Booklet Serial No. : 023

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

TEST BOOKLET

LECT (ASH) CHEMISTRY, 2016

Time Allowed : 2 Hours] [Maximum Marks : 100

All questions carry equal marks.

INSTRUCTIONS

1. Immediately after the commencement of the examination, you should check that test booklet does not have any unprinted or torn or missing pages or items, etc. If so, get it replaced by a complete test booklet.
2. Write your Roll Number only in the box provided alongside. Do not write anything else on the Test Booklet.
3. This Test Booklet contains 100 items (questions). Each item comprises four responses (answers). Choose only one response for each item which you consider the best.
4. After the candidate has read each item in the Test Booklet and decided which of the given responses is correct or the best, he has to mark the circle containing the letter of the selected response by blackening it completely with Black or Blue ball pen. In the following example, response "C" is so marked :

   (A) (B) ● (D)

5. Do the encoding carefully as given in the illustrations. While encoding your particulars or marking the answers on answer sheet, you should blacken the circle corresponding to the choice in full and no part of the circle should be left unfilled.
6. You have to mark all your responses ONLY on the ANSWER SHEET separately given according to 'INSTRUCTIONS FOR CANDIDATES' already supplied to you. *Responses marked on the Test Booklet or in any paper other than the answer sheet shall not be examined.*
7. All items carry equal marks. Attempt all items. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet. There will be no negative marking.
8. Before you proceed to mark responses in the Answer Sheet fill in the particulars in the front portion of the Answer Sheet as per the instructions sent to you.
9. After you have completed the test, hand over the Answer Sheet only, to the Invigilator.

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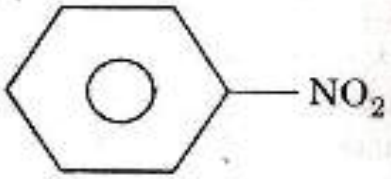
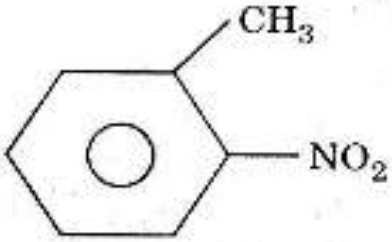
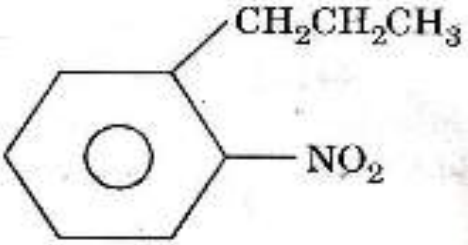
P.T.O.

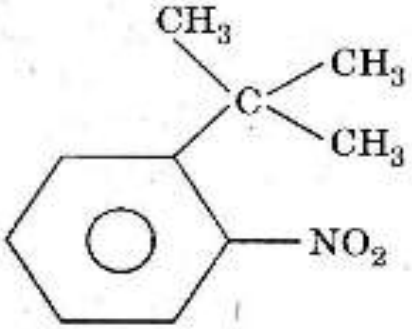
Time Allowed : 2 Hours] [Maximum Marks : 100

1. Which of the following compounds is expected to show no λ_{max} absorption near 250 mμ where other compounds given below show absorption maxima near 250 mμ but with a large decrease in intensity ?

(A) 

(B) 

(C) 

(D) 

2. Which of the following statements is *not correct* with regard to UV absorption spectral studies ?

The general characteristics of absorption bands due to $n \rightarrow \pi^*$ transition are as :

(A) low intensity, generally less than 1500

(B) shifted to longer wavelength by more polar solvents

(C) shifted to shorter wavelengths by electron donating groups

(D) the absorption bands due to $n \rightarrow \pi^*$ transition are seen at longer wavelengths as these require the least energy as compared to other transitions

3. Which of the following statements is *not correct* ?

(A) Symmetrical stretching vibrational mode in CO_2 is infrared inactive but Raman active

(B) Asymmetrical stretching vibrational mode in CO_2 is infrared active but Raman inactive

(C) Bending mode of vibration in CO_2 is infrared inactive but Raman active

(D) All the three modes of vibration in SO_2 molecule are infrared as well as Raman active

4. In electron resonance spectroscopy, the selection rule is :

(A) $\Delta m_S = \pm 1$ and $\Delta m_I = 0$ (B) $\Delta m_S = \pm 1$ and $\Delta m_I = \pm 1$

(C) $\Delta m_S = 0$ and $\Delta m_I = \pm 1$ (D) $\Delta m_S = 0$ and $\Delta m_I = \pm 2$

5. Which of the following is *not* a characteristic of tetramethyl silane (TMS, $(CH_3)_4Si$) used as an internal standard in obtaining nmr spectra ?

(A) The signal displays exponentially decaying oscillations, called ringing i.e. a symmetrical peak on higher field side

(B) TMS is chemically inert and gives a sharp signal even at low concentrations

(C) It has low boiling point

(D) It is insoluble in most organic solvents but soluble in H_2O/D_2O

6. Which of the following statements is *not correct* ?

(A) The most common magnetically active nuclei in natural abundance are ^{1}H, ^{19}F, ^{31}P. Each nuclei has nuclear spin number, I = 1/2.

(B) ^{2}H, ^{14}N, ^{13}C, ^{15}N are also useful magnetically active nuclei. Each nuclei have nuclear spin number I = 3/2.

(C) The non-usable nuclei are ^{12}C, ^{16}O, ^{28}Si and have nuclear spin number, I = 0.

(D) In medical field 2D nmr, called tomography is of great value and detects abnormal growth in tissues.

7. Which of the following is a momentum operator ?

(A) $ih\frac{\partial}{\partial x}$

(B) $-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}$

(C) $V_{(x)}$

(D) x

8. A wave function is *not* acceptable if :

(A) it is continuous

(B) it has continuous slope

(C) it must be single valued

(D) it must be infinite

9. Which of the following statements is *not correct* ?

(A) Elastic gels are irreversible and non-elastic gels are reversible Gelatin, agar-agar are examples of non-elastic gel whereas silica, alumina are examples of elastic gel.

(B) Elastic gels can imbibe water when placed in it and undergo swelling. Non-elastic gels are incapable of doing so.

(C) Elastic and non-elastic gel undergo shrinkage in volume when allowed to stand. This phenomenon is called syneresis. For amphoteric proteins maximum syneresis is observed at its isoelectric point.

(D) Some of the gels, gelatin and silica, liquefy on shaking, changing into the corresponding sol. The sol on standing reverts back to the gel. This phenomenon of reversible sol-gel transformation is called thixotropy.

10. Which of the following statements is *not correct* ?

(A) The cleansing action of soap is due to lowering of interfacial tension between water and grease. This causes emulsification of grease in water.

(B) The negatively charged particle of rubber are made to deposit on to wires and tools to insulate by electrophoresis. This is called rubber plating.

(C) Gold number is the number of milligrams of the lyophobic colloid which just fail to prevent a change in colour from red to violet by the addition of 10 ml of 10% NaCl solution.

(D) Milk is an emulsion between fat dispersed in water, stabilised by emulsifying agent casein (protein) a lyophilic colloid.

