

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

**TEST BOOKLET**  
**AP(AS&H) CHEMISTRY-3/2014**

[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)    (C)    (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]

1. Which of the following electrodes is *not* reversible to anion of the electrolyte ?
- (A) Bromine electrode
- (B) Silver-silver bromide electrode
- (C) Mercury-mercurous bromide electrode
- (D) Quinhydrone electrode
2. Which of the following is an example of electrolyte concentration cell with transference ?
- (A)  $H_2(p_{H_2} = p_1) | H^+(a_1) | p_{H_2}(p_2), H_2$
- (B)  $Cd(Hg)(C_{Cd} = C_1) | Cd^{++} | Cd(Hg)(C_{Cd} = C_2)$
- (C)  $Ag | AgCl(s), HCl(a_1) | HCl(a_2), AgCl(s) | Ag$
- (D)  $Zn | ZnSO_4(a_1) | PbSO_4(s) | Pb(Hg) - Pb(Hg), PbSO_4(s), ZnSO_4(a_2) | Zn$
3. Which of the following is *not* a correct statement with regard to hydrogen over voltage ?
- (A) Increase of temperature decreases hydrogen over **voltage**
- (B) The composition and pH of the solution influence **considerably** hydrogen over voltage.
- (C) On smooth surfaces of Pt, Au and graphite hydrogen **over voltage** is very low at small current densities but increases **gradually** with the latter to approach a limiting value at high current density.
- (D) Hydrogen over voltage is already quite large at **zero current density** in case of metal surfaces such as that of Ag, Hg, Bi,  $Cd^{++}$  etc. These electrode do not function reversibly under any **condition** and thus hydrogen cannot be deposited on them.

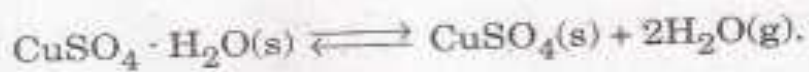
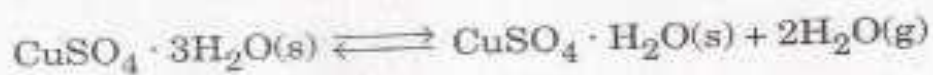
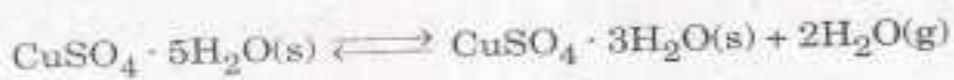
Which of the following statements is *not* correct with reference to Debye Hückel theory of strong electrolytes ?

- (A) Each ion is surrounded by ions of opposite charge forming an ionic atmosphere.
- (B) The formation of new ion-atmosphere and destruction of the old ionic atmosphere occur instantaneously.
- (C) Increase in molar conductance with dilution in case of strong electrolyte is due to increase in mobility of ions.
- (D) There exists an electrolyte which is completely ionised but not completely dissociated.

5. Which of the following pair of solutions have the same ionic strength ?

- (A) 0.1M KCl and 0.1M CaCl<sub>2</sub>
- (B) 0.1M CaCl<sub>2</sub> and 0.1M NaCl
- (C) 0.1M K<sub>2</sub>SO<sub>4</sub> and 0.1M BaCl<sub>2</sub>
- (D) 0.1M BaCl<sub>2</sub> and 0.1M KCl

6. If copper sulphate pentahydrate is gradually dehydrated at a given temperature, the following dissociation reactions are possible :



The dissociation pressure of the given trihydrate—monohydrate system at 50°C is :

- (A) 45.4 mm
- (B) 30.9 mm
- (C) 4.40 mm
- (D) 4.58 mm

7. Which of the following is *not* an extensive property ?

- (A) Partial internal energy                      (B) Partial molar enthalpy  
(C) Partial molar entropy                      (D) Vapour pressure

8. Which of the following is a Gibbs-Duhem equation ?

- (A)  $\Delta G = \Delta H + \left[ \frac{\delta(\Delta G)}{\delta T} \right]_P$                       (B)  $\frac{d \ln K_p}{dT} = \frac{\Delta H^0}{RT^2}$   
(C)  $\sum n_i d\mu_i = 0$                       (D)  $S_T = \int_0^T C_P d(\ln T)$

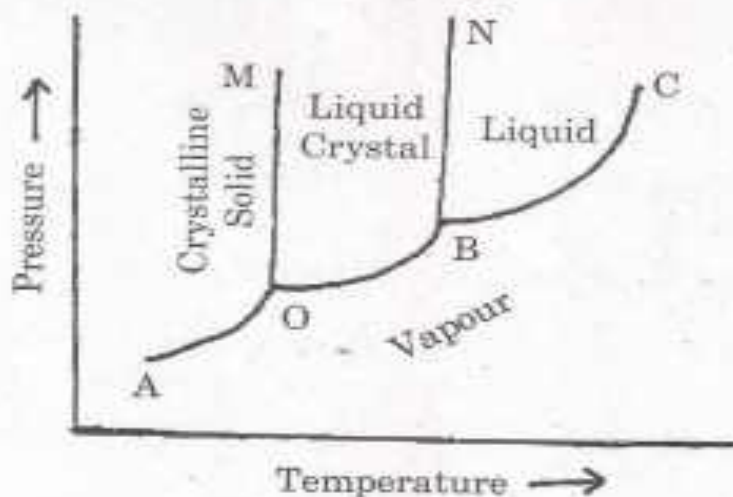
9. Which of the following is the characteristic of nematic **liquid crystal** ?

- (A) non-Newtonian flow  
(B) viscosity concept not applicable  
(C) uniaxial, not affected by strong magnetic field  
(D) thread like structure in polarised light

10. The molecular partition function for translational energy is given as :

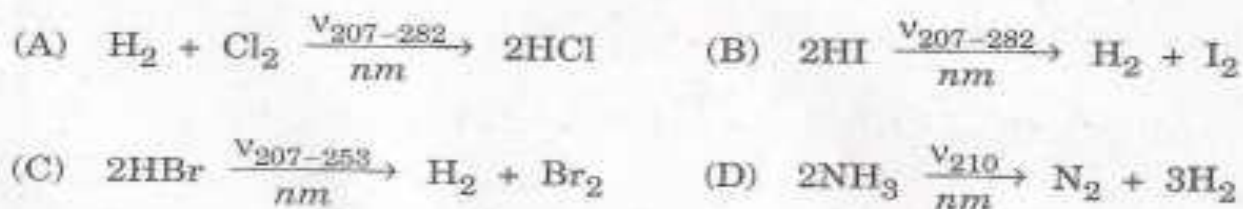
- (A)  $\frac{(2\pi mkT)^{3/2} V}{h^3}$                       (B)  $\frac{8\pi^2 I kT}{h^2}$   
(C)  $e^{-\frac{1}{2} h\nu/kT} (1 - e^{-h\nu/kT})^{-1}$                       (D)  $\sum e^{-\epsilon_i/kT}$

1. The vapour pressure-temperature diagram is shown below for a substance which undergoes mesomorphic change :



The effect of pressure on transition temperature is shown by the curve :

- (A) BC (B) OM  
(C) BN (D) OB
2. In which of the following photochemical reactions the quantum yield is lowest ?



13. In a photochemical reaction there occurs a primary process involving the absorption of a quantum of radiation ( $h\nu$ ) by a reactant molecule (A) resulting in excited molecule ( $A^*$ ). It undergoes secondary process independent of light absorption giving products. The cause of high quantum yield is :

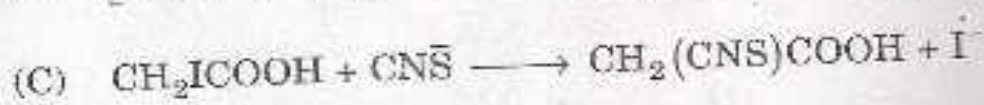
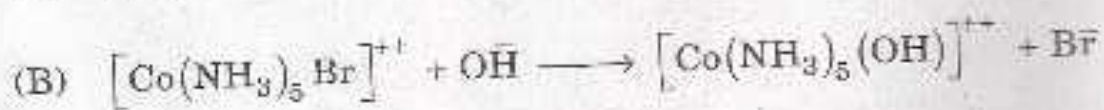
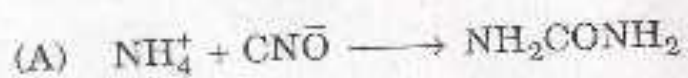
(A) secondary reaction may be exothermic, the heat of reaction can activate other molecules and cause them to react.

(B) the collisions of excited molecules with non-excited molecules may cause the excited molecules to lose the energy.

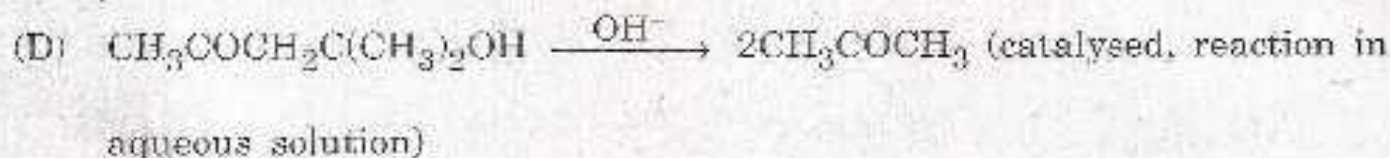
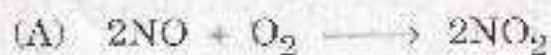
(C) the dissociated fragments may recombine to form the original molecule.

