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

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**TEST BOOKLET**  
**AP (AS&H) CHEMISTRY—2016**

Time Allowed : 2 Hours]

[Maximum Marks : 100

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All questions carry equal marks.

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**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. After the response has been marked in the ANSWER SHEET, no erasing/fluid is allowed.
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. If a candidate give more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct.
10. After you have completed the test, hand over the Answer Sheet only, to the Invigilator.

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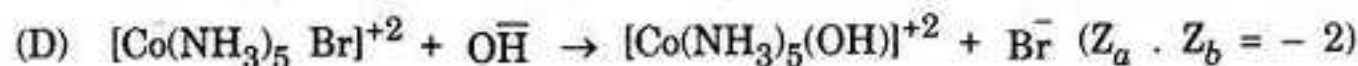
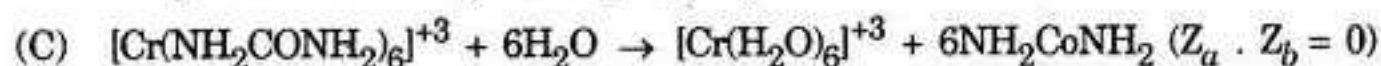
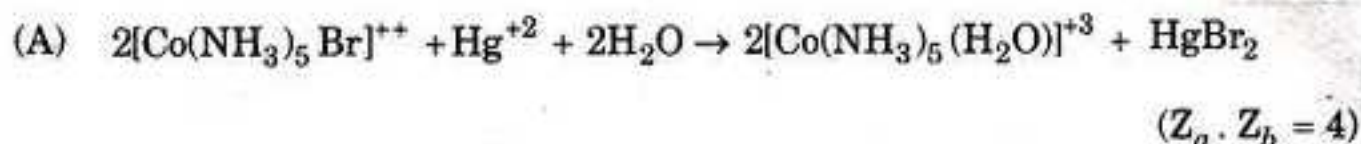


Time Allowed : 2 Hours]

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1. The effect of ionic strengths on reaction velocity of ionic reactions has been studied and found that a plot of  $\log \frac{k}{k_0}$  v/s  $\sqrt{\mu}$  gives a straight line with a slope equals to  $Z_a \cdot Z_b$ .

Which of the following reactions has reaction velocity independent of ionic concentrations (The value of  $Z_a \cdot Z_b$  of each reaction is given in parenthesis)



2. The rate equation in terms of product concentration for zero order reaction is :

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

(B)  $[x] = kt$

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

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

[Rate =  $k[A]^n$ ;  $[A]$  = concentration of reactant at a given time  $t(s)$ .

$[A_0]$  = initial concentration of the reactant

$[x]$  = concentration of the product at a given time  $t(s)$



3. For the reaction  $A \rightarrow C + D$ , the initial concentration of A is 0.010 M. After 100 secs the concentration of A is 0.0010 M. The rate constant has a numerical value 9.0.

The order of the reaction is :

4. Which of the following observations can be explained without the knowledge of hydrogen voltage ?

- (B) The reversible electrode potential of  $H_2$  at pH 7 (neutral solution) is  $-0.41$  V. This value is very close to that of Cd  $0.48$  V. Hence Cd and  $H_2$  are expected to evolve simultaneously but only Cd is deposited at cathode.

- (D) The standard electrode potential of Ni and Cd are  $-0.24$  and  $-0.76$  V respectively.  $\text{Ni}^{+2}$  are discharged first and metallic Ni will be deposited at cathode till all  $\text{Ni}^{+2}$  present in solution is deposited. If cathode potential is made more negative and brought to the level of  $-0.76$  V deposition of Zn takes place.

5. The specific conductivity ( $k$ ) of a decinormal NaCl is  $0.00918 \text{ mhos cm}^{-1}$ . The ionic conductance of Na and Cl ions at the same temperature are 43.2 and 65.3 respectively at infinite dilution. The degree of ionisation of NaCl at this temperature :

(A) 0.846

(B) 0.096

(C) 0.0109

(D) 1.009

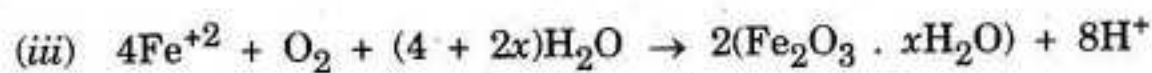
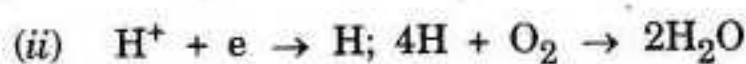
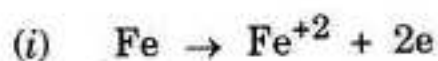
6. Which of the following statements is *not* correct ?

(A) Corrosion is an electrochemical process involving anode where the electron leaves the metal and cathode where reduction occurs, an electrolyte to conduct the ionic current between anode and cathode and a metallic path to conduct the electrons outside the electrolyte.

(B) The reaction is thermodynamically feasible because of higher the enthalpy of certain compounds as compared to the free metal.

(C) Both  $\text{O}_2$  and  $\text{H}_2\text{O}$  must be present. The rust has the formulae  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ .

(D) The acid generated speeds the process of rusting. The process is autocatalytic :

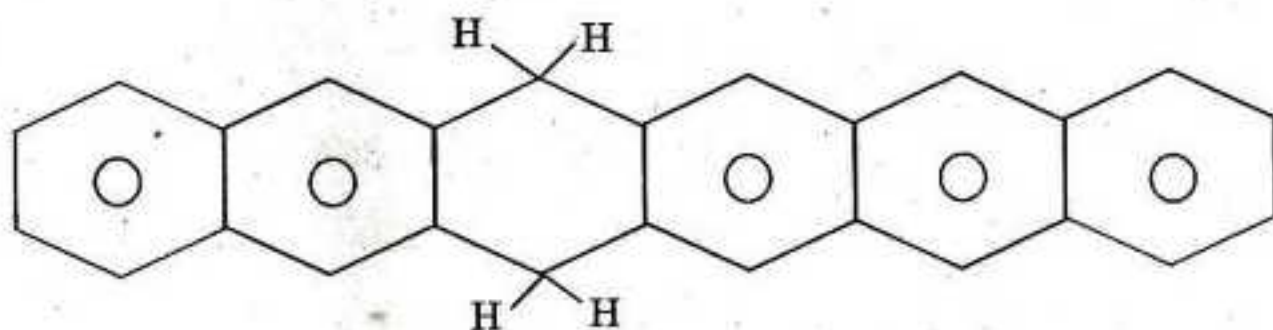


7. Which of the following statements is *not* correct with regard to *nmr* spectral studies ?
- (A) All protons in tetramethyl silane [TMS,  $(\text{CH}_3)_4\text{Si}$ ] are chemically equivalent but magnetically non-equivalent
  - (B) The number of absorption bands gives the number of groups of nuclei in different molecular environments.
  - (C) The relative areas under the absorption peak for the various bands give the relative number of nuclei in each different environment.
  - (D) The finer details in the absorption band give relationship of one group of nuclei to other nearby groups of nuclei.
8. Which of the following statements is *not* correct ?
- (A) The infrared absorption bands are slightly broader since vibrational transitions are also accompanied by rotational transitions
  - (B) The UV absorption bands are broad since the electronic transitions are accompanied by vibrational as well as rotational transitions.
  - (C) Glass and quartz cells are used in infrared absorption spectral studies as these are transparent to infrared radiations.
  - (D)  $\text{H}_2\text{O}$  is a non-linear molecule and shows three absorption bands at about 3756, 3652 and  $1545\text{ cm}^{-1}$  due to asymmetric, symmetric and bending vibrations respectively.



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

- (A) UV absorption spectral studies exhibit vibrational structure with well defined maxima.
- (B) The wavelength ( $\lambda_{\text{max}}$ ) of the absorption maxima increases regularly through the series and vary from UV region for  $\text{C}_6\text{H}_6$ ,  $\text{C}_{10}\text{H}_8$ ,  $\text{C}_{14}\text{H}_{10}$  to the visible region yellow, blue and green for higher members naphthacene, pentacene and hexacene
- (C) A ring in hexacene molecule (linearly conjugated aromatic hydrocarbon molecule, green in colour, 580 nm) is insulated by introducing two  $-\text{CH}_2$  groups as :

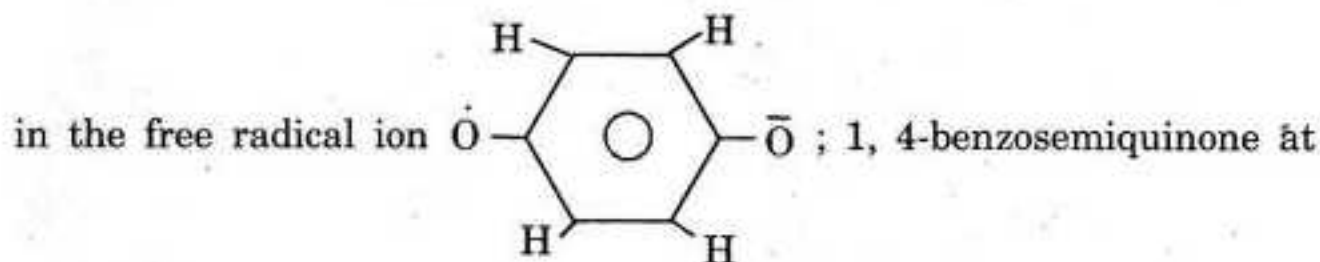


i.e. the linear conjugation is broken and absorption maxima shifts to a shorter wavelength in UV region.

- (D) The absorption spectra of angularly annulated condensed ring hydrocarbons are at longer wavelength than those of linear compounds with the same number of rings for eg. phenanthrene though isomeric with anthracene absorbs in visible region.