11. Which of the following statements is *not correct* ?

(A) Liquid helium does not have any solid-liquid-vapour triple point. However it has two triple points (*i*) for solid $\rightleftharpoons$ HeI(l) $\rightleftharpoons$ HeII(l) equilibrium at 1.76 K and 29.6 atm and (*ii*) for HeII(l) $\rightleftharpoons$ HeI(l) $\rightleftharpoons$ vapour equilibrium at 2.17 K and 0.05 atm.

(B) It is possible to convert graphite into diamond at 2000°C, 70,000 atm and catalyst cobalt.

(C) Au and Sn in the stoichiometric ratio 1 : 2 forms the compound $AuSn_2$. The number of components of the system is two

(D) The freezing point is higher for most substances which have a positive slope of the solid-liquid equilibrium line in phase diagram

12. Which of the following statements is *not correct* ?

(A) A system consisting of NaCl, KCl and H_2O is a three component, since the composition of all five phases KCl(s), NaCl(s), H_2O(s), solution and vapour can be expressed by the above three species.

(B) A system consisting of NaCl, KBr and H_2O is a three component since the composition of all seven phases KBr(s), NaCl(s), H_2O(s), KCl(s), NaBr(s), solution and vapour can be expressed by the above three species.

(C) In sulphur system there are four triple points out of which one represents meta stable equilibrium, the coordinates are 113°C and 0.03 mm mercury.

(D) Air free pure water freezes at 0.0098°C under its own vapour pressure 0.006 atm whereas water saturated with air freezes at 0°C and 1 atm.

13. Which of the following statements is *not correct* ?

(A) The relation between coefficient of viscosity of a liquid and temperature is expressed as, $\eta = A\, e^{E_a/RT}$, where E_a and A are constants for a given liquid. E_a is activation energy for viscous flow.

(B) Surface tension varies linearly with temperature

$$\gamma\left(\frac{M}{e}\right)^{2/3} = a - kT$$

At critical temperature surface tension is zero.

(C) The viscosity of a liquid increases with increase in temperature and that of the gas decreases with increase of temperature.

(D) Thermal conductivity and viscosity of a gas are independent of pressure. At high pressure more molecules are available to transport momentum but they carry less far on account of shorter mean free path.

14. Which of the following statements is *not correct* ?

(A) True liquids exhibit isotropic properties whereas turbid or transluscent liquids are anisotropic. The transluscent liquid exhibits properties like double refraction and gives interference pattern in polarised light.

(B) The anisotropic properties are exhibited by solids hence the liquid crystals get the name. Liquid crystals are more like liquids and exhibit mobility, surface tension, viscosity. Therefore terms such as mesomorphic state is used.

(C) An essential requirement for mesomorphism to occur is that molecule must be anisotropic in shape like a rod or disc.

(D) The temperature T_1 at which solid changes into a turbid liquid is called melting point and the second temperature T_2 at which turbid liquid changes into a clear liquid is called transition point

$$\text{A (solid)} \xrightleftharpoons{T_1} \text{B (liquid crystal)} \xrightleftharpoons{T_2} \text{A (liquid)}$$

15. Which of the following expressions represent the electronic partition function ?

(A) $f = \dfrac{(2\pi mkT)^{3/2}\ V}{h^3}$

(B) $f = \sum\ (2J + 1)e^{-J(J+1)h^2/8\pi^2 IkT}$

(C) $f = \sum_i e^{-E_i/kT}$

(D) $f = e^{-\frac{1}{2}h\nu/kT}\left(1 - e^{-h\nu/kT}\right)^{-1}$

16. Which of the following is *not correct* condition for dz to be a perfect differential ?

(A) z is a single valued function depending entirely on the instantaneous values of x and y; or

(B) $\oint dz$ for complete cyclic process is not zero; or

(C) dz between two any specified points or states is independent of the path of transition; or

(D) $\dfrac{\partial^2 z}{\partial x \partial y} = \dfrac{\partial^2 z}{\partial y \partial x}$ i.e., the second differentials of z with respect to x and y carried out in either order become equal to one another.

17. Which of the following statements is *not correct* ?

(A) Every substance has a finite positive entropy but at absolute zero the entropy tends to become zero. It does so in case of perfectly crystalline solid. There is a perfect order at absolute zero, in other words, there is a zero disorder.

(B) Entropies calculated on the basis of third law of thermodynamics i.e., thermal entropies are slightly greater than those derived from statistical mechanics.

(C) The criterion in terms of free energy change $(\partial G)_{T,\ p} \leq 0$ tells us that if free energy change of a process is positive i.e., if there is likely to be an increase in free energy change, the process will not take place.

(D) Nernst heat theorem can be stated mathematically as

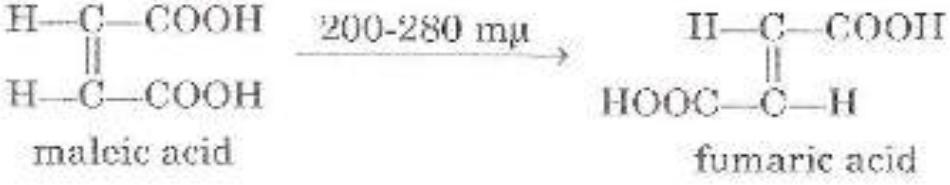
$$\lim_{T \to 0}\left[\frac{\partial(\Delta G)}{\partial T}\right]_p = \lim_{T \to 0}\left[\frac{\partial(\Delta H)}{\partial T}\right]_p = 0.$$

18. Which of the following photochemical reactions has quantum yield unity ?

(A) $2Fe^{+2} + I_2 \xrightarrow{579\ m\mu} 2Fe^{+3} + 2I^-$

(B) $2HBr \xrightarrow{253\ m\mu} H_2 + Br_2$

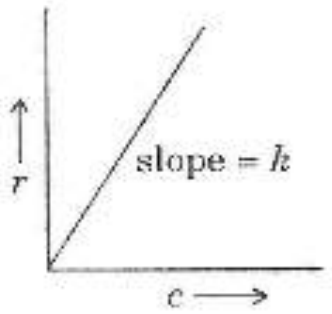
(C) $2HI \xrightarrow{282\ m\mu} H_2 + I_2$

(D) 

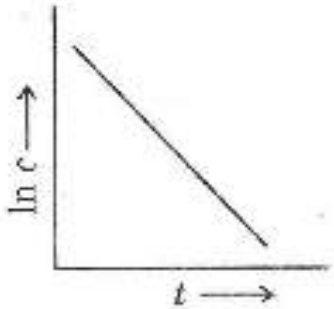
maleic acid fumaric acid

19. Which of the following diagrams *does not* represent first order reaction ?

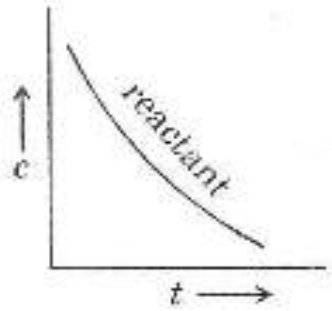
(A)



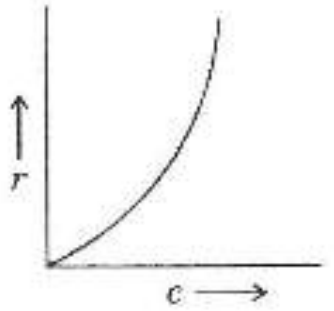
(B)



(C)



(D)



[r = rate, c = concentration, t = time]

20. Which of the following is an example of pseudo bimolecular reaction ?

(A) $R—COOH + R'OH \longrightarrow RCOOR' + H_2O$

[RCOOH is dissolved in solvent R'OH, molecules of acid acting as catalyst.]