(D) the excited molecules may get deactivated before they form products.

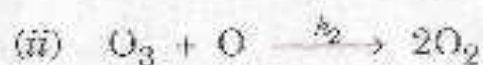
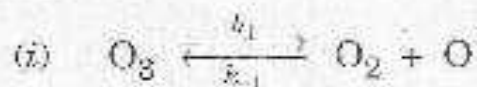
14. The effect of ionic strength on the rates of ionic reaction has been studied for various reactions. A plot of  $\log k$  against  $\sqrt{\mu}$  (ionic-strength) gives a straight line with a slope  $1.02 Z_A \cdot Z_B$  i.e. dependent only on the product  $Z_A \cdot Z_B$  (charges on the reacting ions). For which of the following reactions the primary salt effect is essentially zero :



5. Which of the following is an example of Pseudobimolecular reaction ?



16. The mechanism for thermal decomposition of ozone ( $\text{O}_3$ ) to oxygen as been suggested as :



Using steady state approximation for the transient (short lived) intermediate

we have  $\frac{d[\text{O}]}{dt}$  equals to :

(A)  $k_1[\text{O}_3] - k_{-1}[\text{O}_2][\text{O}] - k_2[\text{O}_3][\text{O}] = 0$

(B)  $-k_1[\text{O}_3] + k_{-1}[\text{O}_2][\text{O}] - k_2[\text{O}_3][\text{O}] = 0$

(C)  $k_1[\text{O}_3] + k_{-1}[\text{O}_2][\text{O}] + k_2[\text{O}_3][\text{O}] = 0$

(D)  $-k_1[\text{O}_3] - k_{-1}[\text{O}_2][\text{O}] + k_2[\text{O}_3][\text{O}] = 0$

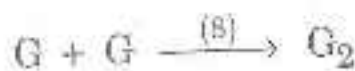
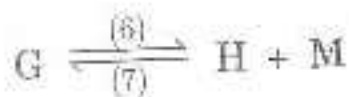
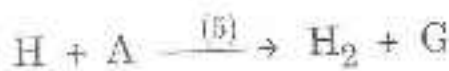
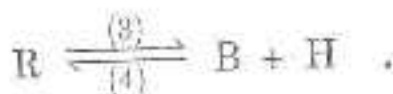
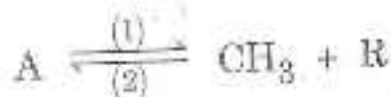
17. Which of the following statements is *not* correct with enzyme catalysed reaction ?

- (A) Each enzyme molecule has one or more active sites at which substrate may be bound in order that catalysed reaction to occur.
- (B) Most active sites remain unoccupied at low substrate concentration at any time. As the substrate concentration is increased, the occupancy of these sites increases hence reaction rate also increases.
- (C) A very high substrate concentration almost all the active sites are occupied at any time so that further increase in substrate concentration cannot further increase the formation of enzyme-substrate complex.
- (D) The Michaelis-Menten equation can be written as :

$$r = V_{\max} [s]/[K_m + [s]].$$

If  $K_m \gg [s]$ ,  $r = V_{\max} [s]/K_m$  the reaction is zero order.  
Now if  $K_m \ll [s]$ ,  $r = V_{\max}$  the reaction is first order.

18. A saturated hydrocarbon undergoes pyrolysis at 800 K according to the mechanism :



The stable products are B, H<sub>2</sub>, M and G. The termination step(s) is :

- (A) 1  
(B) 3, 4  
(C) 2, 8  
(D) 5, 6, 7



19. Which of the following statements is *not* correct with regard to electron and neutron diffractions studies ?
- (A) Electron diffraction has provided precise bond length and angles in a wide variety of molecules that can be obtained in the gas phase.
  - (B) Electron diffraction cannot be used to study the interiors of the solid sample since electrons are charged, scattered strongly by their interaction with the charges of electrons and nuclei.
  - (C) The intensity with which neutrons are scattered is dependent on the number of electrons and dominated by the heavy atoms present in the molecule.
  - (D) Neutrons have a magnetic moment due to their spins. Thus magnetic scatter takes place. Although the atoms are same as far as X-rays are concerned, they are different for neutrons and diffraction intensity is observed at the provided systematic X-ray absences.

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

- (A) The asymmetric unit is the particle (ion or molecule) from which crystal is built.
- (B) The space lattice is two-dimensional infinite array of points, each of which is surrounded in an identical way by its neighbours.
- (C) The crystal structure is obtained by associating with each lattice point an assembly of asymmetric units in a symmetrical arrangement which is identical for each lattice point.
- (D) The unit cell is the fundamental unit from which the entire crystal may be constructed by purely translational displacement.

21. Which of the following statements is *not* correct for the bond types from non-polar to ionic in M.O. theory by writing LCAO as :

$$\psi = C_A\psi_A + C_B\psi_B,$$

where  $\psi_A$  and  $\psi_B$  are the atomic orbitals to the MO and  $C_A$  and  $C_B$  are coefficients :

- (A) The proportion of  $\psi_A$  in the bond is  $C_A^2$  and that of  $\psi_B$  is  $C_B^2$ .
- (B) A pure ionic bond has one coefficient zero such that  $A^+B^-$  will have  $C_A = 0$  and  $C_B = 1$ .
- (C) A polar bond would have unequal non-zero coefficients.
- (D) A non-polar bond has  $C_A^2 \neq C_B^2$  and  $C_A$  and  $C_B$  can have any value other than zero.
22. A wave function is acceptable only if it is :
- (A) not continuous                      (B) discontinuous slope
- (C) single valued                        (D) infinite over a finite region
23. Which of the following statements is *not* correct ?
- (A) The attraction of opposites can produce a stable union for example sodium chloride. (ionic bond)
- (B) Shared electrons lead to the strongest bonds for example diamond, graphite. (covalent bond)
- (C) A gas of free electrons is responsible for the characteristic properties of metal. (metallic bond)
- (D) van der Waal bond are also strong but present every where for example behaviour of matter in bulk.

1. Which of the following is *not* quantum mechanically permissible ?

(A)  $2s$

(B)  $3f$

(C)  $4p$

(D)  $5g$

5. Which of the following is *not* related to the characteristic of photoelectric effect ?

(A) No electrons are ejected regardless of the intensity of light unless its frequency exceeds a threshold value characteristic of metal.

(B) The kinetic energy of the ejected electron is linearly proportional to the frequency of the incident light.

(C) Even at low light intensities electrons are ejected immediately if the frequency is above threshold.

(D) The experiments on photoelectric effect and diffraction of electron by a crystal have led to the fusion of concept of particle and wave, particle taking the characteristic of wave and wave characteristic of particle.