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

- (A) In an esr spectrum the total number of signals expected for an electron delocalised over  $n$  equivalent protons is given as  $(2nI + 1)$  lines. Thus,



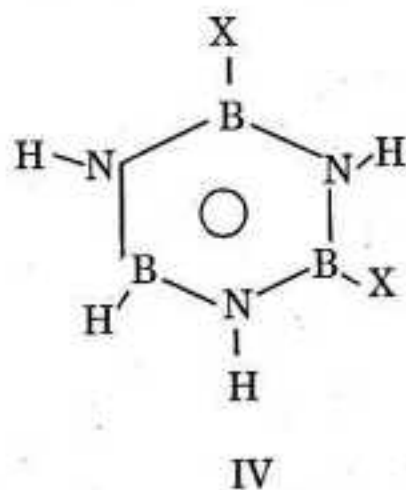
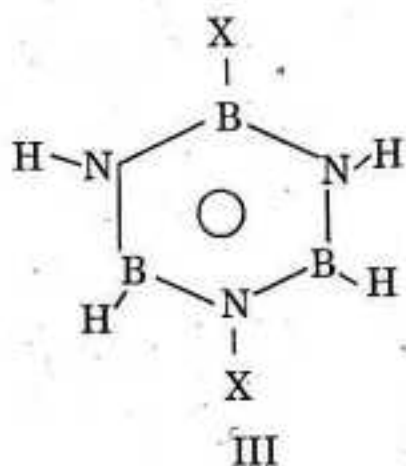
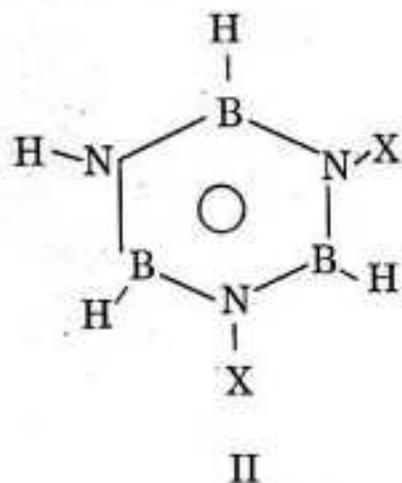
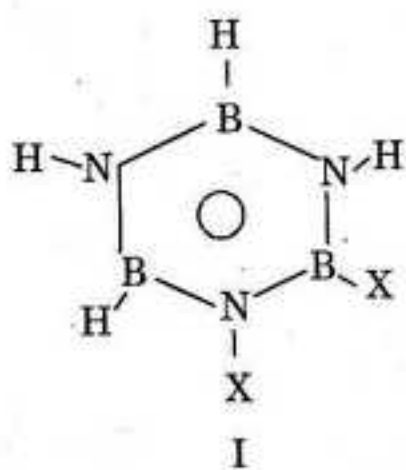
a frequency 9500 MHz and a magnetic field at about 0.34T gives five line spectrum with intensity 1 : 2 : 3 : 2 : 1.

- (B) The esr spectrum for the unpaired electron of the radical ion  $(\text{SO}_3)_2\text{NO}^-$  shows a three line spectrum of equal intensity.

- (C) An electron is delocalised over sets of two non-equivalent nuclei with  $I_i$  and  $I_j$ , the number of lines expected in the spectrum  $(2nI_i + 1)(2mI_j + 1)$  i.e.  $(2 \times 1 \times 1 + 1)(2 \times 1 \times 1 + 1) = 9$  lines for two non-equivalent nuclei.

- (D) Naphthalene contains two different sets of four equivalent protons. In naphthalene negative ion  $4 \times 4$  i.e sixteen lines spectrum is expected.

11. Borazene ( $B_3N_3H_6$ ) is isoelectronic and isostructural with  $C_6H_6$ . There is a delocalised  $\pi$ -bonding just as there is in benzene. The number of electrons is the same as in benzene. Each nitrogen has one more electron than carbon but each boron has one fewer. The disubstituted borazene molecule  $B_3N_3H_4X_2$  can have the following isomers :



Which of the following structures are not the same despite the X atom being one atom apart on each ring ?

(A) II and IV

(B) I and II

(C) III and IV

(D) I and III



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

(A) When steam is passed over red hot iron, the reaction never goes to completion  $[4\text{H}_2\text{O}(\text{g}) + 3\text{Fe}(\text{s}) \rightleftharpoons \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})]$  since the ratio  $\frac{p_{\text{H}_2}}{p_{\text{H}_2\text{O}}}$  is constant at a given temperature (active mass of solids is taken as constant).

(B)  $\text{CaCO}_3$  dissociates as  $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ . The equilibrium constant  $k_p = p_{\text{CO}_2}$  at a given temperature.  $p_{\text{CO}_2}$  is called dissociation pressure. At every temperature the system attains the new equilibrium and corresponds to its new dissociation pressure.

In lime kiln the evolved gas is continuously removed so that pressure of  $\text{CO}_2$  falls below dissociation pressure at that temperature.

(C) The substances for which triple point pressure exceed one atmosphere the condition for sublimation is automatically maintained, hence they directly pass into vapour state on heating.

(D) In sulphur system both rhombic and monoclinic sulphur can co-exist along with their vapour at  $151^\circ\text{C}$ , hence a triple point.

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

- (A) The triple point pressure is 4.6 mm for water. If the partial pressure of water vapour in the atmosphere falls below this value, water vapour will be condensed to the solid state when the atmosphere gets sufficiently cooled (frost).
- (B) If a solid is heated and vapour pressure above it is not allowed to exceed the triple point pressure the solid will be converted into liquid.
- (C) The lowest possible freezing point of a solution at which solution freezes 'enmasse' is called eutectic temperature and the solid phase which separates out during freezing at the eutectic point is called eutectic mixture.
- (D) A dilute solution is cooled, ice separates with progressive lowering of freezing point until it freezes as a whole. A solution stronger than eutectic composition is cooled the salts separate out on cooling until the eutectic composition is reached when it freezes as a whole.

If a solution of eutectic composition is cooled, the solution freezes unchanged in composition at the eutectic temperature.

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

- (A) Lyophobic colloids are reversible and have marked affinity for dispersion medium while reverse is true for lyophilic colloids.
- (B) Lyophobic sols are easily coagulated with a small concentration of electrolyte but lyophilic sols require relatively large concentration of electrolyte.
- (C) Lyophilic colloids are positively charged in strongly acid solution and negatively charged in alkaline solution. There is a concentration of  $H^+$  ion at which it moves neither to the cathode nor to the anode. This concentration of hydrogen ion is called isoelectric point of the colloid.
- (D) Colloidal properties of soap (for eg. sodium palmitate) are due to aggregate of palmitate ions associated with some undissociated molecules, called micelles.



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

- (A) Lyophobic sol is stable due to electrical charge present on the colloidal particle whereas stability of the lyophilic colloids depends upon both the electrical charge and solvation.
- (B) In a lyophobic sol the charge on all the colloidal particle is of the same sign the repulsive forces prevent the particles from approaching sufficiently close to one another and to coalesce and coagulate.
- (C) The zeta potential is the difference in potential between the surface of the tightly bound layer and the electroneutral region of the solution. If zeta potential is small, the resultant potential energy is negative so that van der Waal attraction predominates over the electrostatic repulsion and the sol coagulates rapidly.
- (D) In a lyophobic sol solvation also plays an important role. The colloidal particles are enclosed in a solvent cage, the cage serves as a barrier preventing the particles from coalescing to form aggregates.



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

- (A) Surfactants are the substances which when added to water reduces its surface tension.
- (B) The effect of surface tension is to increase the area of the surface to maximum.
- (C) The vapour pressure is a measure of the escaping tendency of molecules from the surface of the liquid.
- (D) The molar heat of vapourisation of a liquid divided by its boiling point is nearly  $88.0 \text{ J mol}^{-1} \text{ K}^{-1}$ . The quantity  $\frac{\Delta H_{\text{vap}}}{T_b}$  is also called entropy of vapourisation.

17. Which of the following expressions is a thermodynamic equation of state ?

(A)  $\Delta A = \Delta U + T \left( \frac{\delta(\Delta A)}{\delta T} \right)_V$

(B)  $n_1 d\mu_1 + n_2 d\mu_2 + \dots + n_i d\mu_i = 0$

(C)  $V = T \left( \frac{\partial V}{\partial T} \right)_P + \left( \frac{\partial H}{\partial P} \right)_T$

(D)  $\Delta G = \Delta H + T \left[ \frac{\delta(\Delta G)}{\delta T} \right]_P$

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

- (A) Thermodynamics can indicate whether a particular process is feasible or not under a given set of circumstances for eg. temperature, concentration of reactant and product.
- (B) The methods of thermodynamics are dependent on atomic and molecular structure.
- (C) Thermodynamics does not take into account the rate of approach to the equilibrium.
- (D) Thermodynamics deals quantitatively with equilibrium conditions *i.e.* condition which do not change with time.

19. Which of the following statements is *not* correct or a mathematical expression has not been applied correctly to a situation ?

- (A) In an exothermic reaction the bonds in the products are stronger than reactants. The stronger is the bond formation, the greater is the energy release.
- (B) Since  $q_p = q_v + \Delta nRT$  where  $q_p$  and  $q_v$  are enthalpy of reactions at constant pressure and at constant volume respectively and  $\Delta n$  is difference in number of moles of products and reactants. Thus for Haber's process in the synthesis of  $\text{NH}_3$   $\Delta n = 2 - (3 + 1) = -2$ , and the relation becomes  $q_p = q_v - 2RT$ .
- (C) In an endothermic reaction, energy is used up in breaking the bonds in reactants, heat does not come out and has no chance to appear as heat and raise the temperature.
- (D) A student performed an experiment on Bomb calorimeter for determining enthalpy of combustion. He uses the relation  $\Delta H = \Delta V + PdV$  and found  $\Delta H = \Delta V$  at constant volume.

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

- (A) First law of thermodynamics puts firmly the relation between heat absorbed and work performed by the system. It puts no restriction for the direction about the flow of heat.
- (B) The energy of an isolated system remains constant during a specified change of state. It does not tell whether a specified change or a process is spontaneous or whether it is feasible.
- (C) The energy of one form can be converted into an equivalent amount of energy of another form. It does not tell that heat energy cannot be completely converted into an equivalent amount of work.
- (D) Thermodynamics in the form of second law tells us that how fast a reaction will actually occur.

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

- (A) The quantum theory assumes quantisation as postulate at the start.
- (B) Each wave function  $\psi_n$  itself has no readily interpretable physical meaning, the square of the wave function  $\psi_n^2$  gives the intensity of the electron wave or the probability of finding the electron at that point in space about the nucleus.
- (C) The quantum theory due to Schrödinger does not predict the position of the particle since it defines precisely the energy of the electron. There becomes large uncertainty in electron position in reference to Heisenberg's uncertainty principle.
- (D) Three quantum numbers are necessary for solving Schrödinger equation for an electron in three-dimensional world.



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

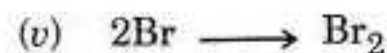
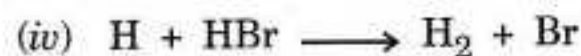
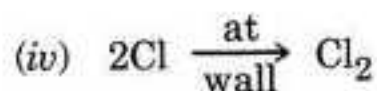
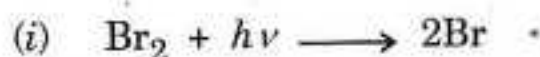
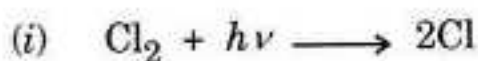
- (A) The value of  $n$  gives the most probable distance of the electron from the nucleus. ' $n$ ' is a measure of orbital radial size. The probability approaches zero but never zero even at a large distance.
- (B) The angular momentum quantum number gives the shape of electron orbitals. The number of values of  $l$  for a given value of  $n$  tells us about the different orbital types.
- (C) The number of values of  $n$  limits the values of  $l$  which in turn limits the values of  $m$ .
- (D) A fourth quantum number becomes necessary to determine electron energies in a multielectron atoms. The quantisation of electron spin means that there are more than two possible orientations of an electron in a magnetic field.