(B) $\underset{\text{Carbonyl sulphide}}{COS} + \underset{\text{Solvent}}{H_2O} \longrightarrow CO_2 + H_2S$

(C) $CH_3COCH_2\underset{\displaystyle OH}{\overset{\displaystyle |}{C}}(CH_3)_2 \xrightarrow[\text{catalyst, OH}]{\text{decomposes}} 2CH_3COCH_3$

(D) $\begin{matrix} CH_3CO \\ \\ CH_3CO \end{matrix}\!\!>\!O + 2C_2H_5OH \longrightarrow 2CH_3COOC_2H_5 + H_2O$

Solvent

21. The rate equation in terms of reactant concentration for first order reaction is :

(A) $[A_0] - [A] = kt$

(B) $\frac{1}{[A]} - \frac{1}{[A_0]} = kt$

(C) $\log[A_0] - \log[A] = \frac{kt}{2.303}$

(D) $\frac{1}{[A]^2} - \frac{1}{[A_0]^2} = 2kt$

[Rate = $k[A]^n$, [A] = concentration of reactant at a given time, t. $[A_0]$ = initial concentration of the reactant]

22. The specific conductivity k of 0.001 N of KCl at 25°C is 1.469×10^{-4} ohm^{-1} cm^{-1}. Its equivalent conductance at this temperature at infinite dilution is 148.9 ohm^{-1} cm^2. The degree of ionisation of KCl so calculated comes out to be :

(A) 0.98

(B) 0.85

(C) 0.92

(D) 0.95

23. Given the following half cell reactions and corresponding potential :

(1) $A + e \rightarrow A^-$, $E^\circ = -0.24$ V

(2) $B^- + e \rightarrow B^{-2}$, $E^\circ = 1.25$ V

(3) $C^- + 2e \rightarrow C^{-3}$, $E^\circ = -1.25$ V

(4) $D + 2e \rightarrow D^{-2}$, $E^\circ = 0.68$ V

Which combination of two half cells would result in a largest potential ?

(A) 1 and 2

(B) 3 and 4

(C) 1 and 4

(D) 2 and 3

24. Which of the following is an electrolyte concentration cell without transference in which electrodes are reversible with respect to anion ?

(A) $Zn, ZnSO_4(a_1), PbSO_4(s), Pb - Pb, PbSO_4(s), ZnSO_4(a_2), Zn$

(B) $Ag, AgCl(s), HCl(a_1)\ H_2(g) - H_2(g)\ HCl(a_2), AgCl(s), Ag$

(C) $Pt \mid H_2(g, 1\ atm)\ HCl(a_1) : HCl(a_2) \cdot H_2(g, 1\ atm) \mid Pt$

(D) $Pt \mid H_2(g, 1\ atm)\ HCl(a_1)\ AgCl(s) \mid Ag - Ag \mid AgCl(s), HCl(a_2), H_2(g, 1\ atm) \mid Pt$

25. Which of the following electrodes is a preferred referrence electrode in connection with accurate measurement in chloride solution ?

(A) hydrogen electrode under standard condition (25°C, $H^+(a = 1)$, $H_2(g, 1\ atm)$)

(B) Calomel electrode with 1 – N KCl solution, $Hg(l), Hg_2Cl_2(s), Cl^-$

(C) Silver-silver chloride electrode $Ag \mid AgCl(s), Cl^-(a\ Cl^- = 1)$

(D) Chlorine electrode (25°C, Cl^- $(a = 1)$, $Cl_2(g, 1\ atm)$)

26. Which of the following is an expression for Langmuir adsorption isotherm ?

(A) $\frac{P}{x/m} = \frac{1}{k_1 k_2} + \frac{P}{k_2}$

(B) $\left(\frac{x}{m}\right)^n = kP$

(C) $\Gamma = -\frac{1}{RT}\frac{\partial\gamma}{\partial \ln C}$

(D) $\frac{P}{V_{Total}(P_0 - P)} = \frac{1}{V_{mono} \cdot C} + \frac{C-1}{V_{mono} \cdot C}\left(\frac{P}{P_0}\right)$

27. Which of the following statements is *not correct* ?

(A) X-ray diffraction finds use in the determination of the spacings between the layers in the lattice

(B) The glancing angle θ corresponding to maximum intensity of the lines is determined, the interplanar distance d may be calculated by using the relation $n\lambda = 2d \sin \theta$.

(C) Caesium chloride (CsCl) has radius ratio 0.411 – 0.732, six coordination number and octahedral arrangement.

(D) Zinc sulphide (ZnS) has radius ratio 0.414 – 0.255, four coordination number and tetrahedral arrangement.

28. Which of the following statements is *not correct* ?

(A) Miller indices are very useful for expressing the separation of (hkl) planes for example planes of a cubic lattice is given as $\frac{1}{d_{hkl}^2} = \frac{1}{a^2}\left[h^2 + k^2 + l^2\right]$

(B) The separation of (hkl) plane of the square lattice $\frac{1}{d_{hko}^2} = \left(\frac{h}{a}\right)^2 + \left(\frac{k}{b}\right)^2$

(C) For a general orthorhombic lattice (a rectangular lattice based on a unit cell with different sides) separation of hkl planes is given as $\frac{1}{d_{hkl}^2} = \left(\frac{h}{a}\right)^2 + \left(\frac{k}{b}\right)^2 + \left(\frac{l}{c}\right)^2$

(D) The three dimensional infinite array of points each of which is surrounded in an identical way by its neighbours is called space lattice.

29. The complex $K_2[Ni(CN)_4]$ is diamagnetic. The central metal ion involves hybrid orbitals viz :

(A) sp^3d^2 (B) sp^2d

(C) dsp^2 (D) d^2sp^3

30. O_2 molecule has the configuration KK $\sigma(2s)^2\ \sigma^*(2s)^2$, $\sigma(2p_z)^2\ \pi(2p_x)^2\ \pi(2p_y)^2$ $\pi^*(2p_x)^1\ \pi^*(2p_y)^1$. Which of the following informations is completely *correct* ?

