to the following reaction

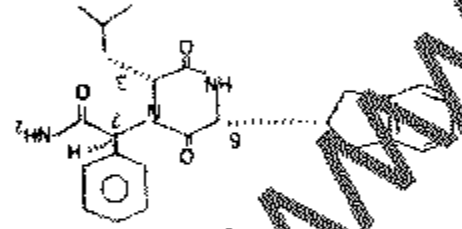


Which one of the following statements is correct for stereo-chemical outcome of the reaction?

- a) The reaction proceeds with inversion

Flow are R and S configurations at C-3, C-6 and C-7, in the above compound assigned?

- a) 3R, 6S, 7R
- b) 3S, 6R, 7R
- c) 3R, 6R, 7S
- d) 3S, 6S, 7R



86 Consider the following compound

- a) Diastereotopic, respectively enantiomeric
- b) Enantiomeric, homotopic, respectively
- c) Homotopic, diastereotopic, respectively
- d) Diastereotopic, enantiomeric, diastereotopic, respectively

b The reaction proceeds with

racemization

c The reaction proceeds with complete

retention of configuration

d The reaction leads to destruction of

chirality in the molecule

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The reaction of the compound 'A' with

excess of MeMgI followed by acidification

yields t-butyl alcohol. What is the

compound 'A'?

a Methanal

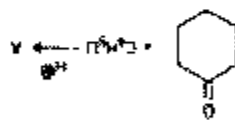
b Ethanal

c Propanal

d Methyl ethanoate

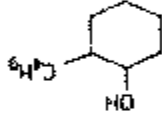
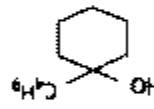
62

Consider the following reaction



What is the product 'A' in the reaction

given above?



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Consider the following compounds:

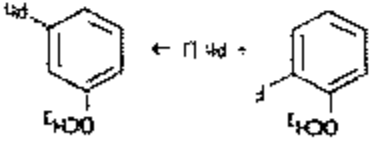


According to Huckel's rule, which of the

species given above is/are aromatic?

64

Consider the following reaction:



d 3 and 4

c 4

b 2

a 1

65

What is the major product formed in the

reduction of nitro compound Ar-

(NO₂ with Zn/HCl/H⁺)

a Ar-NH₂

b Ar-NH₂OH

c Ar-N=N-Ar

d Ar-NH-NH-Ar

Consider the following statements

1. Zn is a highly specific catalyst for benzoin

condensation because

1. It acts as a nucleophile

2. It has electron withdrawing ability

facilitates loss of aldehydic proton

3. It acts as a good leaving group

4. It acts as a strong base

Which of the statements given above are

correct?

a. 1, 2 and 4

b. 1, 3 and 4

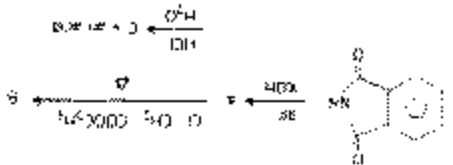
c. 1, 2 and 3

d. 2 and 3 only

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Consider the following sequence of

reactions:

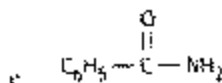


What is the product 'C' in the above

reaction sequence?

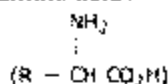
a. 2-N,3-Ethyl-2,3-dioxolane

b. 1,2-N,3-Ethyl-2,3-dioxolane



d. None of the above

68. Consider the following statements about α -amino acids



- 1 They have unusually high melting point.
- 2 They are highly soluble in polar solvents but insoluble in non-polar solvents
- 3 At their so-electric point, they do not migrate under the influence of an electric field

Which of the statements given above are correct?

- a. 1 and 2 only
- b. 2 and 3 only
- c. 1 and 3 only
- d. 1, 2 and 3

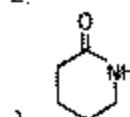
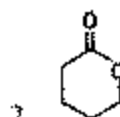
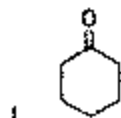
69. The UV spectrum of acetone shows absorption maxima at 166, 189, 279 nm. What type of transition is responsible for each of these bands respectively?

1. $n \rightarrow \sigma^*$
 2. $\pi \rightarrow \pi^*$
 3. $n \rightarrow \pi^*$
- a. 1, 2 and 3
 - b. 2, 1 and 3
 - c. 1, 3 and 2
 - d. 3, 2 and 1

70. A bicyclic diene, $\text{C}_{10}\text{H}_{16}$, gives λ_{max} at 245 nm in its UV spectrum. What is its most likely structure according to Woodward-Fieser rules?