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

- (A) Chemisorption has a very slow rate at low temperature i.e. it has a fairly large energy of activation but physical adsorption predominates at low temperature for the same adsorbent-adsorbate system.
- (B) Physical adsorption involves a high degree of specificity whereas chemical adsorption is non-specific.
- (C) The forces responsible for chemisorption are much stronger and so chemical adsorption is irreversible or reversible with great difficulty.
- (D) Physical adsorption involves weak van der Waal forces and has a heat of adsorption of the order of 10,000 cals whereas chemical adsorption involves chemical forces and has heat of adsorption 20,000 to 60,000 cals.

24. The kinetics of the photochemical reactions of hydrogen-chlorine, and hydrogen-bromine reaction have been studied and found that the quantum yield for (A) hydrogen-chlorine reaction is very high and that of (B) hydrogen-bromine reaction is too low. Mechanism for both reactions are given below :

**(A) hydrogen-chlorine reaction      (B) hydrogen-bromine reaction**



The important and chief reason for the difference in quantum yield is :

- (A) Both (A) and (B) are chain reactions
- (B) Reaction (ii) in (A) is exothermic and takes place spontaneously while reaction (ii) in (B) is endothermic and takes place slowly
- (C) There is no inhibition step in (A) while there is an inhibition step (iv) in (B)
- (D) The quantum yield in both (A) and (B) depends upon the number of times reaction steps (ii) and (iii) in each case are repeated before the final termination step



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

The reason for the low quantum yield in a photochemical reactions are :

- (A) The excited molecule may simply emit the radiation of frequency which it absorbed.
- (B) The excited molecule is deactivated through phosphorescence and fluorescence.
- (C) The excited molecule is deactivated by converting its energy into the kinetic energy of the other molecule.
- (D) The secondary process may involve a step which produces the reactant molecule as one of the products.

26. Which of the following statements is *correct* for canonical ensemble :

A system of specified volume, composition and temperature and think of it as being reproduced  $\boxed{N}$  times. (This  $\boxed{N}$  is different from  $N$  where it means the number of particles in the actual system). An ensemble is a collection of imaginary replication of the system.

- (A) Consider an ensemble consisting of identical closed systems in thermal contact with each other. This thermal contact ensures that they are all at the same temperature but allows them to exchange energy with each other. The total energy of the ensemble is constant [ $N$ ,  $V$  and  $T$  are common].
- (B) In the ensemble the condition of constant temperature is replaced by the requirement that all the systems should have exactly the same energy, each system is individually isolated [ $N$ ,  $V$  and  $E$  are common].
- (C) In the ensemble the volume and temperature of each system is the same, but they are open. Thus matter can be imagined as able to pass between the systems, the composition of each one may fluctuate but the chemical potential ( $\mu$ ) is the same in each system [ $\mu$ ,  $V$  and  $T$  are common].
- (D) An ensemble is stationary if  $\frac{\partial p}{\partial t} = 0$  and  $p$  does not depend explicitly on time. This equation is called Liouville theorem.



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

- (A) NaCl crystal consists of two interpenetrating cubic lattices, one of  $\text{Na}^+$  ions and the other of  $\text{Cl}^-$  ions.  $\text{Na}^+$  ion has fewer electrons than  $\text{Cl}^-$  ion. The scattering power of  $\text{Na}^+$  is less than  $\text{Cl}^-$  ion.
- (B) Some reflections from  $\text{Na}^+$  ion lattice are out of phase with some  $\text{Cl}^-$  ion reflections. For other orientations the two sets of reflections are in phase and intense lines appear.
- (C) Cancellation is complete only when the ions have identical scattering power as in case of KCl where  $\text{K}^+$  and  $\text{Cl}^-$  are almost identical and have the same scattering power. This is not so in case of NaCl where cancellation is incomplete and some intense lines and some faint lines appear.
- (D) X-ray diffraction pattern for KCl appears to be that of simple cubic lattice whereas diffraction pattern for NaCl is that of face centred cubic lattice. Therefore both KCl and NaCl do not have same crystal structure.

28. Nitric oxide has the electronic configuration  $kk\sigma(2s)^2\sigma^*(2s)^2\sigma(2p_z)^2\pi(2p_x)^2\pi(2p_y)^2\pi^*(2p_z)^1$ . Which of the following statements is *not* correct ?

- (A) Bond order is  $\frac{1}{2}(8 - 3)$  i.e. 2.5
- (B) Bond dissociation energy of nitric oxide 667.8 kJ/mol, is less than nitrogen which is 945.6 kJ/mol
- (C) Bond length in NO is shorter than in nitrogen
- (D) Bonding M.O. would have greater characteristics of atomic orbital of oxygen and the antibonding M.O. will have greater characteristics of atomic orbitals of nitrogen

29. The valence bond wave function for the HF molecule assuming that it is formed from  $1s$  orbital of H i.e. A (electron 1) and  $2p_z$  orbital of F i.e. B (electron 2). Which of the following statements or mathematical expressions is *not* correct ?

- (A) For purely covalent structure of HF,  $\psi_{\text{covalent}} = \phi_A(1) \phi_B(2) + \phi_A(2) \phi_B(1)$
- (B) For purely ionic structure  $\text{H}^+\text{F}^-$ ,  $\psi_{\text{ionic}} = \phi_B(1) \phi_A(2)$
- (C) HF is a resonance hybrid shown as  $\text{H} - \text{F} \longleftrightarrow \text{H}^+\text{F}^-$
- (D) HF is 80% covalent and 20% ionic

$$\psi = c_1 \psi_{\text{covalent}} + c_2 \psi_{\text{ionic}} \text{ with } c_1^2 + c_2^2 = 1; c_1^2 = 80 \text{ i.e. } c_1 = 0.89 \text{ and } c_2^2 = 20 \text{ i.e. } c_2 = 0.45$$

$$\psi = 0.89 [\phi_A(1) \phi_B(2) + \phi_A(2) \phi_B(1)] + 0.45 [\phi_B(1) \phi_B(2)]$$

30. Which of the following represents the correct electronic configuration of CO molecule ?

- (A)  $kk \sigma(2s)^2 \sigma^*(2s)^2 \pi(2p_x)^2 \pi(2p_y)^2 \pi^*(2p_x)^1 \pi^*(2p_y)^1$
- (B)  $kk \sigma(2s)^2 \sigma^*(2s)^2 \sigma(2p_x)^2 \pi(2p_y)^1 \pi(2p_z)^1 \sigma^*(2p_x)^2$
- (C)  $kk \sigma(2s)^2 \sigma^*(2s)^2 \sigma(2p_z)^2 \pi(2p_x)^2 \pi(2p_y)^2 \pi^*(2p_x)^1$
- (D)  $kk \sigma(2s)^2 \sigma^*(2s)^2 \pi(2p_x)^2 \pi(2p_y)^2 \sigma(2p_z)^2$

31. Which of the following statements is *not* correct ?
- (A) Electronic configuration of  $\text{He}_2$  is  $\sigma(1s)^2 \sigma^*(1s)^2$  and bond order is zero
- (B) Electronic configuration of  $\text{He}_2^+$  is  $\sigma(1s)^2 \sigma^*(1s)^1$  and bond order is  $\frac{1}{2}(2 - 1)$
- (C) Bond order of  $\text{He}_2$  is zero and that of  $\text{He}_2^+$  is 0.5
- (D)  $\text{He}_2$  exists but  $\text{He}_2^+$  does not exist
32. In a hypothetical nuclear reaction  ${}_{92}^{238}\text{U} + 17 {}_0^1n \rightarrow \text{X} + 8 {}_{-1}^0e$ , the element X is :
- (A) Nobelium (B) Fermium
- (C) Einstenium (D) Mendelevium
33. Which of the following is an example of linkage isomerism ?
- (A)  $[\text{Co}(\text{en})_2 (\text{NCS})_2]\text{Cl}$  and  $[\text{Co}(\text{en})_2 (\text{NCS})\text{Cl}] \text{NCS}$
- (B)  $[(\text{NH}_3)_5 \text{Ir} - \text{NO}_2]\text{Cl}_2$  and  $[(\text{NH}_3)_5 \text{Ir} - \text{ONO}]\text{Cl}_2$
- (C)  $[\text{Pt}(\text{NH}_3)_4] [\text{PtCl}_6]$  and  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2] [\text{PtCl}_4]$
- (D) Cis-diglycinato platinum (II) and trans-diglycinato platinum (II)



34. Which of the following is a natural order of stability of divalent complexes of transition metal ions with nitrogen ligands ?
- (A)  $\text{Mn} < \text{Fe} < \text{Co} < \text{Ni} < \text{Cu} > \text{Zn}$
- (B)  $\text{Mn} < \text{Fe} < \text{Ni} < \text{Co} > \text{Cu} > \text{Zn}$
- (C)  $\text{Mn} < \text{Ni} < \text{Co} < \text{Fe} > \text{Cu} < \text{Zn}$
- (D)  $\text{Mn} < \text{Cu} < \text{Zn} < \text{Ni} < \text{Co} < \text{Fe}$

35. Which of the following rules is *not* correct for atomic term symbol :

The term atomic term symbol is designated as  $2(\sum m_s) + 1 L_J$  where the superscript represents the multiplicity of the term i.e.  $\sum m_s$  and subscript the value of J. S is the sum of the spin quantum number ( $m_s = \pm \frac{1}{2}$ ) for each unpaired electron. L is indicated by letters S, P, D, F for L values 0, 1, 2, 3 :

- (A) Maximise the spin multiplicity (S) i.e. electrons occupy degenerate orbitals so as to retain parallel spins as long as possible
- (B) Maximise orbital angular momentum (L) i.e. fill the orbitals with the highest positive  $m$  values first
- (C) Select the minimum J value for the ground state of the subshell is more than half filled and the maximum value if the subshell is less than half filled
- (D) The complete subshell do not contribute to L or S because sum of the  $m_s$  and  $m_l$  values for a filled s, three filled p or five filled d-orbitals is zero

36. Which of the following statements is *not* correct ?
- (A) Term symbols are used to indicate both the electronic configuration and the resultant angular momentum of an atomic state
  - (B) The term symbol for carbon in the ground state is  $3P_0$
  - (C) The term symbol for  $V^{3+}$  in the ground state  $3F_2$  ( $L = 3$ ,  $S = 1$ ,  $J = 4, 3, 2$ )
  - (D) With nitrogen the term  $4S_{5/2}$  results in the ground state
37. Crystal field theory could not explain satisfactorily :
- (A) Stereochemistry
  - (B) Favourable coordination number
  - (C) The possibility of double bonding between metal and ligand
  - (D) Reaction path for substitution reactions
38. Valence bond theory when applied to metal complexes provides a satisfactory explanation for :
- (A) Limited qualitative aspects
  - (B) Interpretation or prediction of spectra
  - (C) Prediction of detailed magnetic properties
  - (D) Splitting of  $d$ -energy levels

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

- (A)  $\pi$ -acid ligands have the ability to accept electron density into low lying empty  $\pi$ -orbitals, the word acid being used in the Lewis sense.
- (B)  $\pi$ -acid ligands can stabilise low oxidation states.
- (C) These ligands possess vacant  $\pi$ -orbitals in addition to lone pairs. These vacant orbitals can accept electron density from filled metal orbitals to form a type of  $\pi$ -bond that supplements the  $\sigma$ -bonding arising from lone pair donation.
- (D) High electron density on the metal atom do not delocalise on to the ligand.