(A) O_2^- has bond order 1.5, largest bond length and minimum bond strength

(B) O_2^{2-} has bond order 1.0, largest bond length and maximum bond strength

(C) O_2 has bond order 2.0, shortest bond length and minimum bond strength

(D) O_2^+ has bond order 2.5, shortest bond length and maximum bond strength

31. A bond between H and Cl in HCl is formed from 1s electron of hydrogen atom (labelled as electron 1) and 3*p* electron of Cl atom (labelled as electron 2). Which of the following statements is *not* correct [ψ represents MO and ϕ represents AO]

(A) $\psi_{MO} = \psi_1\psi_2$

(B) $\psi_1 = c_1\phi_A(1) + c_2\phi_B(1)$ and $\psi_2 = c_1\phi_A(2) + c_2\phi_B(2)$

(C) $\psi_{MO} = c_1^2[\phi_A(1)\ \phi_A(2)] + c_1c_2[\phi_A(1)\ \phi_B(2) + \phi_A(2)\ \phi_B(1)] + c_2^2[\phi_B(1)\ \phi_B(2)]$

(D) First and last terms in item (*c*) are covalent and middle term in item (*c*) is ionic

32. Which of the following is an example of coordination compounds with linkage isomerism ?

(A) $[CoBr(NH_3)_5]SO_4$ and $[CoSO_4(NH_3)_5]Br$

(B) $[Cr(NH_3)_6]$ $[Cr(CN)_6]$ and $[Cr(CN)_2$ $(NH_3)_4]$ $[Cr(CN)_4$ $(NH_3)_2]$

(C) $[(NH_3)_4$ Co(OH)(OH)Co$(NH_3)_2$ $Cl_2]^{+2}$ and

$[Cl(NH_3)_3$ Co(OH)(OH)Co$(NH_3)_3$ $Cl]^{+2}$

(D) $[Co(NO_2)$ $(NH_3)_5]Cl_2$ and $[Co(ONO)$ $(NH_3)_5]Cl_2$

33. Which of the following statements is *correct* ?

Stability depends on ionic potential, ratio of cationic charge to the cationic crystal radius. Log K values which reflect the stability of the metal-ligand bond increases regularly as :

(A) $Ba^{+2} < Sr^{+2} < Ca^{+2} < Mg^{+2}$

(B) $Mg^{+2} < Ba^{+2} < Ca^{+2} < Sr^{+2}$

(C) $Sr^{+2} < Ba^{+2} < Mg^{+2} < Ca^{+2}$

(D) $Ca^{+2} < Ba^{+2} < Sr^{+2} < Mg^{+2}$

34. The term inner orbital and outer orbital complex was used by :

(A) Linus Pauling (B) R.S. Nyholm

(C) Henry Taube (D) L. Orgel

35. Which of the following is *not* an organometallic compound ?

(A) $(\eta^5—C_5H_5)_2$ Ni

(B) $Iu(\eta^8—C_8H_8)_2]$

(C) $K[PtCl_3(C_2H_4)] \cdot H_2O$

(D) $Mg[N(CH_3)_2]_2$

36. Which of the following air pollutants is capable of preventing photosynthesis in plants ?

(A) Chlorofluoronated carbons

(B) Dust

(C) Oxides of nitrogen

(D) Carbon monoxide (CO)

37. In which of the following reactions in non-aqueous medium (anhydrous sulphuric acid) the substance acts as an acid :

(A) $NH_2CONH_2 + H_2SO_4 \longrightarrow HSO^-_4 + NH_2CONH^+_3$

(B) $HClO_4 + H_2SO_4 \longrightarrow H_3SO^+_4 + ClO^-_4$

(C) $KNO_3 + 2H_2SO_4 \longrightarrow 2HSO^-_4 + NO^+_2 + H_3O^+$

(D) $H_2O + H_2SO_4 \longrightarrow HSO^-_4 + H_3O^+$

38. Which of the following is *not* an example of solvolysis ?

(A) $ZnX_2 + 2N_2O_4 \longrightarrow 2NO + X_2 + Zn(NO_3)_2$

(B) $UCl_6 + 2SO_2 \longrightarrow UO_2Cl_2 + 2SOCl_2$

(C) $SnCl_4 + 8NH_3 \longrightarrow Sn(NH_2)_4 + 4NH^+_4 + 4Cl^-$

(D) $6KMnO_4 + 6KNH_2 \longrightarrow 6K_2MnO_4 + 4NH_3 + N_2$

39. Which of the following is *not* a precipitation reaction in non-aqueous medium ?

(A) $AgNO_3 + BF_3 + 2HF \xrightarrow{\text{liq. HF}} AgBF_4 + H_2NO_3F$

(B) $AgCl + KNO_3 \xrightarrow{\text{liq. } NH_3} KCl + AgNO_3$

(C) $H_3BO_3 + 6H_2SO_4 \xrightarrow{\text{liq. } H_2SO_4} B(HSO_4)^-_4 + 3H_3O^+ + 2HSO^-_4$

(D) $2CH_3COOAg + SOCl_2 \xrightarrow{\text{liq. } SO_2} 2AgCl + SO(COOCH_3)_2$

(Thionyl acetate)

40. Which of the following cobalt complex has –1 oxidation state ?

(A) $[Co(CO)_3NO]$

(B) $Na_3Co(NO_2)_6$

(C) $K_4[Co(CN)_4]$

(D) $Hg[Co(NCS)_4]$

41. Which of the following alloys of nickel has the highest percentage of nickel used in electrical work ?

(A) Monel metal

(B) Nichrome

(C) German silver

(D) Constantan

42. Which of the following species has coordination number eight in their complexes ?

(A) $\left[Th(NO_3)_6\right]^{-2}$ (B) UF_6^-

(C) $(NH_4)_2\ ThF_8$ (D) $\left[AmCl_2(H_2O)_6\right]^+$

43. The group of strong field ligands i.e. which provides very large crystal field splitting are :

(A) $F^- > OH^- > NO^-_2 > NH_3$ (B) $CO = CN^- >$ phen. $> NO^-_2$

(C) $OH^- > Cl^- > Br^- > I^-$ (D) $NH_3 > N\bar{C}S > H_2O > F^-$

44. The element, atomic number 119 as and when discovered will belong to :

(A) *s*-block (B) *p*-block

(C) *d*-block (D) *f*-block

45. The degeneracies of a particle of mass '*m*' in a three-dimensional cubical box of width '*a*' having energies equal to 12 units of $\frac{h^2}{8ma^2}$ i.e. $\frac{12h^2}{8ma^2}$ is :

(A) three fold degeneracy (B) six fold degeneracy

(C) non-degenerate (D) two fold degenerate

46. Which of the following statements is *not correct* ?

(A) The coupling of spin angular momenta of two electrons, s-s coupling, give rise to a quantum number S (total spin number) where S = 1, 0, –1.

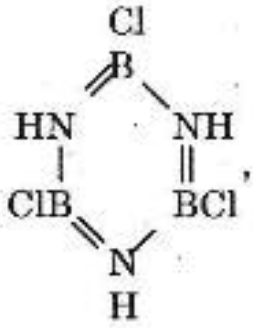
(B) The coupling of orbital angular momenta of two electrons, l-l coupling, give rise to a quantum number L (total orbital angular momentum quantum number where $L = (l_1 + l_2), (l_1 + l_2 - 1), \ldots\ldots\ldots, (l_1 - l_2)$.

(C) The coupling of L and S, Russell-Saunders coupling, give rise to quantum number J where J = (L + S), (L + S – 1), ..., (L – S).

(D) The term L, S, J collectively constitute a term known as atomic term symbol designated as $^{2S+1}J_L$ where L = 0, 1, 2, 3 correspond to atomic states S, P, D, F.

47. Borazole or borazene ($B_3N_3H_6$) and benzene are structurally similar. Which of the following statements is *not correct* ?