26. Which of the following is an energy operator ?

(A)  $\frac{\hbar}{i} \frac{\partial}{\partial x}$

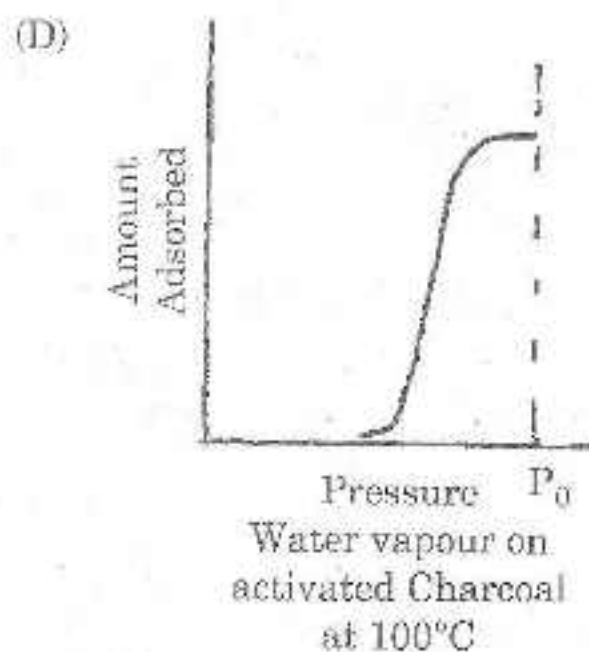
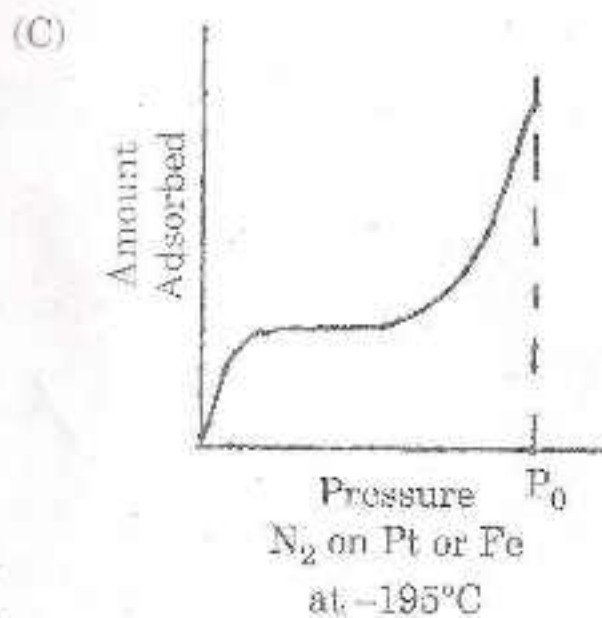
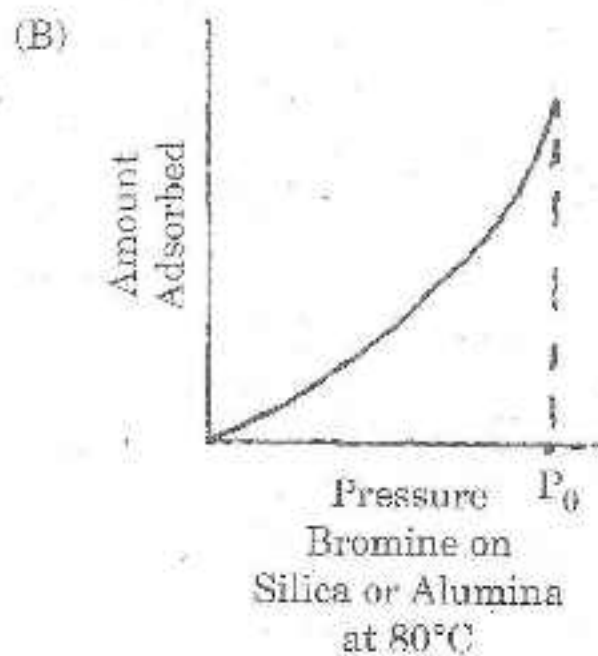
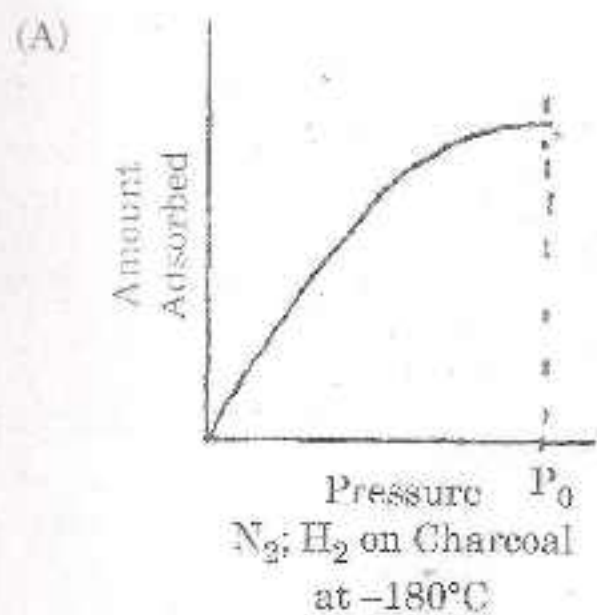
(B)  $i\hbar \frac{\partial}{\partial T}$

(C)  $-\frac{\hbar}{2m} \frac{\partial^2}{\partial x^2} + U$

(D)  $\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$

27. The term symbol for nitrogen in the ground state is :
- (A)  $^2P_{3/2}$  (B)  $^3P_2$   
 (C)  $^3F_2$  (D)  $^4S_{3/2}$
28. The number-average molar mass of a polymer can be determined by :
- (A) Osmometry method  
 (B) Light scattering method  
 (C) Viscosity method  
 (D) Sedimentation equilibrium method
29. Which of the following properties does *not* commensurate with the electronic configuration of A and B given below :
- A :  $1s\sigma^2 1s\sigma^{2*} 2s\sigma^2 2s\sigma^{2*} 2p_x\sigma^2 2p_x\pi^2 2p_y\pi^2 2p_x\pi^{1*} 2p_y\pi^{1*}$   
 B :  $1s\sigma^2 1s\sigma^{2*} 2s\sigma^2 2s\sigma^{2*} 2p_x\sigma^2 2p_x\pi^2 2p_y\pi^2 2p_x\pi^{1*}$
- (A) The species B has highest bond order  
 (B) The species B has shortest bond length  
 (C) The species B has smaller dissociation energy than that of A  
 (D) The species B has maximum bond strength than that of A

30. Which of the following adsorption isotherms of gases shows monomolecular adsorption as postulated by Langmuir ?



31. Which of the following lanthanides forms  $MO_2$  and not  $M_2O_3$  ?

- (A) Cerium (B) Proseodymium  
(C) Neodymium (D) Terbium

32. Which complexes of cerium has highest coordination number ?

- (A)  $\text{Ce}^{\text{IV}}[(\text{NO}_3)_4\text{Ph}_3\text{PO}]$                       (B)  $(\text{NH}_4)_2[\text{Ce}^{\text{IV}}(\text{NO}_3)_6]$   
(C)  $(\text{NH}_4)_2\text{Ce}^{\text{IV}}\text{F}_6$                               (D)  $\text{CS}_2[\text{Ce}^{\text{IV}}\text{Cl}_6]$

33. Which of the following statements is not correct with regard to transition elements ?

(A) The magnetic moment of an atom or ion results from combination of spinning of electron along its own axis and an electron traveling in a closed path around a nucleus.

(B) The diamagnetism and its magnitude depend on temperature. The moment induced also depend on the sizes and shapes of the orbital in the closed shell.

(C)  $\text{Mn}(\text{II})$ ,  $\text{Fe}(\text{III})$  and  $\text{Gd}(\text{III})$  have ground S-states. There is no orbital angular momentum, hence there is no orbital contribution to the magnetic moment. The magnetic moment of transition element is known from the relation,  $\mu_{\text{BM}} = g\sqrt{s(s+1)}$ .

(D) The transition elements in their ground state D or F being most common, do possess orbital angular momentum. The magnetic moment is given

$$\text{as : } \mu_{\text{S} + \text{L}} = \sqrt{4s(s+1) + \text{L}(\text{L} + 1)}$$

34. Which of the following statements is *not* correct with regard to the chemistry of inner transition elements ?
- (A) Spectra involving only one  $f$ -electron consists of single transition  ${}^2F_{5/2} - {}^2F_{7/2}$ .
  - (B) For  $f^7$ -configuration in  $Cm^{+3}$  the lowest excited state be about 4 eV above the ground level, the ion shows only charge transfer band in UV region.
  - (C) The experimental magnetic moments in actinide ions are usually lower than the calculated value due to ligand field effects since  $5f$ -orbitals can participate to some extent in covalent bonding and to inadequacy of Russell Saunders coupling scheme.
  - (D) The magnetic properties of actinide ions are much simpler to interpret than those of lanthanide ions.

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

- (A) The crystal field theory (CFT) treats the interaction between the metal ion and the ligand as a purely electrostatic problem in which the ligand atoms are represented as pure point charges. The basic difficulty with CFT is that it takes no account of partly covalent nature of M-L bonds. Whatever effects stem directly from covalence are entirely inexplicable in simple CFT.
- (B) The metal-ligand interaction can be explained in terms of molecular orbital theory (MOT) formed by the overlap of ligand and metal orbitals. MOT provides a very simple way of treating numerical many aspects of electronic structure of the complex. CFT calculations are more tedious than MO.
- (C) Both CFT and MOT make explicitly rigorous use of symmetry properties of the complex.
- (D) A modified CFT has been devised in which certain parameters are empirically adjusted to allow the effect of covalence without introducing covalence in CFT formalism. The modified theory is called ACFT (adjusted crystal field theory).

36. For a high spin octahedral transition metal ion complex :
- (A) every  $t_{2g}$  electron represents a stability decrease of  $2\frac{2}{5}$
- (B) every  $e_g$  electron represents a stability decrease of  $3\frac{3}{5}$
- (C) any configuration  $t_{2g}^p e_g^q$  the net destabilisation energy  $\left(\frac{2p}{5} - \frac{3q}{5}\right) \Delta_0$ .
- (D)  $\Delta_0$  for any complex involving  $d^0$  to  $d^{10}$  electron can be obtained by spectrum. It is possible to determine CFSE independent of thermodynamics.
37. In an octahedral complex formation of a transition metal ion the non-bonding orbitals are :
- (A)  $3d_{xy}, 3d_{yz}, 3d_{xz}$  (B)  $4p_x, 4p_y, 4p_z$
- (C)  $4s$  (D)  $3d_{x^2-y^2}, d_{z^2}$
38. Which of the following reactions is *not* used to reduce acidity in the stomach ?
- (A)  $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 2\text{H}_2\text{O} + 3\text{H}^+ \longrightarrow 3\text{Na}^+ + \text{H}_3\text{C}_6\text{H}_5\text{O}_7 + 2\text{H}_2\text{O}$   
Sodium citrate
- (B)  $\text{MgO} + 2\text{H}^+ \longrightarrow \text{Mg}^{+2} + \text{H}_2\text{O}$   
Milk of magnesia
- (C)  $\text{NaHCO}_3 + \text{H}^+ \longrightarrow \text{Na}^+ + \text{H}_2\text{O} + \text{CO}_2$   
Baking soda
- (D)  $\text{Na}_2\text{CO}_3 + 2\text{H}^+ \longrightarrow 2\text{Na}^+ + \text{H}_2\text{O} + \text{CO}_2$   
Sodium carbonate



39. Alkali metals Rb and Cs have complete miscibility whereas Li and Na do not have complete miscibility. The former pair forms substitution alloy whereas the latter forms alloy within a limited range only. Which of the following is not a reason for this behaviour ?