40. There are unsaturated organic molecules and ions which form stable transition metal,  $\pi$ -complexes, metal ion being in low oxidation state.

Which of the following statements is *not* correct ?

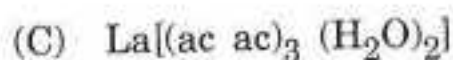
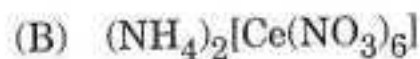
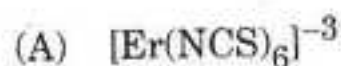
- (A) There is a donation of  $\pi$ -bonding electrons from the highest filled olefine orbitals into metal orbitals of suitable symmetry and there is a donation of electrons from filled metal orbitals of suitable symmetry back into the lowest lying  $\pi$ -antibonding orbitals of the olefine. The two components are synergically related .
- (B) The donation of  $\pi$ -bonding electron to the metal  $\sigma$ -orbital and the introduction of electron into  $\pi$ -antibonding orbital both strengthen the  $\pi$ -bonding in olefine. There is a significant shortening of the olefine C-C bond.
- (C) bis (penta hapto-cyclopentadienyl) iron,  $(\eta^5 - C_5H_5)_2Fe$ , has sandwich structure confirmed by X-ray studies, and other physical and chemical evidence.
- (D)  $[PtCl_3(C_2H_4)]^-$ , anion Zeise salt : the plane of the olefine and C = C axis are itself perpendicular to one of the expected bond direction from the central metal atom. The expected line of a bond orbital from the metal strikes the C = C bond at its mid-point.



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

- (A) The  $\pi$ -acceptor ligands form bonds to the metal using  $\sigma$ -orbital and exercise their  $\pi$ -acidity by using  $\pi$ -orbitals whose nodal planes include the axis of the  $\sigma$ -bond.
- (B) The metal atom in  $\pi$ -acceptor ligand complex lies out of the molecular plane of the ligand.
- (C) The  $\pi$ -acceptor ligands include CO, dinitrogen ( $N_2$ ), NO and isocyanide.
- (D) CO and  $N_2$  are isoelectronic and dinitrogen form metal complexes  $[Ru(NH_3)_5 N_2]Cl_2$ .  $[Ru(NH_3)_5 N_2]^{+2}$  cation can be obtained by the reaction of nitrogen (100 atm.) with  $[Ru(NH_3)_5 H_2O]^{+3}$ . An important aspect is dinitrogen replaces water molecule. The chief difference is that for CO the  $\sigma$ -donor orbital is weakly antibonding whereas corresponding orbital for  $N_2$  is of bonding character.

42. Which of the following complexes of lanthanides has coordination number 12?



[ac ac = acetyl acetone]

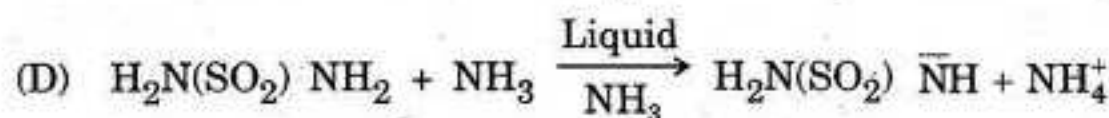
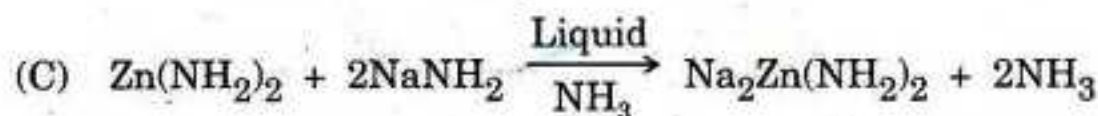
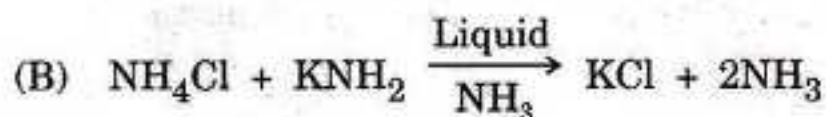
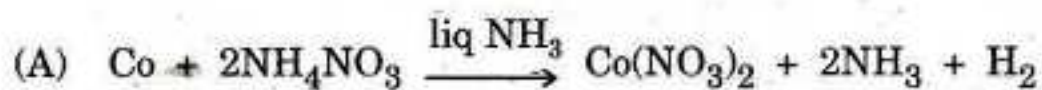
43. Which of the following statements is *not* correct ?

- (A)  $\text{Eu}^{+2}$ ,  $\text{Sm}^{+2}$  and  $\text{Yb}^{+2}$  cannot be prepared by electrolytic reduction in aqueous solution.
- (B)  $\text{Eu}^{+2}$  ( $E^\circ = -0.43 \text{ V}$ ) reduces  $\text{V}^{+3}$  more slowly than does  $\text{Cr}^{+2}$  ( $E^\circ = -0.41 \text{ V}$ ).
- (C)  $\text{Eu}^{+2}$  ( $E^\circ = -0.43 \text{ V}$ ) and  $\text{Cr}^{+2}$  ( $E^\circ = -0.41 \text{ V}$ ) will not reduce  $\text{ClO}_4^-$  but a weaker reductant  $\text{V}^{+2}$  ( $E^\circ = -0.25 \text{ V}$ ) will do so.
- (D)  $\text{Sm}^{+2}$ ,  $\text{Yb}^{+2}$  and  $\text{Eu}^{+2}$  give blue solution in liquid  $\text{NH}_3$ . The blue solution reacts with 2, 2'-bipyridine (L) to form  $\text{ML}_4$  type of compounds.

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

- (A) The magnetic moments in actinides are usually lower than the values calculated by Russell Saunders coupling. This is due to ligand field effects and to inadequacy of the coupling scheme.
- (B) For  $f^7$  configuration ( $\text{Cm}^{+3}$ ) the lowest excited state lies about 4 eV above the ground level so that these ions show only charge transfer absorption band in UV region.
- (C)  $\text{Md}^{+3}$  cannot be reduced to  $\text{Md}^{+2}$  by Zn amalgam. Cf, Es, Fm and Md do not exist as  $\text{M}^{+2}$  ion in solution.
- (D) 5f-orbitals can participate to some extent in covalent bonding, ligand effects are therefore expected.

45. Which of the following is an acid-base neutralisation reaction in liquid  $\text{NH}_3$  ?



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

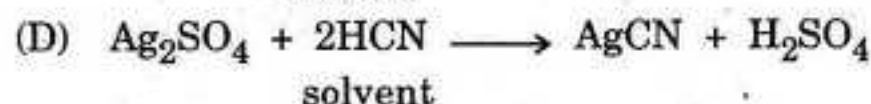
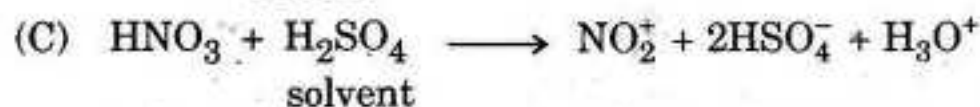
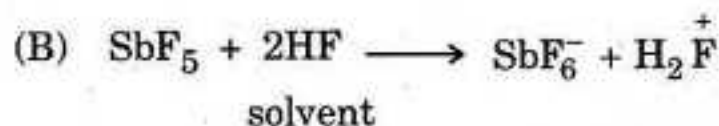
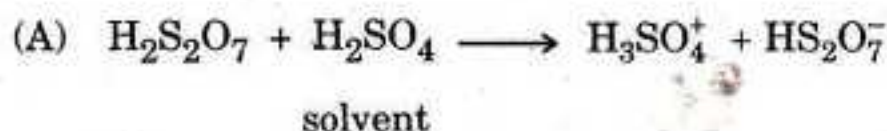
(A) Low temperature or high pressure is necessary to work with liquid  $\text{NH}_3$ .

(B) The alkali metals in liquid  $\text{NH}_3$  are powerful reducing agents.

(C) Ammonium salts dissolved in liquid  $\text{NH}_3$  finds application in preparative chemistry.

(D) The tendency of solvolysis is more in liquid  $\text{NH}_3$  than in water

47. In which of the following reactions the non-aqueous solvent donates a proton so that the substance act as a base in it ?





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

- (A) Diamagnetism is a property of all forms of matter. All substances contain at least some electrons in closed shells. In closed shells the electron spin moments and orbital moments of individual electrons balance one another so that there is no net magnetic moment. Diamagnetic substances are repelled from magnetic field.
- (B) Diamagnetism does not vary with temperature. Paramagnetism is inversely proportional to temperature and independent of field strength.
- (C) The magnetic permeability, ratio of  $\frac{B}{H}$  is given as :

$$\mu = \frac{B}{H} = 1 + 4\pi \left( \frac{I}{H} \right) \text{ i.e. } \frac{B}{H} = 1 + 4\pi k$$

where  $k$  is magnetic susceptibility per unit volume.

- (D) For ferromagnetic substances above Curie's temperature a simple paramagnetic behaviour is seen but below Curie's temperature it is field strength dependent and different behaviour is seen.

For antiferromagnetic substances above Neel's temperature the susceptibility increases with increase in temperature and simple paramagnetic behaviour is not seen but below this temperature simple paramagnetic behaviour is observed. Both ferromagnetism and antiferromagnetism are independent of field strength.

49. Which of the following alloys of copper has highest percentage of copper ?
- (A) Gun metal (B) Brass  
(C) Bronze (D) Bell metal
50. The element, atomic number 118, as and when discovered will belong to :
- (A) s-block (B) p-block  
(C) d-block (D) f-block
51. The structures of diborane ( $B_2H_6$ ) and ethane ( $C_2H_6$ ) are not alike. Which of the following statements is *not* correct ?
- (A) Diborane is diamagnetic and colourless liquid  
(B) There is a free rotation about B-B bond  
(C) Tetramethyl diborane on hydrolysis gives  $(CH_3)_2B-OH$  only. Two  $CH_3$  groups are attached per boron atom in diborane and that four hydrogen atoms are alike and other two are different  
(D) Diborane has two kinds of B-H bond.  $C_2H_6$  has 14 electrons and  $B_2H_6$  has 12. electrons

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

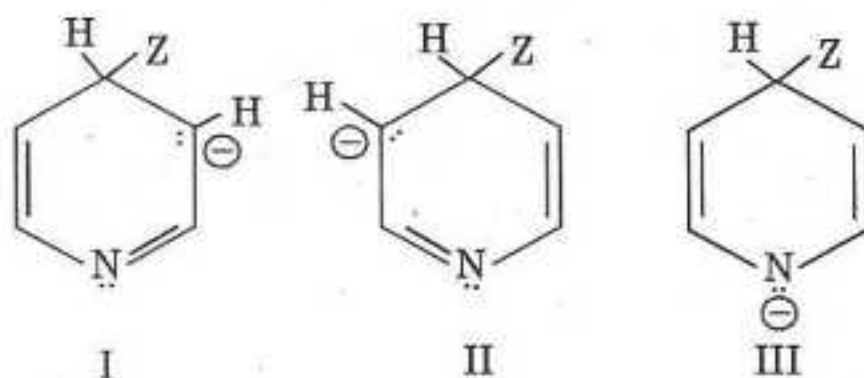
- (A) Molecules such as CO and  $\text{CN}^-$  provide the large crystal field and are able to form  $\pi$ -bonds with the central metal ion. The  $\pi$ -bonding can markedly increase the magnitude of crystal field splitting.
- (B) The crystal field splitting is strongly influenced by the oxidation state of a central metal ion and the type of  $d$ -electrons.
- (C) The higher oxidation state of the metal ion, larger will be the crystal field splitting.
- (D) Crystal field splitting in  $[\text{Rh}(\text{NH}_3)_6]^{+3}$ ,  $[\text{Ir}(\text{NH}_3)_6]^{+3}$  is much less than in  $[\text{Co}(\text{NH}_3)_6]^{+3}$ . Crystal field splitting is least for complexes containing  $5d$  electrons and greatest for those containing  $3d$  electrons.