(A) Borazole reacts with HCl to form boron trichloroborazole at 60°-100°C



, whereas benzene does not react with HCl.

(B) Borazole reacts with H_2O at 0° forming addition compound which decomposes at higher temperature to give $B(OH)_3$, NH_3 and hydrogen.

(C) Borazole reacts with excess of alcohol to give $(C_2H_5O)_3B$, NH_3 and hydrogen.

(D) Borazole reacts with bromine to form $Br_3H_3B_3N_3H_3Br_3$ which give $Br_3B_3N_3H_3$ and HBr whereas benzene does not react with bromine at all.

48. The ore of titanium is :

(A) Bauxite

(B) Haematite

(C) Ilmenite

(D) Pyrolusite

49. Which of the following triad in their trivalent state do not show absorption in either UV, visible or near infrared region ?

(A) Ce^{+3}, Yb^{+3}, Gd^{+3}

(B) Pr^{+3}, Tm^{+3}, Er^{+3}

(C) Sm^{+3}, Dy^{+3}, Ho^{+3}

(D) Pm^{+3}, Eu^{+3}, Tb^{+3}

50. Crystal field theory (CFT) could not explain satisfactorily :

(A) detailed magnetic properties

(B) relative strength of the ligands

(C) detailed absorption spectral studies

(D) thermodynamic properties

51. Which of the following statements is *not correct* ?

(A) Praseodymium (Pr^{+4}) is a powerful oxidising agent and oxidises water itself and therefore exists in solution only.

(B) Eu^{+2} can be readily obtained by reducing Eu^{+3} with Zn or Mg.

(C) Sm^{+2} and Yb^{+2} are rapidly oxidised by water as well as by air.

(D) Sm^{+2} and Yb^{+2} can be obtained by reducing M^{+3} with Na amalgam.

52. The purpose of a moderator in an atomic reactor is to :

(A) control fusion reaction

(B) retard the speed of the neutron

(C) accelerate the speed of the neutron

(D) control heat liberation

53. An electronic transition in transition elements occurs from one J sta to another J state of the same configuration, the absorption spectra are extremely sharp. They are similar to those for free atoms and are quite unlike the broad bands. This could be due to :

(A) $n \rightarrow \pi^*$ transition

(B) $n \rightarrow \sigma^*$ transition

(C) $f \rightarrow f$ transition

(D) $d \rightarrow d$ transition

54. A compound alloy of metals A and B of widely different electronegativities has a unit cubic cell containing A atoms at its corners and B atoms at face centres. The formulae of the compound alloy is :

(A) A_4B_3

(B) AB_3

(C) A_2B_5

(D) A_3B_2

55. Which of the following cobalt complexes has low spin configuration ?

(A) $\left[Co(NH_3)_6\right]^{+2}$

(B) $\left[Co(CN)_6\right]^{-4}$

(C) $\left[CoF_6\right]^{-3}$

(D) $\left[Co(NH_3)_6\right]^{+3}$

56. Which of the following nuclear disintegration series produces $^{209}_{83}Bi$ as the end product ?

(A) Neptunium, $4n + 1$ series

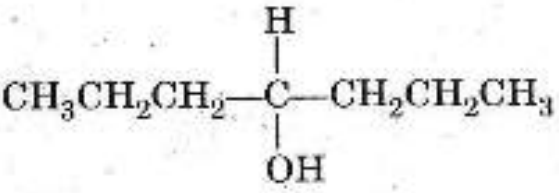
(B) Actinium, $4n + 3$ series

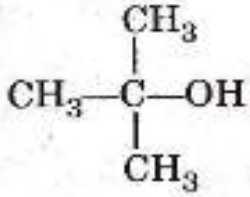
(C) Uranium, $4n + 2$ series

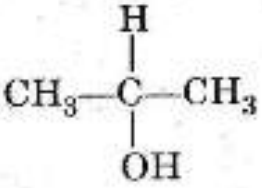
(D) Thorium, $4n$ series

57. Which of the following species gives iodoform test ?

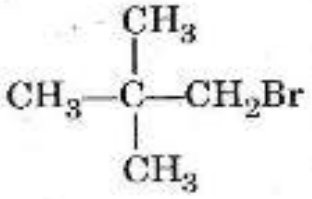
(A) $C_6H_5CH_2CH_2OH$

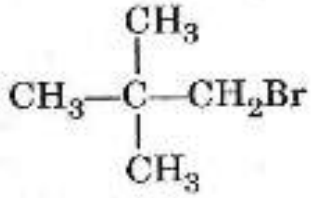
(B) 

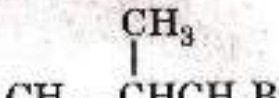
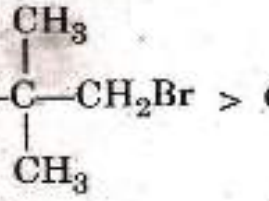
(C) 

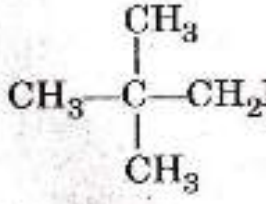
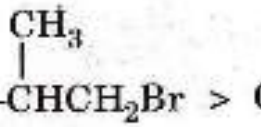
(D) 

58. In S_N2 substitution reaction the relative reactivity is observed as follows :

(A) $CH_3CH_2CH_2Br > CH_3-CH(CH_3)CH_2Br > CH_3CH_2Br >$ 

(B) $CH_3CH_2Br > CH_3CH_2CH_2Br >$  $>$ 

(C)  $>$  $> CH_3CH_2Br > CH_3CH_2CH_2Br$

(D)  $> CH_3CH_2Br >$  $> CH_3CH_2CH_2Br$

59. The stability of carbocation is as :

(A) $3^\circ > 2^\circ > 1^\circ > \overset{+}{C}H_3$

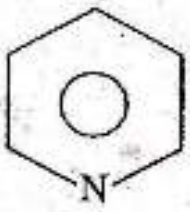
(B) $2^\circ > 1^\circ > 3^\circ > \overset{+}{C}H_3$

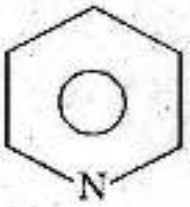
(C) $\overset{+}{C}H_3 > 3^\circ > 1^\circ > 2^\circ$

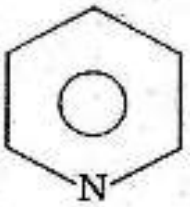
(D) $1^\circ > 2^\circ > \overset{+}{C}H_3 > 3^\circ$

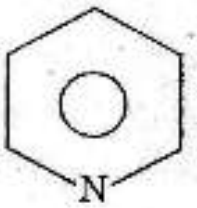
$\left[3^\circ = C\left(CH_3\right)_3^+,\ 2^\circ = CH(\overset{-}{C}H_3)_2,\ 1^\circ = CH_3\overset{-}{C}H_2\right]$

60. Electrophilic substitution takes place in pyridine. Which of the following reaction *does not* take place ?

(A)  $\xrightarrow[H_2SO_4,\ 300^\circ C]{KNO_3}$

(B)  $\xrightarrow[350^\circ C]{H_2SO_4}$

(C)  $\xrightarrow[AlCl_3]{RX,\ RCOX}$

(D)  $\xrightarrow{Br_2,\ 300^\circ C}$

61. In which of the following examples the reactants will form crossed aldol condensation product under suitable conditions :