71. Consider the following compounds:



3. What is the correct sequence of the compounds given above in the decreasing order of $\nu_{\text{C}=\text{O}}$ absorption band (cm^{-1}) in IR spectrum?

- a. $3 > 1 > 2$
- b. $2 > 1 > 3$
- c. $1 > 2 > 3$
- d. $2 > 3 > 1$

72. Consider the following statements for a compound $\text{C}_3\text{H}_8\text{O}$ showing three signals in its ¹H-NMR spectrum:

1. It is a saturated ether which is symmetrical
 2. It gives isopropyl iodide with hot HI.
- Which of the statements given above is/are correct?

- a. 1 only
- b. 2 only
- c. Both 1 and 2
- d. Neither 1 nor 2

73. Match List-I with List-II and select the correct answer using the code given below the lists

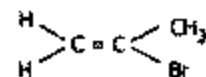
List-I

- A. TMS
- B. Hooke's law
- C. KMnO₄
- D. Bathochromic Shift

List-II

1. UV
 2. Visible
 3. NMR
 4. IR
- a. A3, B4, C1, D2
 - b. A4, B3, C2, D1
 - c. A3, B4, C2, D1
 - d. A4, B3, C1, D2

74. Consider the following compound:




How many different proton NMR signals are possible for the compound given above?

- a. 1
b. 2
c. 3
d. None of the above
75. At 400 K, the pressure of an ideal gas is 0.082 atm. What is its concentration in mol dm^{-3} ?
($R = 0.082 \text{ dm}^3 \text{ atm mol}^{-1} \text{ K}^{-1}$)
a. 2.5×10^{-1}
b. 2.5×10^{-2}
c. 2.5×10^{-3}
d. 2.5×10^{-4}
76. The van der Waals' constants for CO are given by
a = $15 \text{ dm}^6 \text{ atm mol}^{-2}$ and
b = $0.04 \text{ dm}^3 \text{ mol}^{-1}$. What is the Boyle temperature (in K) for CO?
($R = 0.082 \text{ dm}^3 \text{ atm mol}^{-1} \text{ K}^{-1}$)
a. 69
b. 320
c. 457
d. 690
77. What is the correct order of effusion of the gases H_2 , N_2 , O_2 and NH_3 ?
a. $\text{H}_2 > \text{N}_2 > \text{O}_2 > \text{NH}_3$
b. $\text{O}_2 > \text{N}_2 > \text{NH}_3 > \text{H}_2$
c. $\text{H}_2 > \text{N}_2 > \text{NH}_3 > \text{O}_2$
d. $\text{H}_2 > \text{NH}_3 > \text{N}_2 > \text{O}_2$
78. Samples of two gases, A and B are at the same pressure and temperature. The ratio of the mean free path of gas A to that of gas B is equal to 2. What is the ratio of the molecular diameter of gas A to that of gas B?
a. 1
b. 2
c. 4
d. $1/\sqrt{2}$
79. Total kinetic energy of gas A having 1.0×10^{22} molecules is $2.4 \times 10^3 \text{ J}$ at -123°C . Gas B at 27°C has a total kinetic energy $4.8 \times 10^3 \text{ J}$. What is the number of molecules in gas B?
a. 2.0×10^{22}
b. 1.0×10^{22}
c. 1.0×10^{24}
d. 5.0×10^{21}
80. At 27°C , two moles of a gas expand isothermally from 10 litre to 20 litre against a constant pressure of 1 atm. What is the work done in calories (1 atm litre = 242 cal)
a. 10
b. 242
c. 484
d. 1000
81. Which one of the following has the same value of Van't Hoff factor as $\text{K}_4[\text{Fe}(\text{CN})_6]$?
a. NH_4Cl
b. $\text{Al}_2(\text{SO}_4)_3$
c. $\text{Al}(\text{NO}_3)_3$
d. Na_2SO_4
82. What is the work done, when 100 g of iron reacts with hydrochloric acid in a closed vessel (volume constant)? (At. wt. of iron = 56)
a. -4 kJ
b. 4 kJ
c. 2.2 kJ
d. 4.4 kJ
83. If $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O} - 13.7 \text{ k cal}$, then what is the heat of neutralization for complete neutralization of one mole of H_2SO_4 by base?
a. 27.4 k cal
b. 13.7 k cal
c. 6.85 k cal
d. 3.42 k cal
84. Match List-I with List-II and select the correct answer using the code given below the lists:
List-I
A. $\left(\frac{\partial F}{\partial P}\right)_T$
B. $\left[\frac{\partial(G/T)}{\partial T}\right]_P$
C. $\left(\frac{\partial F}{\partial T}\right)_P$
D. $\left(\frac{\partial G}{\partial T}\right)_P$
List-II
1. $-HT^2$
2. $-S$