- (A) The metallic radii of Rb and Cs differ by about 6.9% which is less than 14-15%, and difference between the metallic radii is about 22% which is greater than 14-15% (cf. Hume-Rothery rule).
- (B) All metals, Rb, Cs, Li and Na have body centred cubic lattice i.e. they have same crystal structure.
- (C) The number of valence electrons are same in Rb, Cs, Li and Na.
- (D) Rb and Li have body centred whereas Li and Na have face centred cubic lattices.

40. Which of the following is not correct with regard to super-conductivity ?

- (A) Super-conductivity of metals and alloys is considered to involve two electron transfer at a time.
- (B) Super-conductors do not have perovskite or its related structure.
- (C) Many super-conductors contain copper. The metal Cu exists in three oxidation states I, II and III. Cu(II) involves a transfer of electron to change from oxidation state II to III. If two electrons are involved the change could be I to III.
- (D) Cu(II) forms many tetragonally distorted octahedral complex. Oxygen deficiency seems to be critical. There is an evidence which finds support from neutron diffraction that the vacancies left by missing O are ordered. The octahedral copper is surrounded by six O atoms, when an oxygen vacancy occurs, then two copper atoms interact directly with each other. Interaction may be Cu(II to III) or Cu(I to III).

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

- (A) Helium is the only pure substance that can exist in two different isotropic liquid phases viz. liquid He I and liquid He II. Liquid He I (a normal liquid) has unusual properties in the vicinity of 0°K—no internal friction, thermal conduction about 800 times greater than Cu, no electrical resistance.
- (B) The first ionisation energy of O<sub>2</sub> (i.e. O<sub>2</sub> → O<sub>2</sub><sup>+</sup>) is 1165 kJ mol<sup>-1</sup> and that of Xe (i.e. Xe → Xe<sup>+</sup>) is 1170 kJ mol<sup>-1</sup>.
- (C) Xe combines with PtF<sub>6</sub> to form Xe<sup>+</sup>[PtF<sub>6</sub>]<sup>-</sup> cf. O<sub>2</sub><sup>+</sup>[PtF<sub>6</sub>]<sup>-</sup>. Xenone hexafluoroplatinate (V) reacts with [PtF<sub>6</sub>] to form [XeF]<sup>+</sup> [Pt<sub>2</sub>F<sub>11</sub>]<sup>-</sup>.
- (D) The low ionisation energies of heavier noble gas (Xe, Kr and Rn) form compounds with electronegative ligands such KrF<sub>2</sub> and RnF<sub>2</sub>.

42. Which of the following statement/description is *not* correct ?

- (A) The selection rule for e.s.r. spectrum is as :

$$\Delta m_l = \pm 1 \text{ and } \Delta m_s = 0.$$

- (B) An unpaired electron interacts a group of three equivalent nuclei of spin  $\frac{1}{2}$  (eg. methyl radical). A quartet with intensity 1 : 3 : 3 : 1 is seen in an e.s.r. spectrum.
- (C) The e.s.r. spectrum for the hypothetical radical H—X<sup>+</sup> ↔ H—X<sup>-</sup> with spin I = 1 for X, would consist six lines of equal intensity. It is possible to detect 5 lines since inner two lines may merge to give a line with twice the area of other peak.
- (D) The value of g for an unpaired electron in a gaseous atom or ion for which Russell-Saunders coupling is applicable, is given as :

$$g = 1 + \frac{J(J+1) + s(s+1) - L(L+1)}{2J(J+1)}$$

The value of g for a free electron is given by the above expression as 2.00 but the actual value is 2.0023 due to relativistic correction.

43. Which of the following absorption frequency in  $\text{cm}^{-1}$  corresponds to asymmetric stretching mode of vibration in water molecule ?
- (A)  $7500 \text{ cm}^{-1}$  (B)  $3756 \text{ cm}^{-1}$   
(C)  $3652 \text{ cm}^{-1}$  (D)  $1545 \text{ cm}^{-1}$
44. Which of the following is a neutralisation reaction of acid and base in solvent hydrogen fluoride ?
- (A)  $\text{TlCl}_4 + 4\text{HF} \longrightarrow \text{TlF}_4 + 4\text{HCl}$   
(B)  $\text{KIO}_4 + \text{AgF} \longrightarrow \text{AgIO}_4 + \text{KF}$   
(C)  $2\text{KF} + 2\text{HBF}_4 \longrightarrow 2\text{KBF}_4 + 2\text{HF}$   
(D)  $2\text{HF} \longrightarrow \text{H}_2\text{F}^+ + \text{HF}_2^-$
45. Which of the following properties is *not* useful in the separation of lanthanides ?
- (A)  $\text{Eu}^{+2}$  forms  $\text{EuSO}_4$  which is insoluble in water, all other lanthanides  $\text{Ln}^{+3}$  are soluble in water as sulphates.  
(B) Some of the lanthanides show +2 and +4 oxidation states in addition to +3 oxidation state.  $\text{Ce}^{+3}$  is oxidised to  $\text{Ce}^{+4}$  by  $\text{KMnO}_4$ .  $\text{Ce}^{+4}$  is smaller in size, less basic and less soluble.  
(C) The partition coefficient of  $\text{Gd}(\text{NO}_3)_3$  between water and *n*-butyl alcohol is 1.06 times than  $\text{La}(\text{NO}_3)_3$ .  
(D)  $\text{Ln}^{+3}$  do not form complexes with  $\pi$ -bonding ligands such as, CO, NO etc.

46. Out of the following which actinides is coloured in their aqueous solutions ?

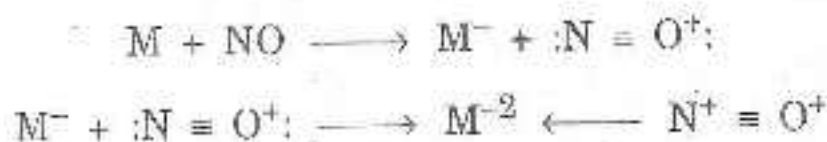
- (A)  $Ac^{+3}$  (B)  $Cm^{+3}$   
(C)  $Th^{+4}$  (D)  $Np^{+3}$

47. In which of the following reactions the compound is acidic in solvent sulphuric acid ?

- (A)  $HNO_3 + 2H_2SO_4 \longrightarrow NO_2^+ + 2HSO_4^- + H_3O^+$   
(B)  $HClO_4 + H_2SO_4 \longrightarrow H_3SO_4^+ + ClO_4^-$   
(C)  $NH_3 + H_2SO_4 \longrightarrow HSO_4^- + NH_4^+$   
(D)  $C_2H_5OH + H_2SO_4 \longrightarrow HSO_4^- + C_2H_5OH_2^+$

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

- (A) NO and  $NO^-$  form complexes with metal ion for eg.  $[Mn(NO)(CN)_5]^{-2}$  and  $[Co(NH_3)_5(NO)]^{+2}$  with two and one  $\sigma$ -electron donor respectively.  
(B) The odd electron in antibonding MO of NO molecule is quite easily lost and forms  $NO^+$  (nitrosonium ion)



NO in its nitrosonium complex acts as 3-electron donor.

- (C)  $M^{-2}-N^+ \equiv O^+ \xleftarrow[\text{back bonding}]{\pi} M^- - N = O^+$

$M^{-2}-N^+ \equiv O^+$  is highly polar. The electron charge from the filled  $d_{\pi}$ -orbitals of the metal would get transferred to  $\pi^*$  MO of  $NO^+$ .

- (D) A dark brown colour formed between NO and  $Fe^{+2}$  (aq.) is as  $[(NO)Fe(H_2O)_5]^{+2}$ . The brown colour is due to charge transfer band in UV region.

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

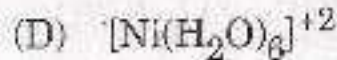
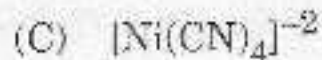
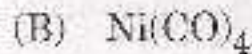
- (A) Mn, Fe, Co, Cu, Zn and Mo are required in major quantities whereas K, Na, Mg and Ca are required in minor quantities by living organism.
- (B)  $\text{Ca}^{+2}$  ions are maintained at very low concentration in intracellular fluid. It is 10,000 times less than present in extracellular fluid.  $\text{Mg}^{+2}$  is more concentrated in intracellular than in extracellular fluid in animal bodies.
- (C)  $\text{Mg}^{+2}$  and  $\text{Ca}^{+2}$  are responsible for the transmission of electrical impulse along the nerve fibre and for the contraction of muscles.
- (D)  $\text{Na}^+$  ion is a major cation of extracellular fluid in human bodies.  $\text{Na}^+$  ions are relatively harmless but when present in excess amount they may cause hypertension.

$\text{K}^+$  ion is a major cation of intracellular fluid. It is moderately toxic to mammals when injected intravenously. It is essential for metabolism of glucose and synthesis of protein.