(A) $C_6H_5CHO + CH_3COCH_3 \xrightarrow[dil\ \overline{O}H]{100^\circ C}$

(B) $(CH_3)_3CCHO + HCHO \xrightarrow[50\%\ \overline{O}H]{}$

(C) $2HCHO \xrightarrow[50\%\ NaOH]{}$

(D) $C_6H_5CHO + HCHO \xrightarrow[concen.\ \overline{O}H]{}$

62. A substance produced by a microorganism which inhibits the growth of another microorganism is called a/an :

(A) antihistamine
(B) disinfectant
(C) antibiotic
(D) antiseptic

63. Which of the following are the chief hormones of posterior portion of hypophysis or pituitary gland ?

(A) Insulin and glucagon
(B) Secretin and gastrin
(C) Epinephrine and nor epinephrine
(D) Oxytocin and vasopressin

64. Which of the following statements is *not correct* ?

(A) Vitamin B_{12} has two coenzymes deoxyadenosyl cobalamin and methyl cobalamin. Its deficiency results in pernicious anemia, characterised by low haemoglobin level, decreased number of erythrocytes.
(B) Vitamin C and Vitamin B complex are fat soluble whereas other vitamins A, D, E and K are water soluble.
(C) Vitamin E is a natural antioxidant necessary for normal reproduction in many animals.
(D) The active form of vitamin D is calcitriol which functions like a stereoid hormone and regulates plasma level of Ca and phosphate. Its deficiency causes osteomalacia in adults and rickets in children.

65. Which of the following statements is *not correct* ?

Vitamin D has some characteristic features which justifies its status as hormone.

(A) Vitamin D_3 (cholecalciferol) is synthesised in the skin by UV rays of sunlight.

(B) The biologically active form of vitamin D, calcitriol is produced in kidney.

(C) Calcitriol has no target organs for eg. intestine, bone and kidney where it can specifically act.

(D) Calcitriol synthesis is self regulated by a feedback mechanism *i.e.* calcitriol decreases its own synthesis.

66. Which of the following is a slow reaction step in the mechanism of sulphonation reaction in aromatic compounds ?

(A) $2H_2SO_4 \rightleftharpoons \overset{+}{H_3O} + HSO_4^- + SO_3$

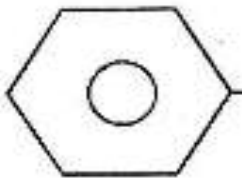
(B) $SO_3 + C_6H_6 \longrightarrow C_6H_5(\overset{\oplus}{}H)(SO_3^-)$

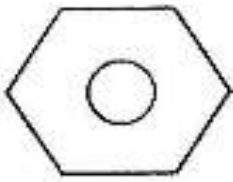
(C) $C_6H_5(\overset{\oplus}{}H)(SO_3^-) + HSO_4^- \longrightarrow C_6H_5SO_3^- + H_2SO_4$

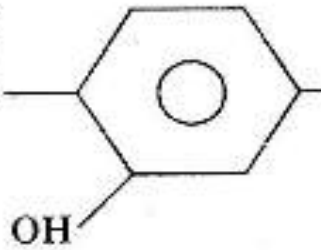
(D) $C_6H_5SO_3^- + \overset{+}{H_3O} \rightleftharpoons C_6H_5SO_3H + H_2O$

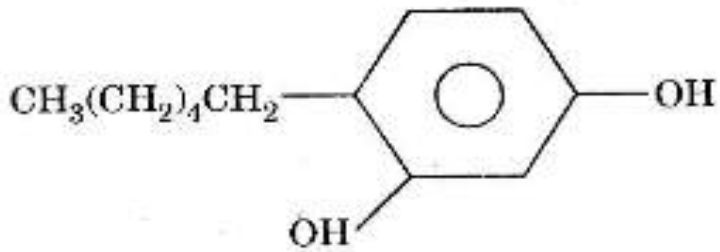
67. Which of the following is an example of Clemensen reduction ?

(A) $CH_3CH = CHCHO \xrightarrow{H_2, Ni} CH_3CH_2CH_2CH_2OH$

(B)  $\xrightarrow{9\text{-BBN}}$ $\xrightarrow{HOCH_2}$



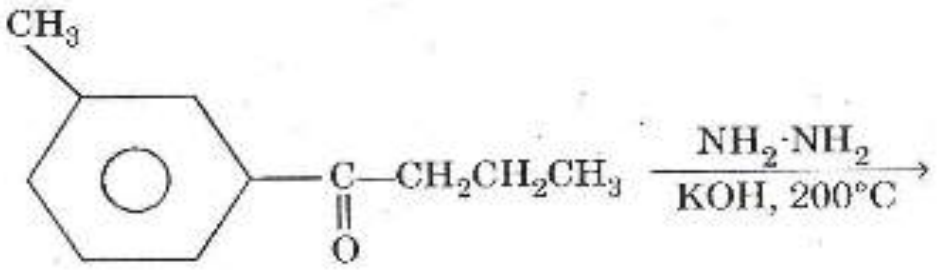
(C) $CH_3(CH_2)_4C$(=O)–  $\xrightarrow[\text{concen. HCl}]{\text{Zn(Hg)}}$

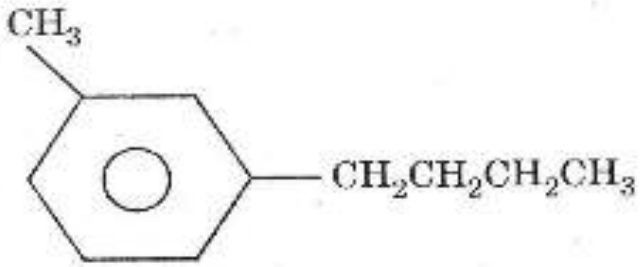


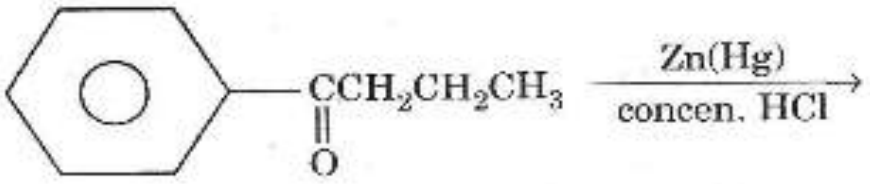
(D) $4R_2C = O + LiAlH_4 \longrightarrow (R_2CHO)_4AlLi \xrightarrow{H_2O} 4R_2CHOH +$

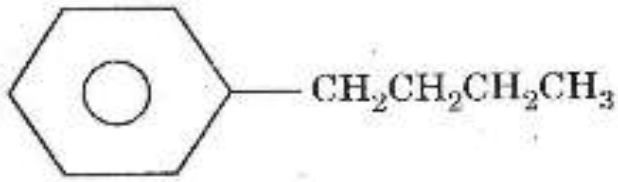
$LiOH + Al(OH)_3$

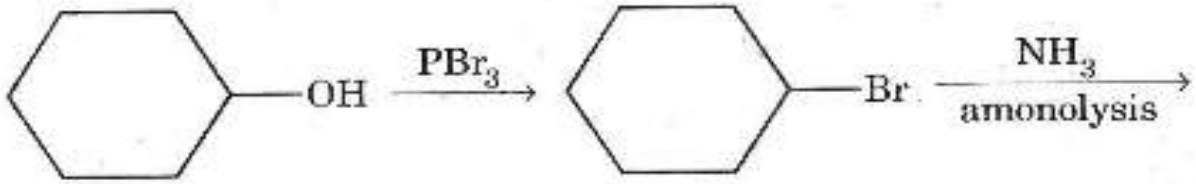
68. Which of the following is an example of Wolff-Kishner reduction ?