3. V
4. μJT
a. A1, B4, C2, D3
b. A4, B1, C2, D3
c. A4, B1, C3, D2
d. A1, B4, C3, D2
85. Match List-I with List-II and select the correct answer using the code given below the lists
- List-I
- Reversible adiabatic expansion
 - Joule Thomson expansion
 - Reversible evaporation of a liquid at its normal boiling point
 - Adiabatic free expansion
- List-II
- $\Delta H = 0$
 - $\Delta U = 0$
 - $\Delta G = 0$
 - $\Delta S = 0$
- a. A2, B1, C3, D4
b. A4, B3, C1, D2
c. A2, B3, C1, D4
d. A4, B1, C3, D2
86. What is the correct order of vapour pressures of 0.1 M aqueous solutions of FeCl_3 , NaCl , CaCl_2 and Glucose?
- Glucose $>$ NaCl $>$ CaCl_2 $>$ FeCl_3
 - FeCl_3 $>$ CaCl_2 $>$ NaCl $>$ Glucose
 - CaCl_2 $>$ Glucose $>$ NaCl $>$ FeCl_3
 - NaCl $>$ CaCl_2 $>$ FeCl_3 $>$ Glucose
87. Consider the following statements in the light of phase rule
- The degree of freedom in case of a pure substance at its critical point is zero.
 - Critical temperature and critical pressure are fixed at critical point for a pure substance.
 - The degree of freedom in case of a pure substance at its critical point is one.
- Which of the statements given above is are correct?
- 1 and 2
 - 2 and 3
 - 1 only
 - 3 only
88. According to Raoult's law the relative lowering of vapour pressure of a solution of a non-volatile substance is equal to which one of the following?
- Mole fraction of solute
 - Mole fraction of solvent
 - Weight percent of solute
 - Weight percent of solvent
89. At 27° C, the vapour pressure of water in a closed vessel is 0.4 atm. If the volume of the vessel is doubled, what will be the vapour pressure of water?
- 0.2 atm
 - 0.4 atm
 - 0.6 atm
 - 0.8 atm
90. If 0.056 g of N_2 gas dissolves in 1000 g of water at a certain pressure of N_2 gas and the Henry's law constant for the gas in water is 1×10^5 atm, then what is the value of
- 2.8
 - 3.6
 - 4.0
 - 4.8
91. A certain quantity of electricity is passed through aqueous solutions of AgNO_3 and CuSO_4 connected in series. The amount of Ag (At. wt. 108) deposited at the cathode is 108 g. What is the amount of Cu deposited at the cathode (At. wt. of Cu is 63.53)?
- 1.27 g
 - 0.317 g
 - 0.635 g
 - 3.177 g
92. The vapour pressure of a solvent decreased by 5 mm of Hg, when a non-volatile solute was added to the solvent. The mole fraction of the solute in the solution is 0.2. What would be the mole fraction of the solvent, if decrease in the vapour pressure is to be 15 mm of Hg?
- 0.8
 - 0.6
 - 0.4
 - 0.2
93. For coagulating As_2S_3 colloidal sol, which one of the following will have the lowest coagulation value?