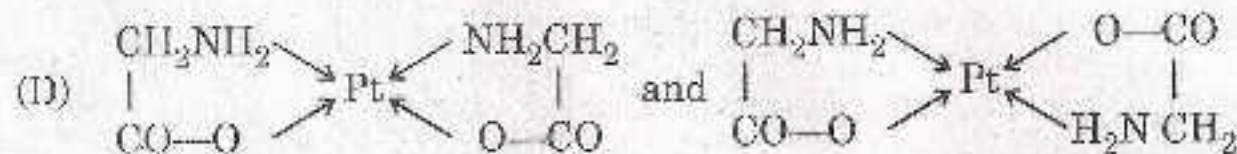
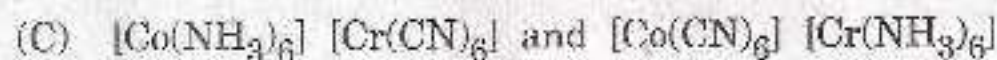
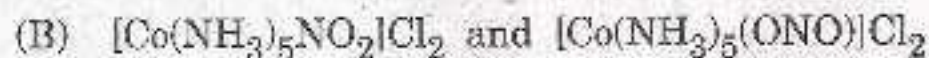
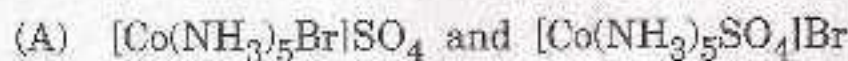
50. Which of the following statements is *not* correct ?

- (A) Chromium is an essential trace element which is involved in glucose metabolism. Chromium (III) and insulin maintain the correct level of glucose in blood. It is highly toxic as Cr(VI) is carcinogenic.
- (B) Cu is an important constituent of hemocyanin which supplies  $\text{O}_2$  to aquatic creatures and redox enzymes. Cu containing enzyme play an important role in pigmentation of skin, functioning of brain and in iron metabolism.
- (C) Cd and Hg along with Fe have practically no biological function. These are highly toxic for central nervous system. Hg(II) inhibits enzymes.
- (D) Zn is an essential element for all organisms. It is present in large number of enzymes.

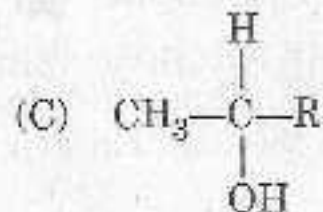
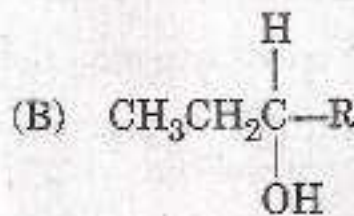
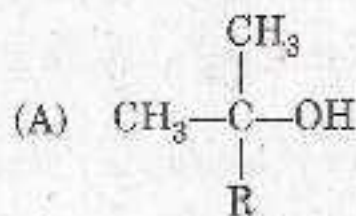
51. Which of the complex of Ni has tetrahedral geometry and paramagnetic with two unpaired electrons ?



52. Which of the following pair of complexes shows coordination isomerism ?



53. Which of the following species among alcohols (their formula are given below) shows a more intense peak at  $m/e = 59$  in their mass spectral analysis ?



54. Which of the following is *not* the characteristic of  $n \rightarrow \pi^*$  transition in an organic compound ?
- (A) low intensity ( $\epsilon < 1500$ )
  - (B) shifted to shorter wavelength by changing to more polar solvent
  - (C) shifted to shorter wavelength by electron donating groups
  - (D)  $n \rightarrow \pi^*$  transition required high energy and occurs in UV region.
55. Which of the following statements is *not* correct with reference to IR spectroscopy ?
- (A) A ketone forms a charge transfer complex with a halogen molecule, the stretching force constant is decreased, the infrared frequency  $\nu_{C=O}$  is lowered whereas the bending frequency of the carbonyl group is increased.
  - (B) A cyclic  $\alpha - \beta$  unsaturated ketone the  $\alpha$ -hydrogen has a bending vibration at  $860 \text{ cm}^{-1}$  whose first overtone is close to  $1710 \text{ cm}^{-1}$ .
  - (C) The infrared vibration is active for a change in polarisability whereas Raman excitation is active for a change in dipole moment.
  - (D) The IR and Raman spectroscopic techniques are complimentary to each other.

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

(A) The methyl protons of TMS (tetramethyl silane) are chemically and magnetically equivalent and shows a symmetrical peak up field.

(B) The relationship of and not the number of one group of nuclei (for eg.  $\text{CH}_3$ ) to other nearby group of nuclei (for eg.  $\text{CH}_2$ ) can be known from relative areas under the absorption curve for the various bands.

(C) A proton absorbs at 188 cps on 60 MHz instrument, its position on  $\delta$ -scale (ppm scale) will be given by,  $\delta \times 60 = 188$  i.e. 3.10 ppm. The above proton will show absorption signal on 100 MHz instrument at 310 cps.

(D) The value of absorption signal in cps can change depending on whether the instrument is working at 40 MHz or say 300 MHz, but its value on  $\delta$ -scale does not change.

57. Which of the following regions in  $\text{cm}^{-1}$  for CH out of plane deformation vibration is characteristic of monosubstituted aromatic compound ?

(A) 3040-3030  $\text{cm}^{-1}$  (m)

(B) 1600  $\pm$  5  $\text{cm}^{-1}$  (m)

(C) 900-690  $\text{cm}^{-1}$  (s)

(D) 710-690  $\text{cm}^{-1}$ ; 750  $\text{cm}^{-1}$  (s)



58. If 50 ml of 0.05 N—NaOH neutralises 0.225 g of an organic acid. The equivalent weight of the acid is found to be :
- (A) 90 (B) 100  
(C) 180 (D) 240
59. The deficiency of vitamin B<sub>12</sub> may cause :
- (A) demineralisation of bone, osteomalacia in adults and rickets in children  
(B) pernicious anemia, characterised by low haemoglobin and decrease number of erythrocytes  
(C) lack of active prothrombin in the circulation  
(D) senoy, spongy soregums, anemia, decreased immunocompetence
60. Hormones can be classified on the basis of chemical nature. Which of the following is a steroid hormones ?
- (A) Thyroxin (B) Adrenaline  
(C) Insulin (D) Glucagon
61. Which of the following alkaloid is dextro-rotatory ?
- (A) Ricinina (B) Papaverine  
(C) Coniina (D) Nicotin



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

(A) D-(+)-glucose fail to undergo certain reactions of typical aldehydes (negative test with Schiff's reagent and no addition product with  $\text{NaHSO}_3$ ).

(B) D-(+)-glucose exists in two isomeric forms which undergo mutarotation (I changes from  $112^\circ$  to  $52.7^\circ$  and II changes from  $19^\circ$  to  $52.7^\circ$ ).

(C) D-(+)-glucose forms two isomeric methyl-D-(+)-glucosides which undergo mutarotation.

(D) D-(+)-glucose is the hemiacetal corresponding to reaction between  $-\text{CHO}$  group and C-5 of the hydroxyl group of the open chain structure. Since  $-\text{CHO}$  group and  $-\text{OH}$  group are the part of the same molecule.