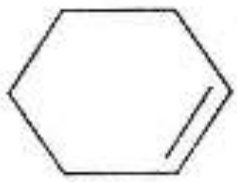
(A) 



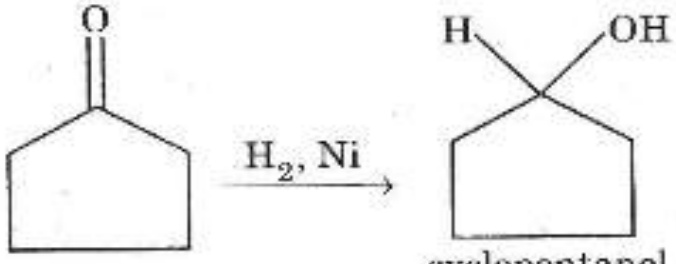
(B) 



(C) 



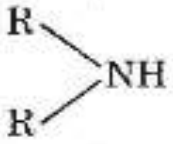
cyclohexene

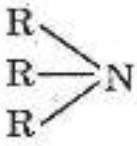
(D) 

cyclopentanol

69. Which of the following aliphatic compounds is strongly basic in their aqueous solution ?

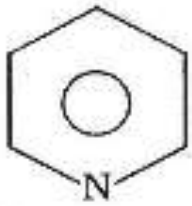
(A) $R—NH_2$

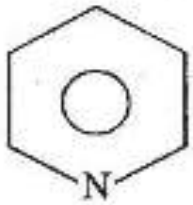
(B) 

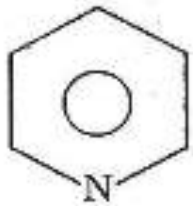
(C) 

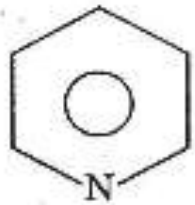
(D) $R_4N—OH$

70. In which of the following reactions of pyridine *n*-pentane is obtained ?

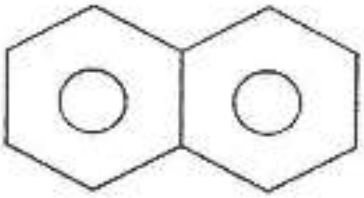
(A)  $+ NaNH_2 \xrightarrow{\text{heat}}$

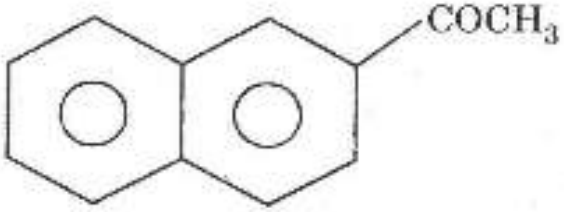
(B)  $\xrightarrow[KNO_3]{H_2SO_4}$

(C)  $\xrightarrow[HI]{300°}$

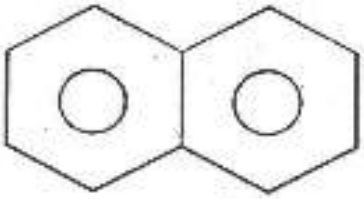
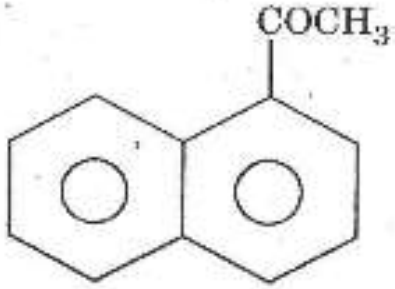
(D)  $\xrightarrow[300°]{C_6H_5Li}$

71. In which of the following reactions of naphthalene β-naphthoic acid is obtained ?

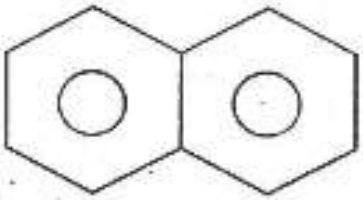
(A)  $\xrightarrow[\text{Solvent } C_6H_5NO_2]{CH_3COCl,\ AlCl_3}$

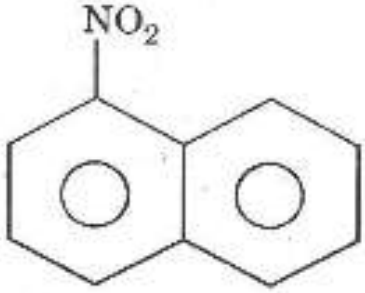


$\xrightarrow[60°\text{-}70°C]{NaOCl}$

(B)  $\xrightarrow[\text{Solvent } C_2H_2Cl_4]{CH_3COCl,\ AlCl_3}$ 

$\xrightarrow[60°\text{-}70°C]{NaOCl}$

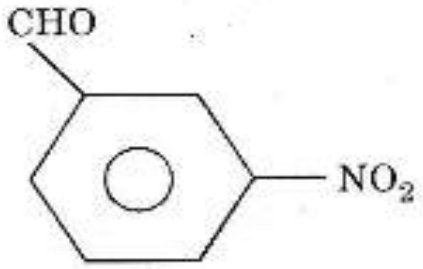
(C)  $\xrightarrow[\text{in presence of HgSO, } 300°C]{\text{concen. } H_2SO_4}$

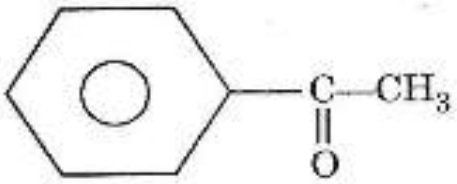
(D) 

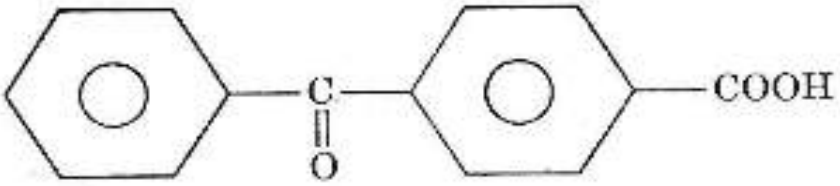
$\xrightarrow{\text{Oxidation}}$

(Nitration of naphthalene)

72. Which of the following compounds can react with Grignard's reagent to obtain the desired reaction ?

(A) 

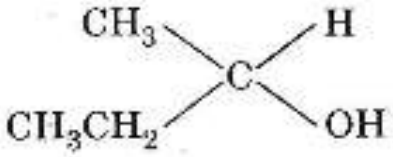
(B) 