- a. NaCl
b. KCl
c. AlCl₃
d. None of the above
94. 0.01 M glucose solution is isotonic with which one of the following?
a. 500 ml solution containing 0.3 g urea
b. 500 ml solution containing 0.6 g urea
c. 500 ml solution containing 1.8 g glucose
d. 250 ml solution containing 1.8 g glucose
95. What is the pH value of a solution obtained by mixing 50 ml of 0.2 M HCl with 50 ml of 0.1 M NaOH? ($\log_{10} 2 = 0.30$)
a. 7.0
b. 4.2
c. 3.6
d. 1.3
96. At 25°C, the conductance of 0.1 M HCl solution is $2 \times 10^4 \text{ ohm}^{-1}$ when measured using a cell of cell constant 0.1 cm^{-1} . What is its equivalent conductance (in $\text{ohm}^{-1} \text{ cm}^2 \text{ g equiv}^{-1}$)?
a. 0.002
b. 0.02
c. 0.2
d. 2
97. The two electrodes of Pt are in a conductance cell are 1 cm apart while the cross-sectional area of each electrode is 0.75 cm^2 . What is the cell constant?
a. 0.2 cm^{-1}
b. 0.5 cm^{-1}
c. 2.0 cm^{-1}
d. 1.125 cm^{-1}
98. What is the value of $E^\circ (\text{M}^{2+}(\text{aq}) | \text{M}^+(\text{aq}), \text{E}^\circ (\text{M}^{2+}(\text{aq}) | \text{M}(\text{s})) 0.30 \text{ V}$ and $E^\circ (\text{M}^+(\text{aq}) | \text{M}(\text{s})) 0.50 \text{ V}$?
a. 0.20 V
b. -0.20 V
c. 0.10 V
d. -0.10 V
99. Cisplatin, a square planar complex of platinum, is used as which one of the following?
a. An anti-cancer drug
b. A substitute for haemoglobin
c. A catalyst
d. Water purifier
100. For the reaction scheme $A \rightarrow B \rightarrow C$, assuming that the concentrations of any intermediate species are negligible, then which one of the following holds during the reaction?
a. $\Delta[A] = \Delta[B] = \Delta[C] = 0$
b. $\Delta[A] + \Delta[B] = \Delta[C] = 0$
c. $\Delta[A] = \Delta[B] = \Delta[C] = 0$
d. $\Delta[A] = \Delta[B] = \Delta[C] = 0$
101. The rate of a second order reaction is $3 \times 10^{-5} \text{ mol l}^{-1} \text{ s}^{-2}$. What is the rate constant k, when the initial concentration is 0.2 mol l^{-1} ?
a. 1.5×10^{-4}
b. 7.5×10^{-4}
c. 7.5×10^{-5}
d. 5×10^{-4}
102. Match List-I with List-II and select the correct answer using the code given below in List-III
List-I (Reaction)
A. Zero order reaction
B. First order reaction
C. Second order reaction
D. Third order reaction
List-II (Half life)
1. $1/ak$
2. $a/(2k)$
3. $0.693/k$
4. $3/(2ka^2)$
a. A3, B2, C4, D1
b. A2, B3, C1, D4
c. A2, B3, C4, D1
d. A3, B2, C1, D4
103. Consider the following statements:
For a first order reaction,
1. the time taken for the completion of 75% reaction is twice of $t_{1/2}$ of the reaction.
2. the pre-exponential factor in the Arrhenius equation has the dimension of $[\text{time}]^{-1}$.
3. a plot of concentration against time gives a straight line.
4. the unit of rate constant is mole s^{-1} .
Which of the statements given above is/are correct?

- a. 1 and 2
b. 1 only
c. 3 and 4
d. 1, 2 and 4
104. Which one of the integrated equations is correct for the reaction
 $A(g) \rightarrow B(g) + C(g) + D(g)$?
 $(P_i = \text{initial pressure of A at } t = 0 \text{ and } P_t = \text{total pressure at time } t)$
 a. $k = (2.303/t) \log_{10}[P_i/P_t]$
 b. $k = (2.303/t) \log_{10}[P_t/P_i]$
 c. $k = (2.303/t) \log_{10}[2P_t/(3P_i - P_t)]$
 d. None of the above
105. Consider the following statements:
 1. The rate constant of a chemical reaction can be increased by increasing the temperature.
 2. In an exothermic reaction, the activation energy of the reverse reaction is higher than that of the forward reaction.
 3. The rate of reaction can be increased in general by an increase in activation energy.
 Which of the statements given above are correct?
 a. 1 and 3 only
 b. 2 and 3 only
 c. 1 and 2 only
 d. 1, 2 and 3
106. If the increase in boiling point of a sucrose solution is 0.2 K, then what is the increase in boiling point of the same molar concentration of 'at' solution?
 a. 0.1 K
 b. 0.2 K
 c. 0.4 K
 d. 0.8 K
107. As per Beer-Lambert law, what is the relationship among absorbance (A), the molar absorption coefficient (ϵ) and transmittance (t)?
 a. $A = \epsilon l / - \log t$
 b. $A = \epsilon l / - \log t$
 c. $A = \epsilon c l / - \log t$
 d. $A = \epsilon l / - \log t$
 where l is the thickness of the sample
108. The quantum yield of $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$ is 10^6 . In a given time, 0.04×10^{-4} Einsteins of radiant energy of wavelength 480 nm is absorbed. How many moles of $HCl(g)$ are formed?
 a. 4
 b. 4×10^2
 c. 4×10^6
 d. 4×10^{17}
109. Which one of the following statements is not a characteristic feature of catalysis?
 a. Catalyst alters the position of equilibrium in a reversible chemical reaction
 b. Catalyst remains unchanged in chemical composition at the end of the reaction
 c. Catalyst does not initiate the reaction
 d. Only a small quantity of the catalyst is generally needed
110. Butter is a colloid. How is it formed?
 a. Fat is dispersed in solid casein
 b. Fat globules are dispersed in water
 c. Water is dispersed in fat
 d. Casein is suspended in H_2O
111. Consider the following statements:
 1. Lyophobic colloids are thermodynamically stable.
 2. Lyophobic colloids are stabilized by the presence of a polymer in solution.
 3. Lyophobic colloids are commonly prepared by precipitation reactions.
 Which of the statements given above are correct?
 a. 1, 2 and 3
 b. 1 and 3 only
 c. 2 and 3 only
 d. 1 and 2 only
112. If ΔH is the change in enthalpy and ΔE is the change in internal energy, then which one of the following is correct?
 a. ΔH is always less than ΔE
 b. ΔH is always greater than ΔE
 c. $\Delta H = \Delta E$ only if the number of moles of gaseous products is greater than the number of moles of gaseous reactants
 d. $\Delta H = \Delta E$ only if the number of moles of gaseous products is less than the number of moles of gaseous reactants