65. Which of the following pairs of purines is found both in DNA as well as in RNA ?

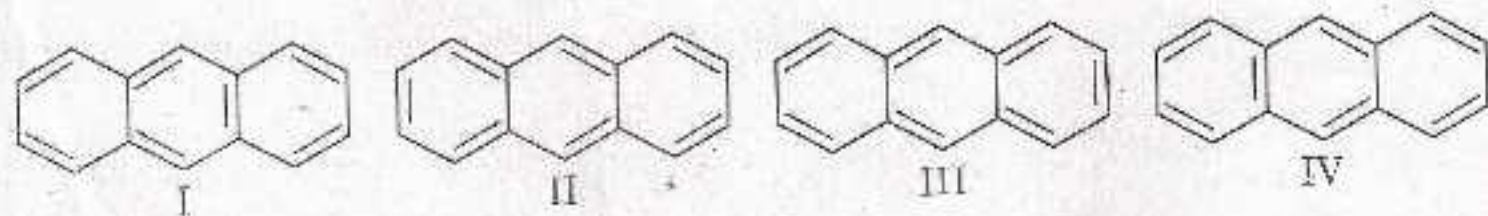
(A) Uracil and Cytosine

(B) Cytosine and Thiamine

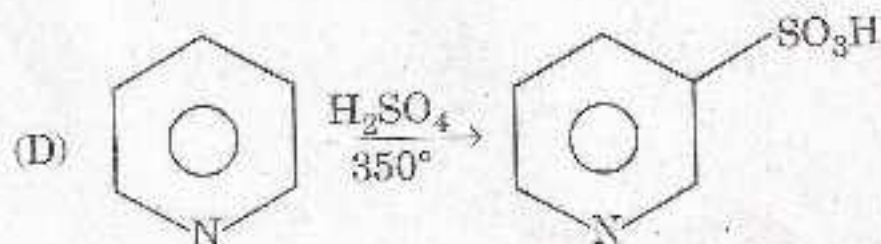
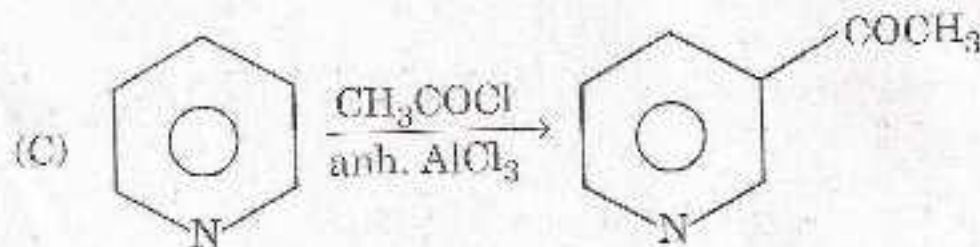
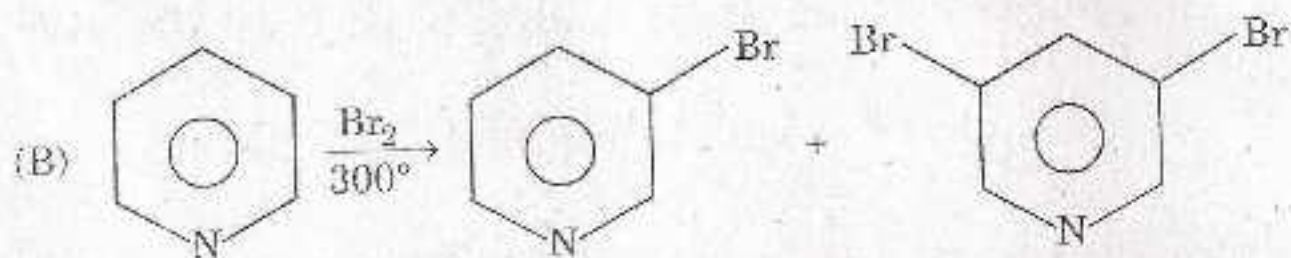
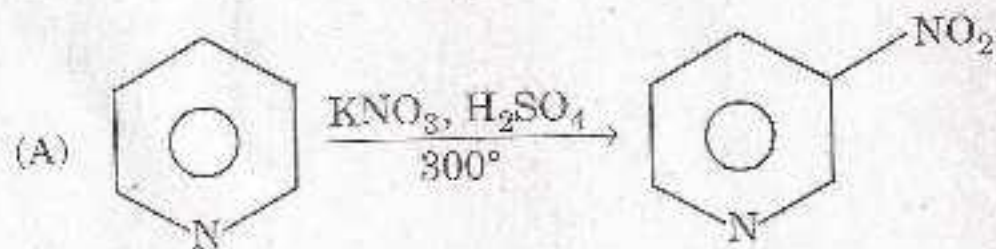
(C) Adenine and Guanine

(D) Thiamine and Uracil

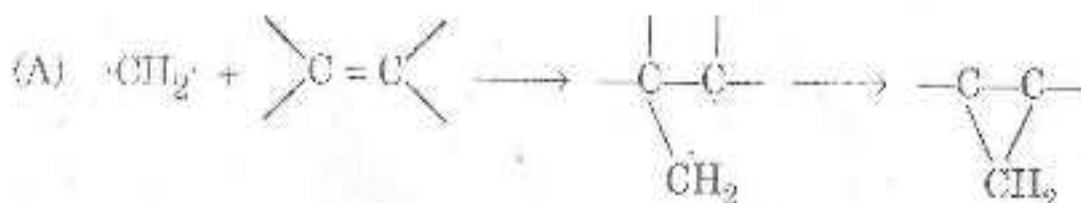
66. Anthracene has I to IV resonance hybrid structures. Which of the following structures are most stable :



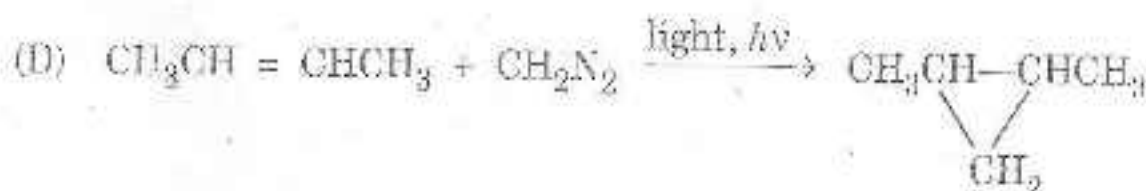
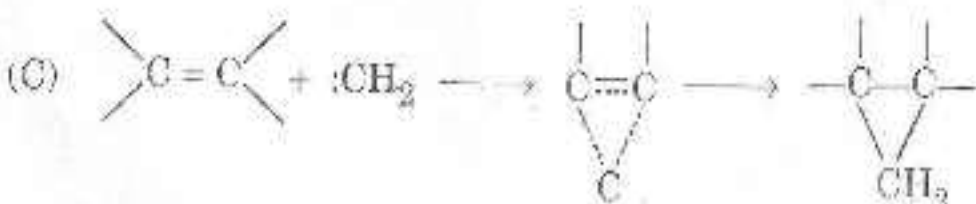
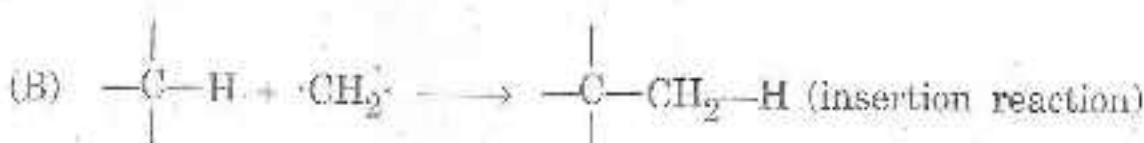
- (A) Structures I and IV  
 (B) Structures II and III  
 (C) Structures II and IV  
 (D) Structures I and III
67. Which of the following electrophilic reaction of pyridine does *not* take place though chemical equation is given :



68. Which of the following is an example of an addition reaction of  $\cdot\text{CH}_2$  generated in-situ in the presence of alkene ?



free radical addition—two step mechanism



69. The rate of formation of carbocation follows the sequence :



70. Which of the following groups of amino acids is non-essential since they can be synthesised by the human body to meet the biological needs ?

(A) arginine, histidine

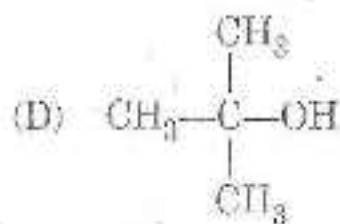
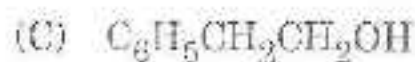
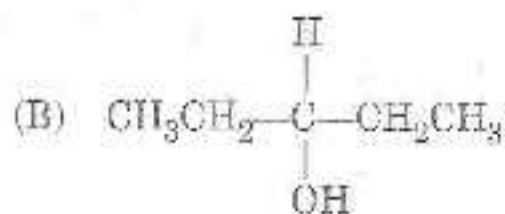
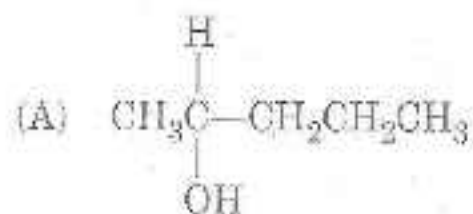
(B) Leucine, threonine, methionine, glutamine

(C) glycine, tyrosine, cysteine, prolin

(D) aspartic acid, cystine, phenyl alanine, voline



74. Which of the following compounds gives a positive iodoform test ?

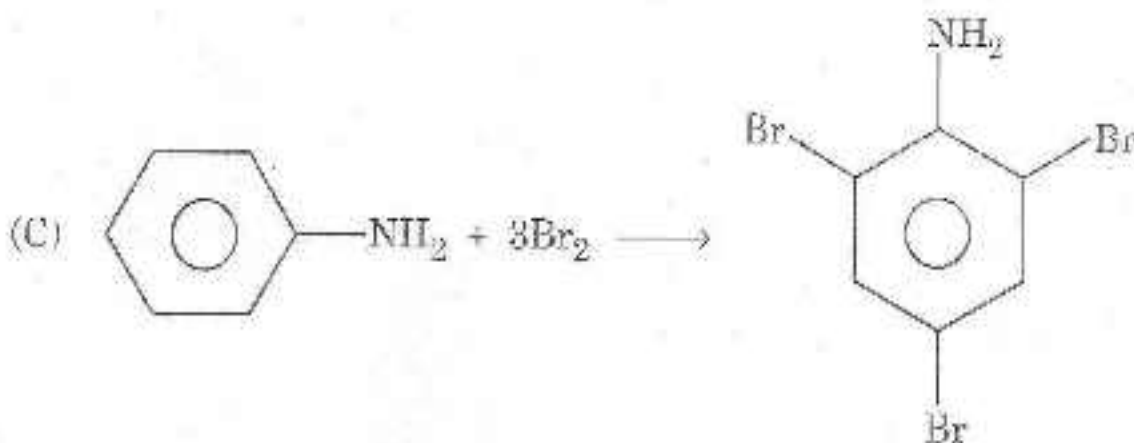


75. Which of the following reactions takes place through carbonium ion reaction mechanism ?

- (A) Perkin condensation reaction  
(B) Benzoin condensation reaction  
(C) Claisen ester condensation reaction  
(D) Friedel-Craft alkylation reaction