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

- (A) The differences between lanthanides ( $4f$  series) and actinides ( $5f$  series) arise because of lower binding energies of  $5f$  electrons in actinides than  $4f$  electrons in lanthanides.
- (B)  $4f$  orbitals provide less shielding than  $5f$  orbitals.
- (C) Actinides have a variety of oxidation states ranging from +7 in Np and Pu (atomic numbers 93 and 94), +6 in Pa (At. No. 91) to Pu, +5 in Th (at. no. 90) to Pu, +4 in Ac (at. no. 89) to Cm (at. no. 96). However the dominant oxidation state in actinides is +3 like in lanthanides.
- (D)  $\text{Ac}^{+3}$  and  $\text{Th}^{+4}$  are colourless in aqueous solution and so also  $\text{Cm}^{+3}$  ions. These do not contain  $5f$  electrons except  $\text{Cm}^{+3}$  which has half filled  $5f$  subshell. Rest trivalent and tetravalent ions of U, Np, Pu, Am are coloured.  $\text{Cm}^{+4}$  is pale yellow in colour.



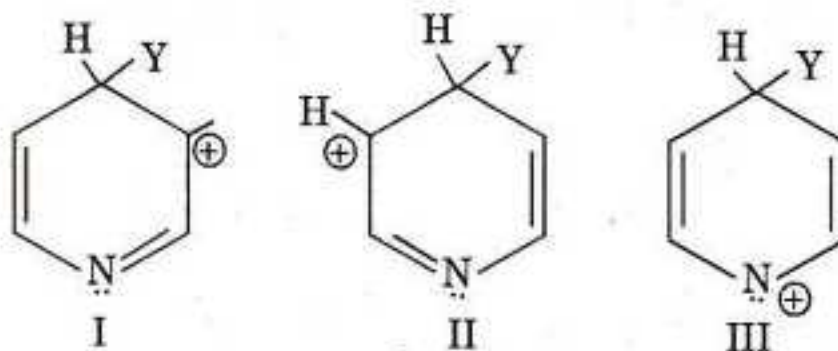
54. Nucleophilic attack at the 4-position yields a carbanion that is a hybrid of structure I, II and III ?



Which of the following statements is *not* correct ?

- (A) Structure III is especially stable since the negative charge is located on nitrogen atom.
- (B) Nucleophilic substitution occurs more rapidly at 2-, and 4-positions than at 3-position.
- (C) Nucleophilic substitution occurs more rapidly on the pyridine ring than on benzene ring.
- (D) The same electronegativity of nitrogen that makes pyridine reactive towards electrophilic substitution makes pyridine less reactive towards nucleophilic substitution.

55. Electrophilic attack at the 4-position yields a carbocation that is a hybrid of structures I, II and III :



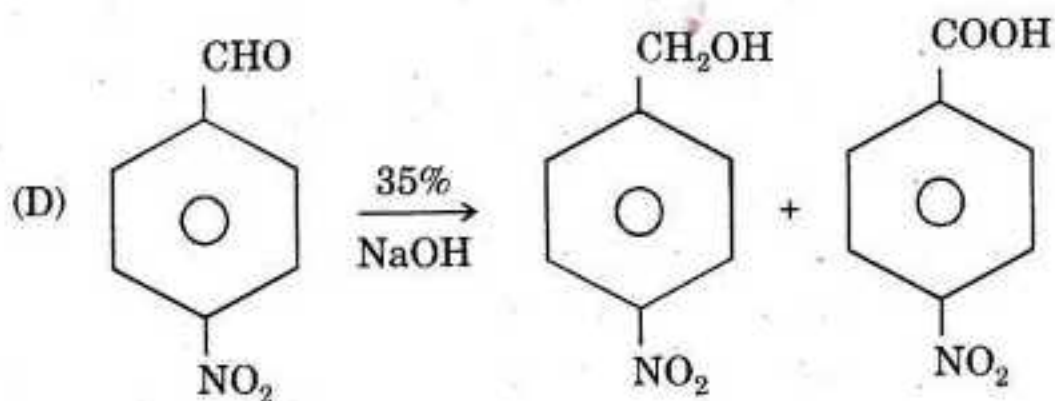
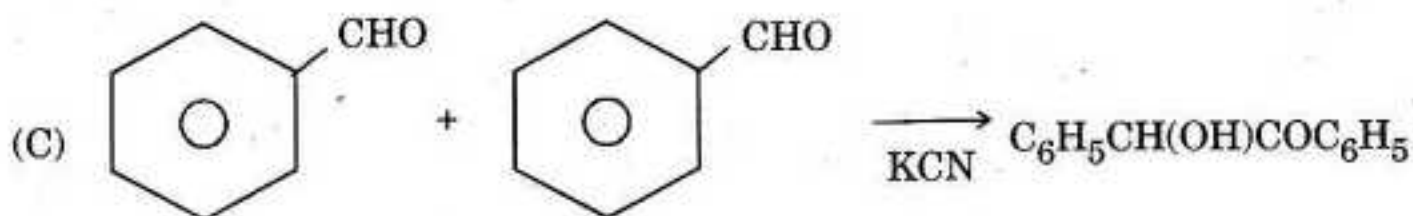
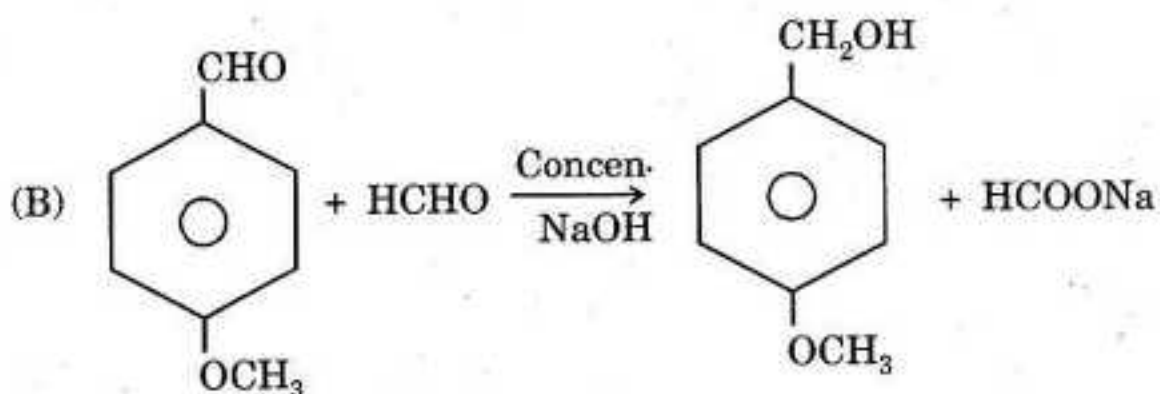
Which of the following statements is *not* correct ?

- (A) All these structures are less stable than the corresponding one for attack on benzene because of electron withdrawal by the nitrogen atom.
- (B) Pyridine undergoes substitution more slowly than  $C_6H_6$ .
- (C) Structure III is especially unstable because nitrogen atom bears a positive charge and has only sextet of electrons.
- (D) Electrophilic substitution occurs predominantly at 2- and 4-position.
56. Compounds containing two or more OH groups or = O groups on adjacent carbon atom undergo oxidative cleavage of carbon-carbon bond by periodic acid.

Which of the following compounds does *not* undergo oxidative cleavage of C-C bond by periodic acid ?

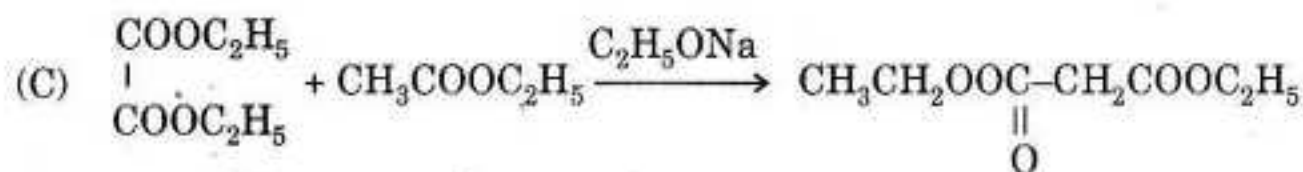
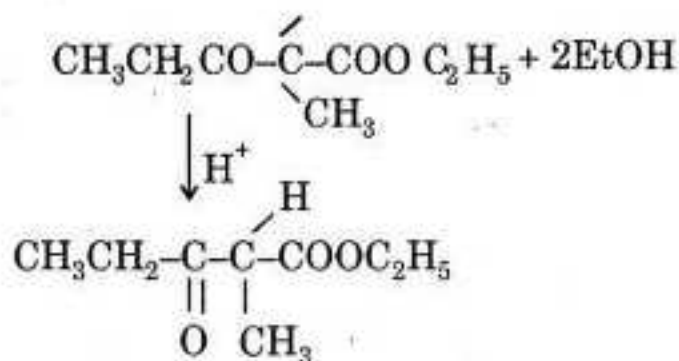
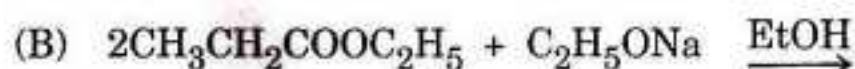
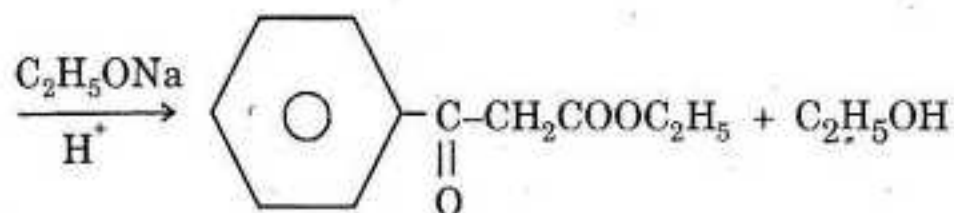
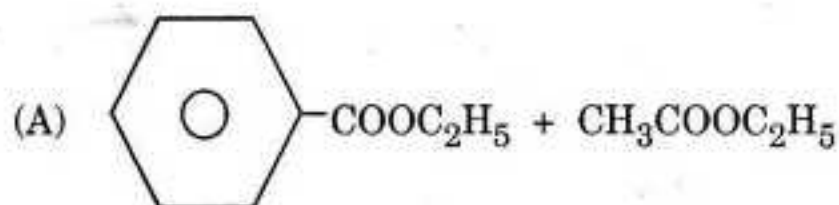
- (A)  $CH_2OH.CH(OCH_3).CH_2OH$       (B)  $RCHOH.COR'$
- (C)  $R-CO.COR'$       (D)  $R_2C(OH).CH(OH)R'$