- 113 PCl_4^+ cation is surrounded by four bonding pairs of electrons and no lone pair. What will be its geometry?
- Square planar
 - Hexagonal
 - Octahedral
 - Tetrahedral
- 114 **Assertion (A)** : According to Pauling's theory of metals, cohesive force which holds metal atoms is large and the presence of ionic contributions explains the electrical conductance
Reason (R): Pauling's theory explains the electrical conductance qualitatively but does not explain the lustre and the retention of metallic properties in liquid state
- Both A and R are individually true and R is the correct explanation of A
 - Both A and R are individually true but R is not the correct explanation of A
 - A is true but R is false
 - A is false but R is true
- 115 **Assertion (A)** : Glucose and fructose form the same osazone when treated with an excess of phenyl hydrazine
Reason (R): All monosaccharides form the same osazone when treated with an excess of phenyl hydrazine
- Both A and R are individually true and R is the correct explanation of A
 - Both A and R are individually true but R is not the correct explanation of A
 - A is true but R is false
 - A is false but R is true
- 116 **Assertion (A)**: The compound  is a non-aromatic aromatic compound
Reason (R): The dipole moment of the above compound is higher than the expected value
- Both A and R are individually true and R is the correct explanation of A
 - Both A and R are individually true but R is not the correct explanation of A
 - A is true but R is false
 - A is false but R is true
- 117 **Assertion (A)**: Meso-tartaric acid is optically inactive
Reason (R): Meso-tartaric acid contains two similar chiral centres
- Both A and R are individually true and R is the correct explanation of A
 - Both A and R are individually true but R is not the correct explanation of A
 - A is true but R is false
 - A is false but R is true
- 118 **Assertion (A)** : $(\text{CH}_2\text{OH})_2$ boils at a much lower temperature than $(\text{C}_2\text{H}_5\text{O})_2$
Reason (R): Glycol can form hydrogen bonds on both sides whereas the dimethyl derivative cannot form hydrogen bonds at all
- Both A and R are individually true and R is the correct explanation of A
 - Both A and R are individually true but R is not the correct explanation of A
 - A is true but R is false
 - A is false but R is true
- 119 **Assertion (A)** : The Arrhenius equation explains the temperature dependence of the rate of a chemical reaction
Reason (R): Plots of $\log_e k$ versus $1/T$ are linear and the energy of activation is obtained from such plots
- Both A and R are individually true and R is the correct explanation of A
 - Both A and R are individually true but R is not the correct explanation of A
 - A is true but R is false
 - A is false but R is true
- 120 **Assertion (A)** : Equivalent conductivity of a weak electrolyte at infinite dilution can be found by Kohlrausch law
Reason (R): Kohlrausch law is applicable only to weak electrolyte
- Both A and R are individually true and R is the correct explanation of A
 - Both A and R are individually true but R is not the correct explanation of A
 - A is true but R is false
 - A is false but R is true