76. Which of the following reactions is generally *not* allowed to perform in an open laboratory due to foul smell ?

- (A)  $\text{C}_6\text{H}_5\text{NH}_2 \cdot \text{HCl} + \text{HNO}_2 (\text{NaNO}_2 \text{ and } \text{HCl}) \longrightarrow \text{C}_6\text{H}_5\text{N}=\text{N}-\text{Cl} + 2\text{H}_2\text{O}$   
(B)  $\text{C}_6\text{H}_5\text{NH}_2 + \text{CHCl}_3 + 3\text{KOH} \longrightarrow \text{C}_6\text{H}_5\text{N} \equiv \text{C} + 3\text{KCl} + 3\text{H}_2\text{O}$



77. With which the following compounds, benzene diazonium chloride reacts to produce mixed ether without benzene ?

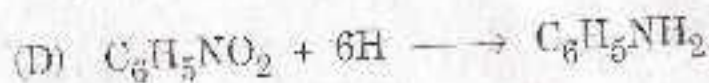
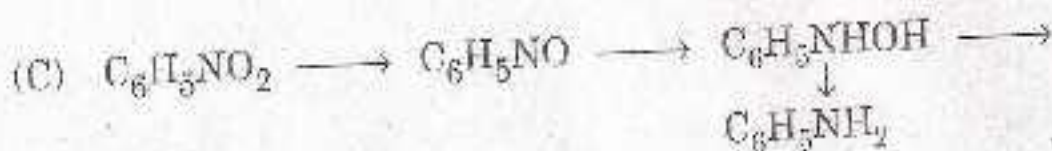
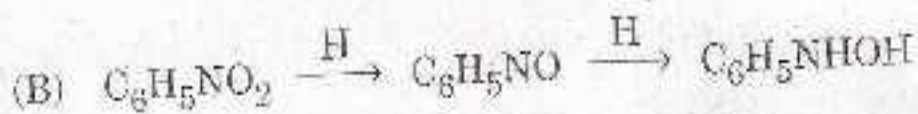
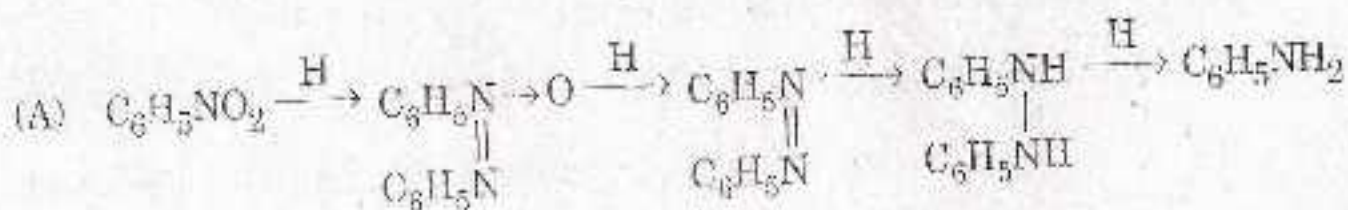
(A)  $\beta$ -naphthol

(B) Methyl alcohol

(C) Absolute ethyl alcohol

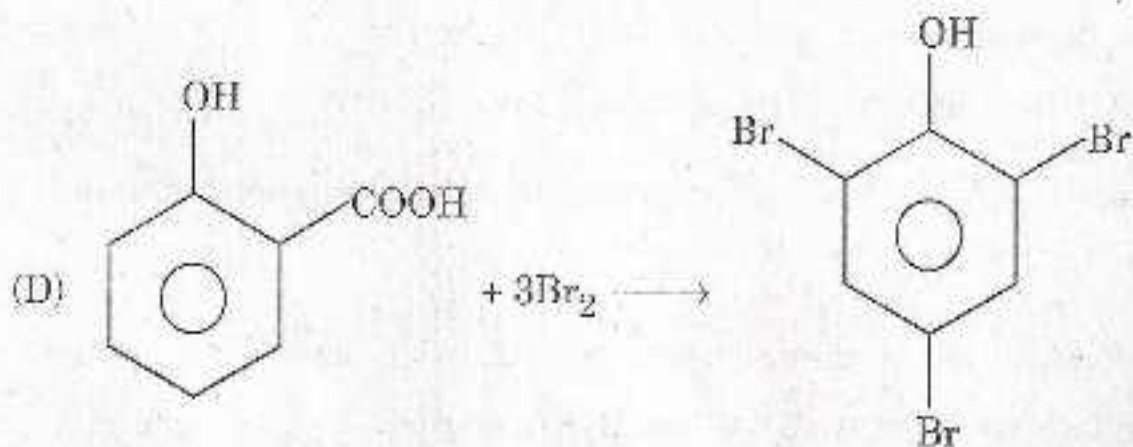
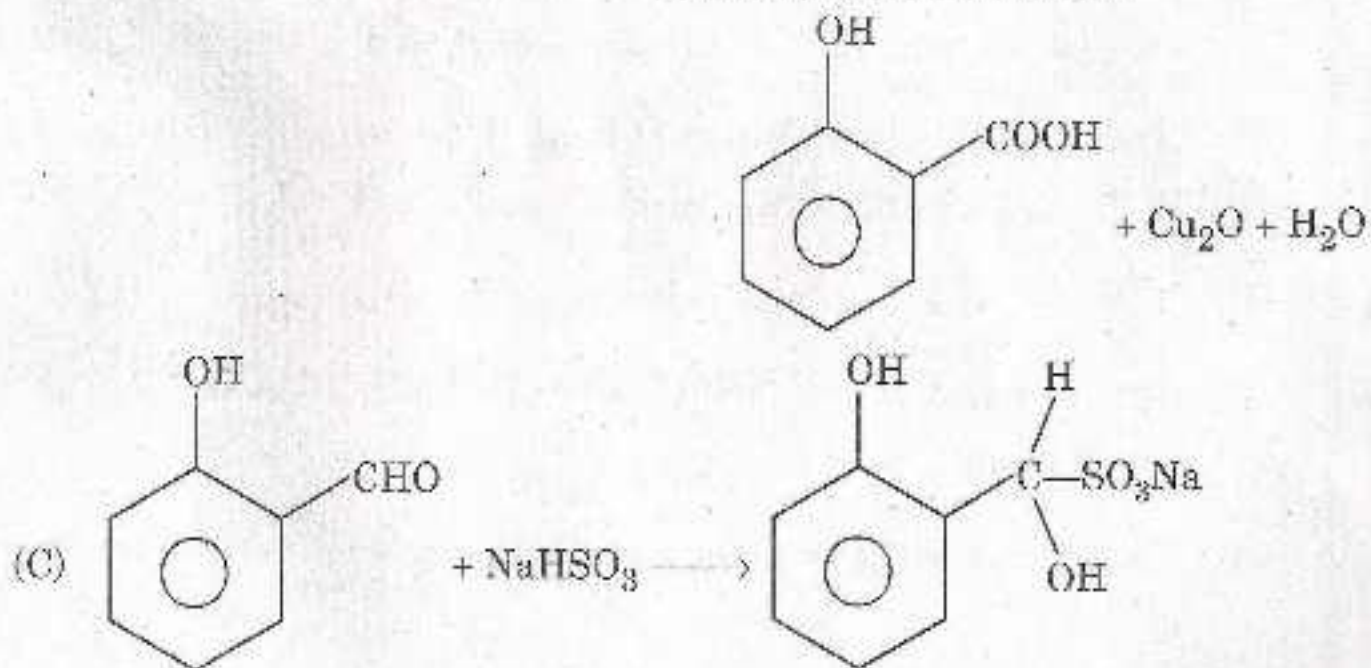
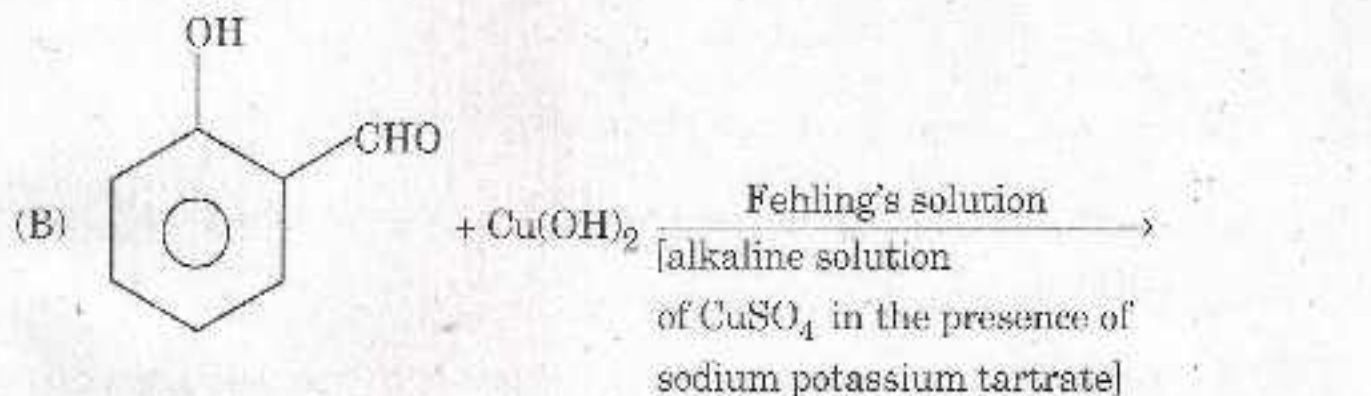
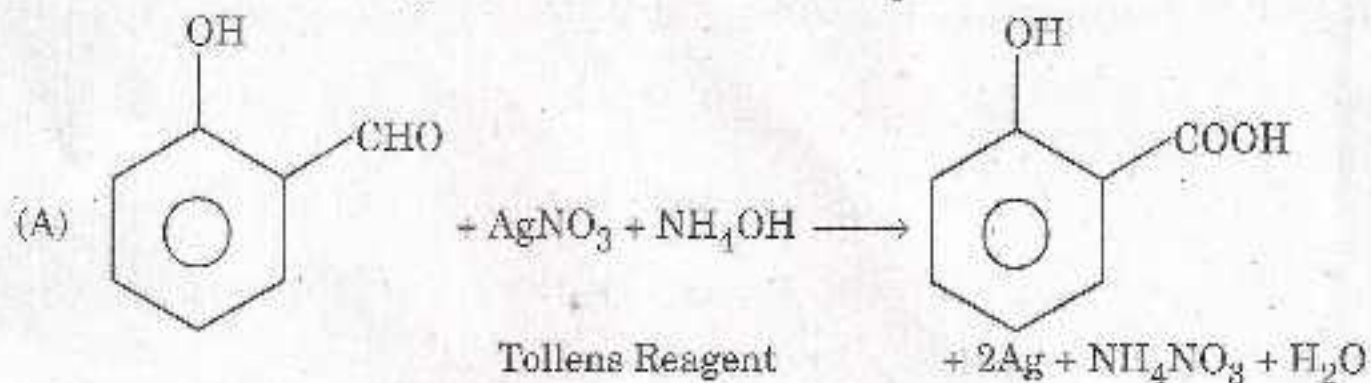
(D) Water at 40–50°C