57. Which of the following reactions is *not* an example of Cannizzaro's reaction or crossed Cannizzaro's reaction ?

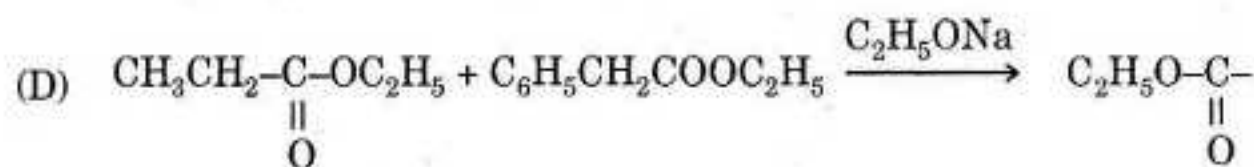




58. Which of the following is an example of Claisen condensation ?



+ C<sub>2</sub>H<sub>5</sub>OH



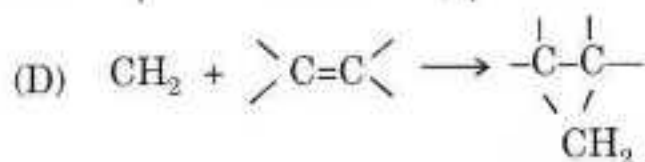
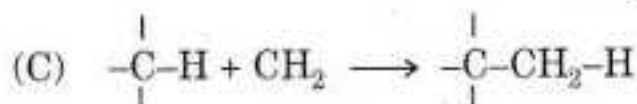
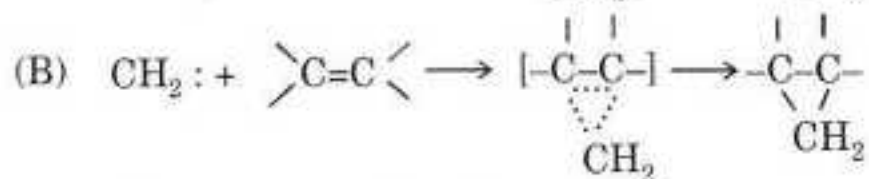
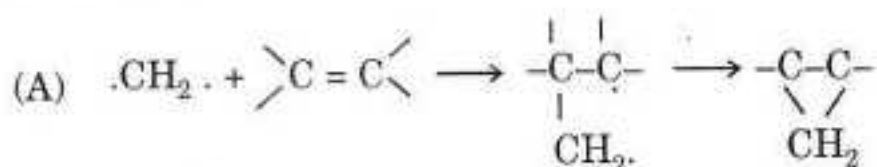
59. Which of the following statements is *not* correct ?
- (A) The B-complex vitamin deficiencies are generally multiple rather than individual with overlapping symptoms.
  - (B) Vitamin B<sub>12</sub>, anti-pernicious anemia vitamin, is cyanocobalamine complex. Methyl cobalamine and 5'-deoxyadenosyl cobalamine are co-enzymes. Food for animal origin is the only source of B<sub>12</sub>.
  - (C) Vitamin E is an oxidant. It helps in the non-enzymatic oxidation of various cell components (unsaturated fatty acids) by molecular oxygen, free radicals, hydrogen peroxide
  - (D) Vitamin A is collectively used many structurally related and biologically active compounds, retinol, retinal, retinoic acid,  $\beta$ -carotene. Its deficiency causes night blindness. Its severe deficiency leads to xerophthalmia (dryness in conjunctiva and cornea and keratinisation of epithelial cell).
60. Which of the following statements is *not* correct with regard to Friedel-Craft alkylation reaction ?
- (A) Aryl halides cannot take the place of alkyl halides.
  - (B) An aromatic ring less reactive than that of halobenzene can only undergo Friedel-Craft reaction.
  - (C) Aromatic rings containing the  $\text{-NH}_2$ ,  $\text{-NHR}$ , or  $\text{NR}_2$  do not undergo Friedel-Craft alkylation reaction.
  - (D) There is a danger of poly-substitution.

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

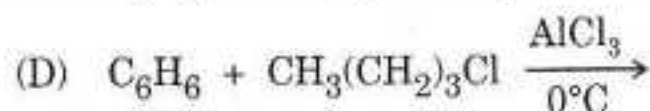
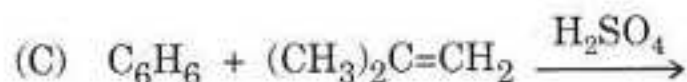
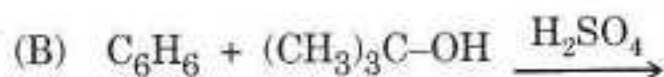
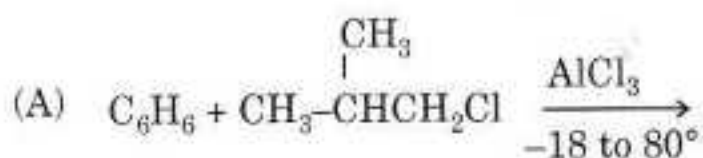
A carbocation may :

- (A) rearrange to a more stable carbocation
- (B) eliminate hydrogen ion to form alkene
- (C) eliminate an alkene to form a larger carbocation
- (D) alkylate an aromatic ring

62. Which of the following is an example of stereospecific electrophilic addition reaction ?

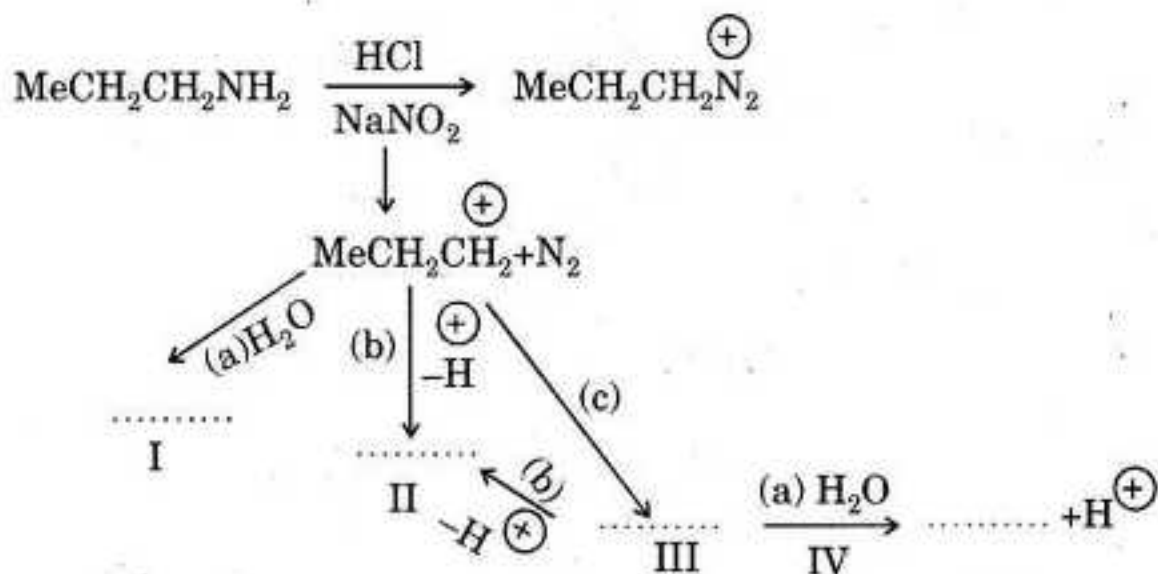


63. Which of the following reactions gives sec-butyl benzene ?





64. Carbonium ion can undergo three main reactions (a) combination with a nucleophile (b) elimination of a proton and (c) rearrangement of structure. This is illustrated in the following reaction :

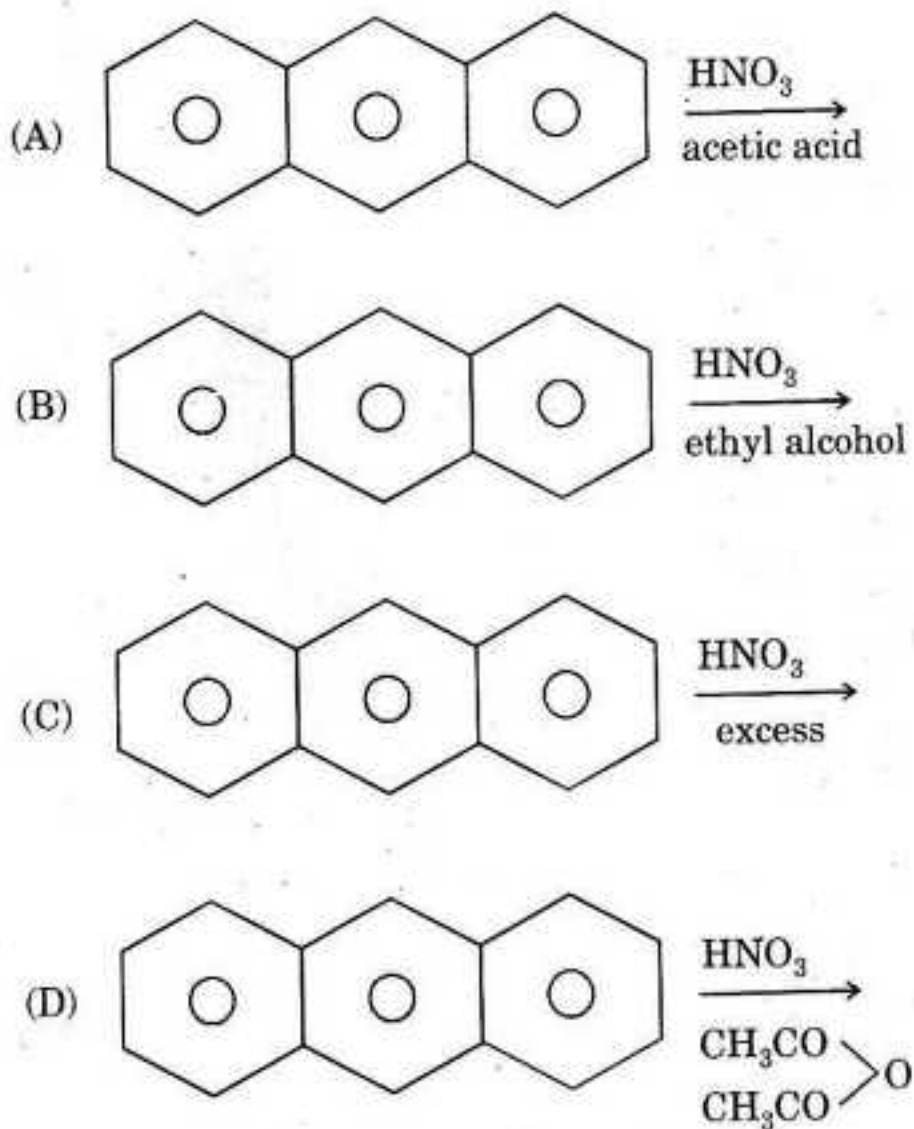


The species obtained are : iso-propyl cation, propylene, n-propanol and isopropanol. Identify the *correct* sequence of the species I to IV :

- (A) n-propanol, propylene, iso-propyl cation, isopropanol  
 (B) iso-propanol, iso-propyl cation, propylene, n-propanol  
 (C) iso-propyl cation, iso-propanol, n-propanol, propylene  
 (D) propylene, n-propanol iso-propanol, iso-propyl cation
65. Which of the following is an example of pyridine alkaloid ?