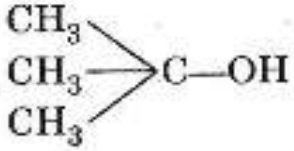
(C) 

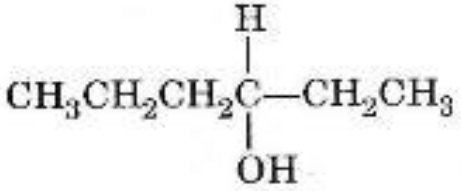
(D) 

73. Which of the following alcohols cannot be oxidised under normal conditions ?

(A) CH_3CH_2OH

(B) 

(C) 

(D) 

74. Which of the following carbohydrates is a non-reducing sugar ?

(A) Sucrose

(B) Lactose

(C) Maltose

(D) Cellobiose

75. Which of the following statements is *not correct* ?

(A) Two monomethyl derivatives of D+ glucose are known, I methyl α–D–glucoside has specific rotation +158°, and II methyl β–D–glucoside has specific rotation –33°. These monomethyl glucosides undergo mutarotation and reduce Fehling's or Tollen's reagent.

(B) D–(+)–glucose has cyclic structure because —CHO and —CHOH are part of the same molecule

(C) α- and β–D(+)–glucose are readily hydrolysed by water. Either anomer is converted via open chain form into an equilibrium mixture containing both cyclic isomers.

(D) The reactions of D–(+)–glucose osazone formation and reduction of Tollen's and Fehling's reagent are due to very small amount of open chain compound which is replenished as fast as consumed.

76. In 3–chloro–2–methyl pentane the sequence for R, S–configuration is as :

(A) isopropyl, Cl, C_2H_5, H

(B) C_2H_5, isopropyl, H, Cl

(C) Cl, isopropyl, ethyl, H

(D) H, Cl, isopropyl, ethyl

77. Which of the following compounds cannot be prepared by Sendmeyer's reaction i.e. benzene diazonium chloride and cuprous salt ?

(A) C_6H_5Cl (B) C_6H_5Br

(C) C_6H_5I (D) C_6H_5CN

78. Which of the following reductions of benzene diazonium chloride gives aniline ?

(A) $C_6H_5N = N—Cl \xrightarrow[\text{sodium stannate}]{H} \longrightarrow$

(B) $C_6H_5N = N—Cl \xrightarrow[SnCl_2 \text{ and } HCl]{H} \longrightarrow$

(C) $C_6H_5N = N—Cl \xrightarrow[Na_2SO_3]{H} \longrightarrow$

(D) $C_6H_5N = N—Cl \xrightarrow[\text{hydrogen under pressure Pt. catalyst}]{H} \longrightarrow$

79. Which of the following Grignard reaction gives secondary alcohol ?

(A) $R—MgBr + \begin{matrix} R \\ \diagdown \\ \diagup \\ R \end{matrix} C = O \longrightarrow$

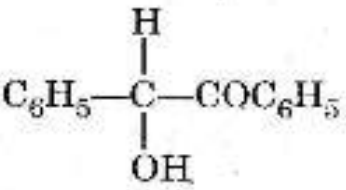
(B) $R—MgBr + R'COOR \longrightarrow$

(C) $R—MgBr + R—C(=O)H \longrightarrow$

(D) $R—MgBr + R—C(=O)NH_2 \longrightarrow$

80. Which of the following statements is *not correct* ?

(A) Glucose and mannose gives the same osazone

(B) Osazone formation is a typical reaction of α-hydroxy aldehydes or hydroxy ketones for example 

(C) A pair of diastereomeric aldoses that differ in configuration about C_2 are called epimers

(D) Fructose on treatment with $C_6H_5NHNH_2$ yields an osazone that is identical with the one prepared from mannose. This shows the two configurations at C_3, C_4 and C_5 are not identical.

81. Which district of H.P. is Parashar lake ?

(A) Kullu (B) Mandi

(C) Sirmaur (D) Shimla

82. At which interval is Bhunda festival celebrated ?

(A) Three years (B) Six years

(C) Nine years (D) Twelve years

83. At which place is HPMC installing a fruit processing plant in Solan District of H.P. ?

(A) Parwanoo (B) Nalagarh

(C) Baddi (D) Barotiwala

84. In which river basin is holi hydel power project ?

(A) Chenab (B) Ravi

(C) Beas (D) Satluj

85. How many meritorious students belonging to scheduled caste category are given scholarship on the basis of their merit in the matriculation examination conducted by the H.P. Board of School Examination under H.P. Government's Ambedkar Medhavi Chhatravriti Yojna ?

(A) 100 (B) 500

(C) 800 (D) 1000

86. According to 2011 census which district of H.P. has the lowest literacy rate ?

(A) Lahul-Spiti (B) Chamba

(C) Sirmaur (D) Kullu

87. In which District of H.P. is Bijli Mahadeva temple ?

(A) Mandi (B) Kullu

(C) Shimla (D) Kangra

88. According to Cunningham which one of the following was a Muhammadan princely state ?

(A) Kotla (B) Kutlchar

(C) Datarpur (D) Shahpur

89. When was the Jagirdar of Siba conferred the title of Raja by the British Government ?

(A) 1880 (B) 1887

(C) 1896 (D) 1909

90. What is the minimum distance that a person must travel in return Journey in order to avail discount in fare in the HRTC buses under the Green Card Scheme ?

(A) 20 km (B) 30 km

(C) 40 km (D) 50 km

91. Why has Shani Shingnapur temple in news recently ?

(A) for clashes between Hindu and Muslims

(B) for not allowing women to contest elections to the temple's governing body

(C) for preventing the Dalits from entering the temple

(D) for not allowing women to worship at the shrine and enter the inner sanctum of the temple

92. How many women were elected to the 16th Lok Sabha during 2014 General Elections ?

(A) 59 (B) 61

(C) 66 (D) 68

93. Which community was notified as minority community in India in 2014 ?

(A) Jain (B) Parsi

(C) Buddhist (D) Christian

94. In which state of India is Chilka lake ?

(A) Andhra Pradesh (B) J and K

(C) Odisha (D) Jharkhand

95. With which dance form is Leela Samson associated ?

(A) Kathak (B) Bharatnatyam

(C) Kathakali (D) Kuchipudi

96. Which is the least corrupt country is South Asia according Transparency International's Corruption Perception Index 2015 ?

(A) Nepal
(B) India
(C) Bhutan
(D) Sri Lanka

97. What is the symbol of Republican Party of the U.S.A. ?

(A) Donkey
(B) Jackal
(C) Elephant
(D) Tiger

98. Whom did Angelique Kerber defeat in the final of women Australian open 2016 ?

(A) Serena Williams
(B) Martina Hingus
(C) Victoria Azarenka
(D) Martina Navaratilova

99. Where is the headquarter of World Trade Organisation (WTO) ?

(A) Paris
(B) Brussels
(C) Geneva
(D) Washington

100. Which of the following was awarded Nobel Peace Prize thrice ?

(A) Scouts and Guides movement
(B) Red Cross
(C) Amnesty International
(D) International Labour Organisation