78. Which of the following products are successively obtained when nitrobenzene is reduced electrolytically in strongly acidic medium ?

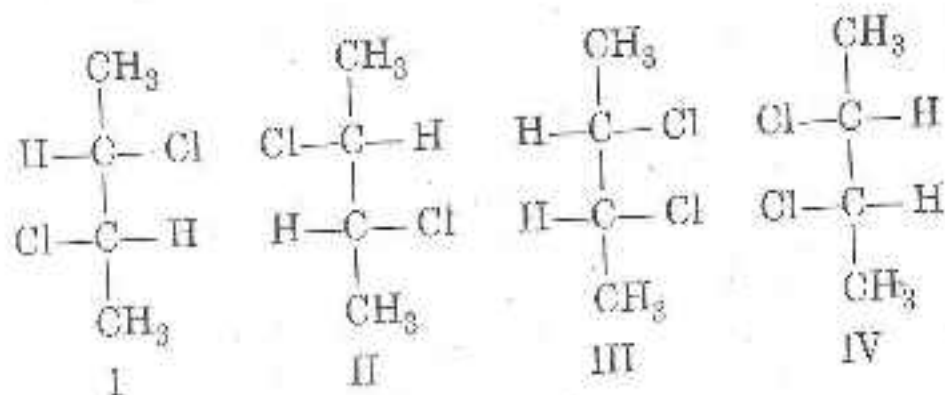




79. Which of the following reactions does *not* take place ?



80. 2, 3-dichlorobutane has two chiral centres :



Which of the following statements is *not* correct ?

- (A) Structure I and II are mirror-images that are not superimposable. These are enantiomers.
- (B) Molecule with structure III is not chiral even though it has two chiral centres. III cannot exist as enantiomers and is optically inactive.
- (C) Structure III is distereomers of I and II. Structure IV, the mirror-image of III, is superimposable, turned end for end.
- (D) Molecule III has *d*- and *l*- forms and not a meso.
81. Which of the following statements about the amended rules relating to Lok Pal Search committee is *correct* ?
- (A) The recommendations of the committee shall be binding on the President of India.
- (B) The committee can shortlist a person from outside the list provided to it by the Department of Personnel and Training.
- (C) There is no time limit on the committee to recommended scrapping names for the Lok Pal.
- (D) The power of the committee to short list candidates is confined only to the list provided to it by the Department of Personnel and Training

82. The union Finance Ministry has introduced some reforms for efficient management of government expenditure. Which of the following is *not* one of them ?

- (A) A project involving an expenditure upto Rs. 100 crore can be approved at the level of administrative ministry.
- (B) Only such schemes shall require approval of the union cabinet that involve expenditure of Rs. 1,000 or more.
- (C) A project involving an expenditure of Rs. 100 crores can be approved by the administrative ministry subject to the final approval of the Finance Ministry.
- (D) The schemes should be evaluated using measurably defined outcomes.

83. According to a review published in the NATURE, a university is supported to be :

- (i) A centre of education and excellence
- (ii) A centre of discovery and research
- (iii) Engine of economic growth
- (iv) Beacons of social justice

Select the *correct* answer from the codes given below :

Codes :

- (A) (i), (ii), (iii) and (iv)
- (B) (i), (ii) and (iii)
- (C) (ii), (iii) and (iv)
- (D) (i), (ii) and (iv)

84. Who is the Chief Minister of Haryana as on 26th October, 2014 ?
- (A) Rao Inderjit Singh (B) Manohar Lal Khattar  
(C) Rao Virendra Singh (D) Captain Abhimanyu
85. Who of the following is the chairman of HP society for the Promotion IT and e-Governance (SITEG) ?
- (A) Chief Secretary  
(B) Secretary, IT, Government of India  
(C) Director General NIC  
(D) Chief Minister
86. Himachal State Cooperative Agriculture and Rural Development Bank Ltd is :
- (A) A cooperative society under the Cooperative Societies Act, 1956  
(B) Registered as a public sector enterprise  
(C) A Joint Stock Company  
(D) Registered as a Private Firm
87. Who was elected unopposed as the President of the Himachal Olympic Association in 2012 ?
- (A) DD Thakur (B) Anurag Thakur  
(C) Sanjeev Khatwal (D) Sushil Bhardwaj
88. The hazard that poses the biggest disaster threat to the state of Himachal is :
- (A) Drought (B) Fresh floods  
(C) Earthquake (D) Dam failures

89. Disaster Management Act was enacted in which of the following years ?
- (A) 2000 (B) 2002  
(C) 2003 (D) 2005
90. Which of the following statements about the Rashtriya Swasthya Bima Yojna is *not correct* ?
- (A) It is scheme under the ministry of labour  
(B) It is being operationalised since the year 2008  
(C) It is a scheme under the Ministry of Health  
(D) It is a scheme that aims to benefit the workers in the unorganized sector
91. The Election Commission of India has submitted a number of proposals for debarring a candidate from contesting elections to the Union Ministry of Law and Justice in 2014. Which one of the following is a part of those proposals ?
- (i) All those against whom charges have been framed in serious crimes involving punishment of 5 years.  
(ii) All those against whom such charges have been framed by the competent magistrate at least 6 months before the scheduled date of elections.  
(iii) Submission of a false Affidavit should become one of the grounds for disqualification for being an MP or an MLA.  
(iv) No one should be debarred from contesting an election on the ground of merely being made a prove insolvent.

Select the *correct* answer from the codes given below :

- (A) (i), (ii), (iii) and (iv) (B) (i), (ii) and (iii)  
(C) (i) and (ii) (D) (iii) and (iv)

92. Which one of the following is *not* a scheduled tribe in HP ?
- (A) Gaddis (B) Pangawals  
(C) Kennets (D) Kinnars
93. Dhoti Kurta, Coat, Waistcoat, Turban and a Hand towel is the traditional dress of which of the following castes in HP ?
- (A) Rajputs  
(B) Scheduled Tribes of Lahaul and Spiti  
(C) Kolis  
(D) Brahmins
94. Which of the following dances is *not* correctly matched with area it is specifically performed in HP ?
- (A) Gee dance and Burah dance — Sirmaur  
(B) Shunto dance — Lahaul and Spiti  
(C) Dangi — Kinnaur  
(D) Cholamba dance — Ropa Valley
95. Which of the following Fairs of HP is *not* correctly matched with the area ?
- (A) Minjar Fair — Chamba  
(B) Renuka Fair — Sirmaur  
(C) Lavi Trade Fair — Rampur  
(D) Naina Devi Fair — Mandi

96. In HP, Jhoori is :
- (A) a type of song (B) a type of dance  
(C) a type musical instrument (D) a string puppet
97. Who of the following was awarded Man Booker International Prize, 2013 ?
- (A) Richard Flanagan (B) Lydia Davis  
(C) Marino Warner (D) Nadeem Aslam
98. The Warsaw Climate conference was held in :
- (A) November, 2011 (B) December, 2012  
(C) October, 2013 (D) November, 2013
99. India was re-elected for 2015-2017 as member of :
- (A) United Nations Human Rights Council  
(B) UN Human Rights Commission  
(C) International Court of Justice  
(D) UNESCO
100. International Convention for the Suppression of Acts of Nuclear Terrorism was adopted in :
- (A) April, 2005 (B) September, 2006  
(C) January, 2008 (D) February, 2009