- (A) Cocaine (B) adrenaline  
 (C) nicotine (D) cinchonine

66. In which example a substituent ( $-\text{NO}_2$ ) occupies 9 position in anthracene to give 9-nitroanthracene ?

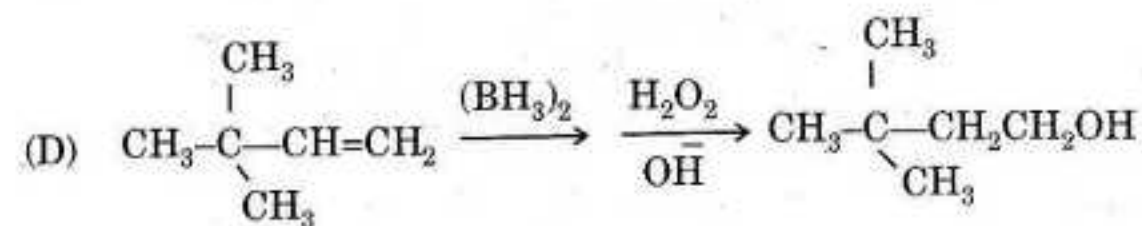
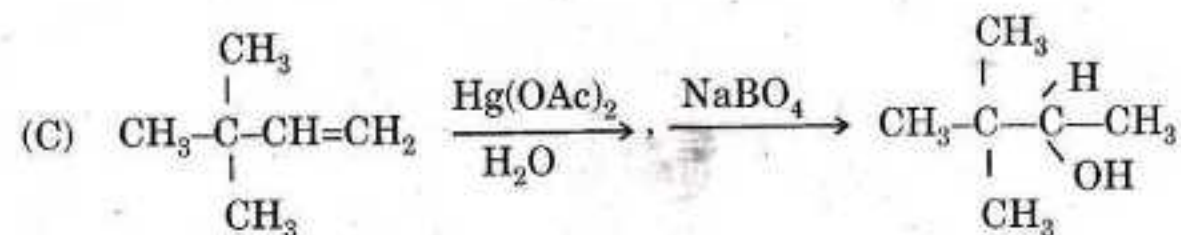
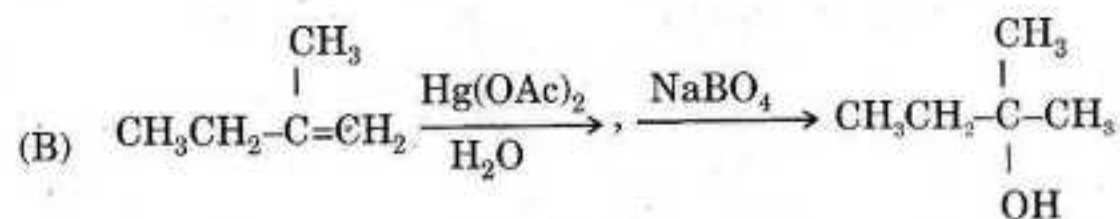
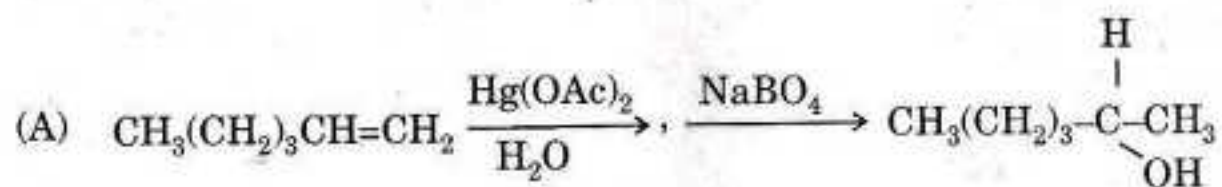


67. Which of the following groups containing compound *cannot* react with Grignard reagent ?



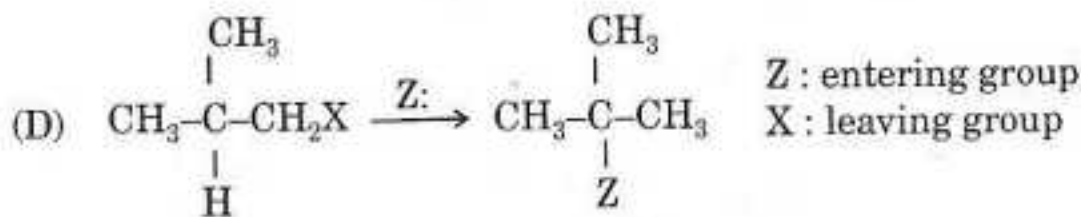
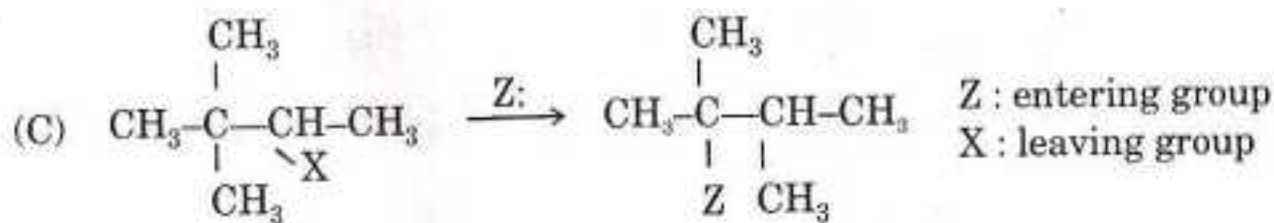
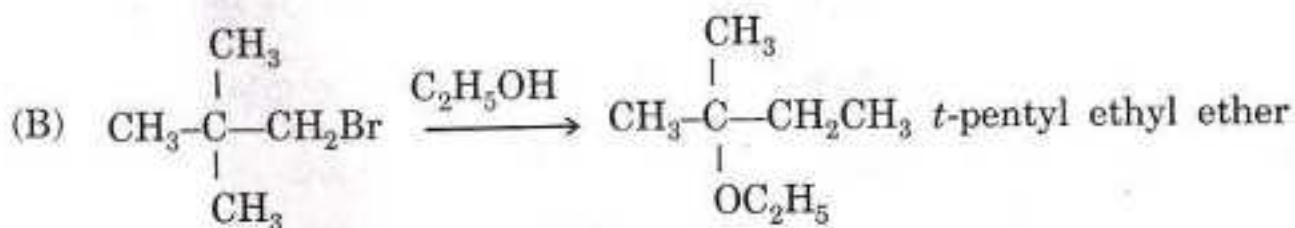
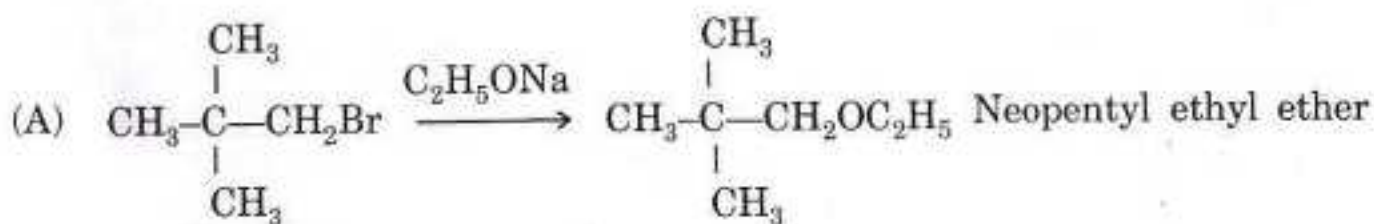
68. The first three reactions are given for the preparation of alcohol from alkenes using oxymercuration-demercuration method and the last one is also used for the preparation of alcohol from alkenes using hydroboration-oxidation method.

Which of the following reactions is *not* correct as per Markownikov rule (addition of  $\text{H}_2\text{O}$  to carbon-carbon double bond) ?





69. In which of the following example rearrangement of carbocation is *not* possible giving  $S_N2$  mechanism for the reaction ?



70. Which of the following disaccharides neither forms osazone nor shows mutarotation ?

(A) Lactose

(B) Sucrose

(C) Maltose

(D) Cellobiose

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

- (A)  $\alpha$  - D - (+) - glucose and  $\beta$  - D - (+) - glucose are diastereomers differ in configuration Cl.
- (B) D - (+) - glucose gives a positive test with Schiff's reagent and forms bisulphite addition product.
- (C) D - (+) - glucose exists in two isomeric forms (I mp  $146^\circ$  and II mp  $150^\circ$ ) which undergo mutarotation, the specific rotation drops from an initial  $+112^\circ$  to  $+52.7^\circ$  and in other case the value rises from  $19^\circ$  to  $52^\circ$ . I is called  $\alpha$  - D - (+) - glucose and II is called  $\beta$  - D (+) - glucose.
- (D) D - (+) - glucose forms two isomeric methyl D-glucosides. D - (+) - glucose on treating with  $\text{CH}_3\text{OH}$  and  $\text{HCl}$  gives a compound methyl - D - glucoside which contains only one  $\text{CH}_3$  group, hemiacetal  $\begin{array}{c} \text{H} \\ \diagup \text{C} \text{---} \text{OCH}_3 \\ \diagdown \\ \text{OH} \end{array}$  but resembles with properties of acetal  $\begin{array}{c} \text{H} \\ \diagup \text{C} \text{---} \text{OCH}_3 \\ \diagdown \\ \text{OCH}_3 \end{array}$

72. Which of the following oxidising agents oxidise glucose to glucaric acid ?

- (A) Bromine water
- (B) Alkaline solution of  $\text{Cu(II)}$  complexed with tartrate ions
- (C)  $\text{HNO}_3$
- (D) Ammonical solution of  $\text{AgNO}_3$

73. How many chiral centres are there in fructose and how many stereoisomeric 2-ketohexoses are there ?

(A) 4 and 16

(B) 3 and 8

(C) 5 and 32

(D) 4 and 8

74. In glyceraldehyde the sequence for R, S-configuration is as :

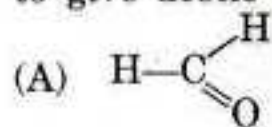
(A) H, CHO, OH, CH<sub>2</sub>OH

(B) CH<sub>2</sub>OH, OH, H, CHO

(C) CHO, CH<sub>2</sub>OH, OH, H

(D) OH, CHO, CH<sub>2</sub>OH, H

75. Which of the following compounds reacts with Grignard's reagent (CH<sub>3</sub>MgI) to give acetic acid under appropriate conditions ?

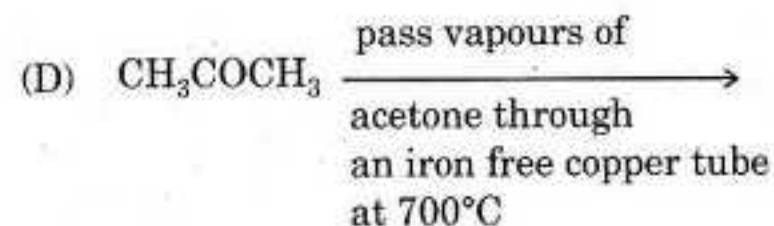
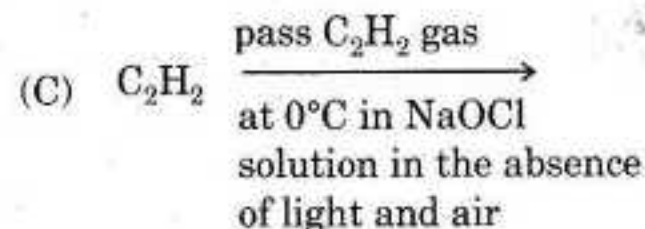
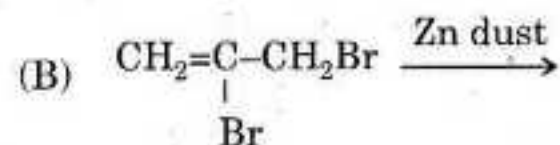
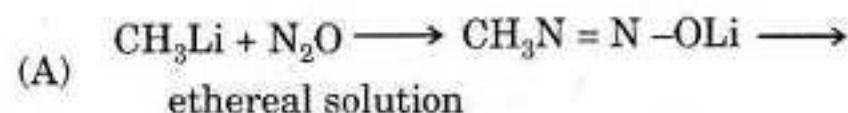


(B) CO<sub>2</sub>

(C) CH<sub>3</sub>C≡N

(D) H<sub>2</sub>O

76. Which of the following reactions gives ketene ?

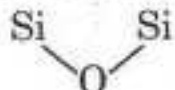




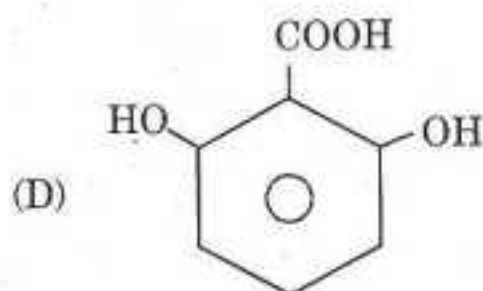
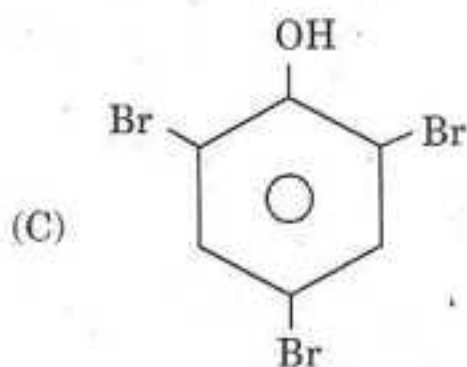
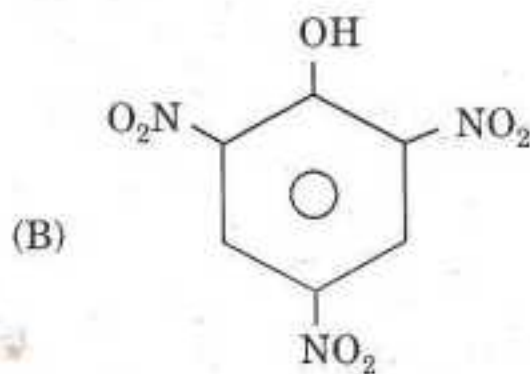
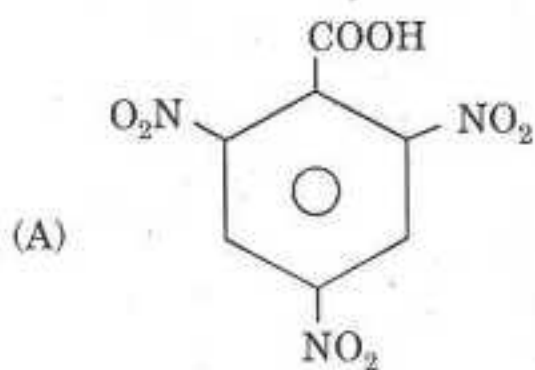
77. Which of the following reactions of benzene diazonium chloride gives benzene ?

- (A)  $\text{C}_6\text{H}_5\text{N}=\text{N}-\text{Cl} + \text{C}_6\text{H}_5\text{NH}_2 \rightarrow$   
(B)  $\text{C}_6\text{H}_5\text{N}=\text{N}-\text{Cl} + \text{H}_3\text{PO}_2 + \text{H}_2\text{O} \rightarrow$   
(C)  $\text{C}_6\text{H}_5\text{N}=\text{N}-\text{Cl} + \text{C}_6\text{H}_5\text{OH} \rightarrow$   
(D)  $\text{C}_6\text{H}_5\text{N}=\text{N}-\text{Cl} \xrightarrow{\text{H}_2\text{O}, \text{H}^+}$

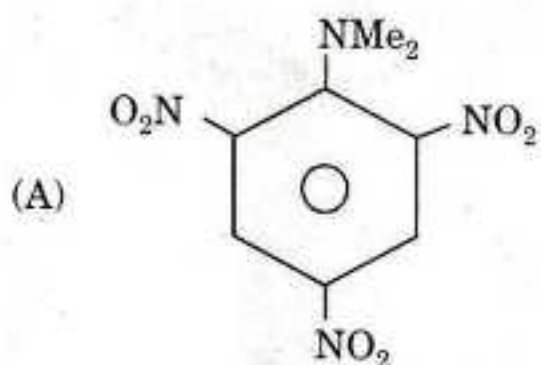
78. Which of the following statements is *not* correct ?

- (A) Silicon oils is a condensation product of dihydroxy silane molecules with  linkage and two methyl groups on each silicon atom  
(B) Nylon 6 is a polymer, a self-condensation product of aminocaproic acid  
(C) Dacron is a polymer, a condensation product of ethylene glycol and terphthalic acid  
(D) Teflon is a polymer of tetrachloroethylene

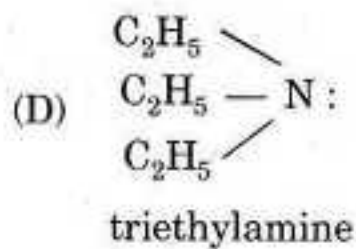
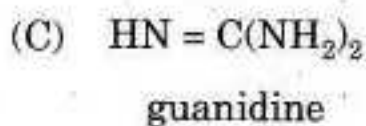
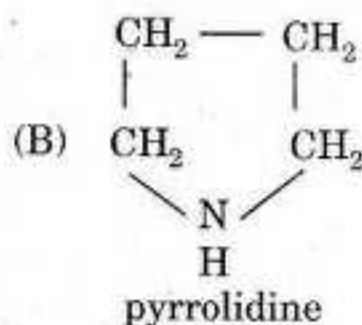
79. Which of the following compounds is strongest in acidic character ?



80. Which of the following is among the strongest organic bases known (having  $pK_b$  too small to be measured accurately). Quaternary alkyl ammonium hydroxide is an exception ?



(2, 4, 6-trinitrodimethyl aniline)



81. Which of the following is on the bank of river Pabbar ?

(A) Rohru

(B) Hatkoti

(C) Saraswati Nagar

(D) All of these

82. Which pass joins Kangra and Bharmaur ?

(A) Jalsu

(B) Darati

(C) Kugti

(D) Chobia

83. Raja of which princely state helped Jahangir in capturing the Kangra fort ?
- (A) Shahpur (B) Nurpur  
(C) Guler (D) Kutlehar
84. In which princely state did Tughlaq Khan who rebelled against Muhammed Shah I take shelter ?
- (A) Kangra (B) Kutlehar  
(C) Handur (D) Sirmaur
85. When did Ram Singh organise a force consisting mainly of Pathanias of Nurpur and Katoaches of Kangra to oust the British ?
- (A) 1843-44 (B) 1846-48  
(C) 1854-56 (D) 1857-59
86. Which was the first hydel project to be given to private sector ?
- (A) Baspa (B) Larji  
(C) Binwa (D) Malana
87. In which district of H.P. is Talra sanctuary ?
- (A) Kinnaur (B) Shimla  
(C) Kullu (D) Bilaspur



88. Date of which festival is decided by the Lamas on the basis of astrological calculations ?

(A) Losser

(B) Gochi

(C) Jidjed

(D) Holi

89. To which Viceroy was a bell gifted by the king of Nepal which was used as Dinnergong at the Viceregal Lodge Shimla (now IAS) ?

(A) Lord Mayo

(B) Lord Dufferin

(C) Lord Curzon

(D) Lord Ripon

90. To which district of H.P. does film star Kangna Ranaut belong ?

(A) Mandi

(B) Shimla

(C) Chamba

(D) Kangra

91. Who is the author of *The Chinar Leaves* ?

(A) M.L. Fotedar

(B) N.N. Vohra

(C) Mehbooba Mufti

(D) Omar Abdullah

92. Who won the 2015 Delhi Vidhan Sabha elections by biggest margin ?
- (A) Arvind Kejriwal (B) Manish Sisodia  
(C) Pankaj Pushkar (D) Mahendra Yadav
93. Through which city of Punjab is the proposed natural gas pipe line (TAPI) designed to pass ?
- (A) Amritsar (B) Taran Taran  
(C) Fazilka (D) Pathankot
94. With which of the following is Sunita Narain associated ?
- (A) Cricket (B) Music  
(C) Banking (D) Environment
95. When was the Bureau of Indian Standards (BIS) set up ?
- (A) 1987 (B) 1989  
(C) 1992 (D) 1996
96. With which of the following is Satya Nadella associated ?
- (A) Google (B) Nokia  
(C) Microsoft (D) Master card

97. Besides Rubaiyats, what is Omar Khayyam known for ?

(A) Medicine

(B) Algebra

(C) Geography

(D) Dance

98. To which country does Svetlana Alexievich, who won the 2015 Nobel prize for literature belong ?

(A) Russia

(B) Belarus

(C) Hungary

(D) Poland

99. When was new (second) Suez canal inaugurated ?

(A) January 2015

(B) March 2015

(C) August 2015

(D) October 2015

100. With which of the following is Niels Bohr associated ?

(A) Botany

(B) Psychology

(C) Music

(D) Physics