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

TEST BOOKLET SERIES

TEST BOOKLET

LAS&H (Polytechnic Chemistry)

A

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. **Encode clearly the test booklet series A, B, C or D as the case may be in the appropriate place in the answer sheet.**

3. Write your Roll Number only in the box provided alongside. Do not write anything else on the Test Booklet.

4. 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.

5. 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 :

$$\text{(A)} \quad \text{(B)} \quad \bullet \quad \text{(D)}$$

6. 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.

7. 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.*

8. 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.

9. 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.

10. After you have completed the test, hand over the Answer Sheet to the Invigilator.

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

(Polytechnic Chemistry)

Time Allowed : 2 Hours]   [Maximum Marks : 100

1.   Which of the following *does not* represent Heisenberg's uncertainty

principle ? $\left[\hbar = \dfrac{h}{2\pi}\right]$

(A) $\Delta p \times \Delta x = \dfrac{\hbar}{2}$

(B) $\Delta l \times \Delta\theta = \dfrac{\hbar}{2}$

(C) $\Delta E \times \Delta t = \dfrac{\hbar}{2}$

(D) $\Delta v \times \Delta t = \dfrac{\hbar}{2}$

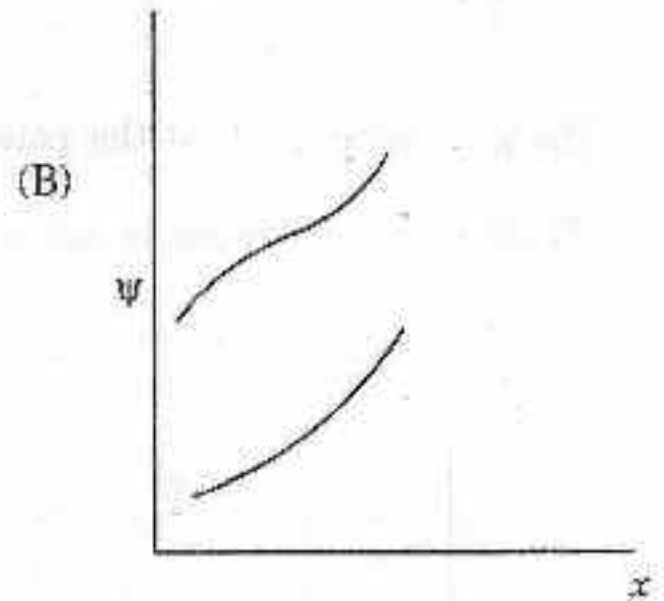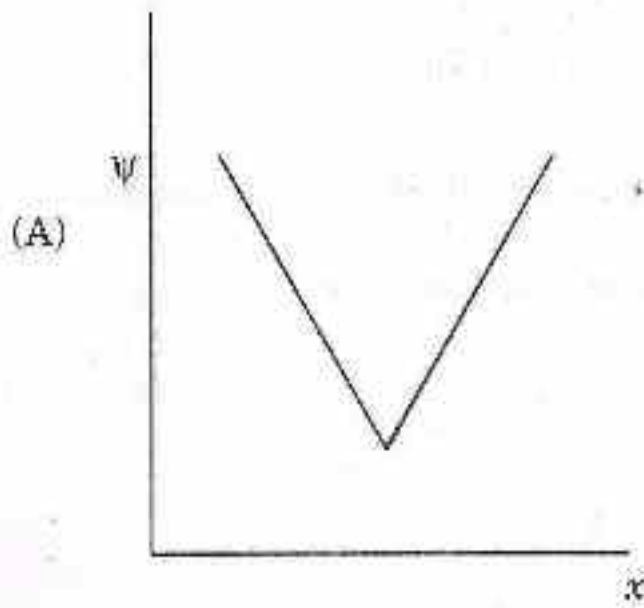2.   Which of the following is a Hamiltonian operator ?

(A) $-\dfrac{\hbar^2}{2m}\dfrac{\partial^2}{\partial x^2} + U$ (B) $i\hbar\dfrac{\partial}{\partial t}$

(C) $\dfrac{\hbar}{i}\dfrac{\partial}{\partial x}$ (D) $-\dfrac{\hbar^2}{2m}\dfrac{\partial^2}{\partial x^2}$

3. Which of the following diagrams represents the condition for wave function to be acceptable ?

(A)

(B)

(C)

(D)
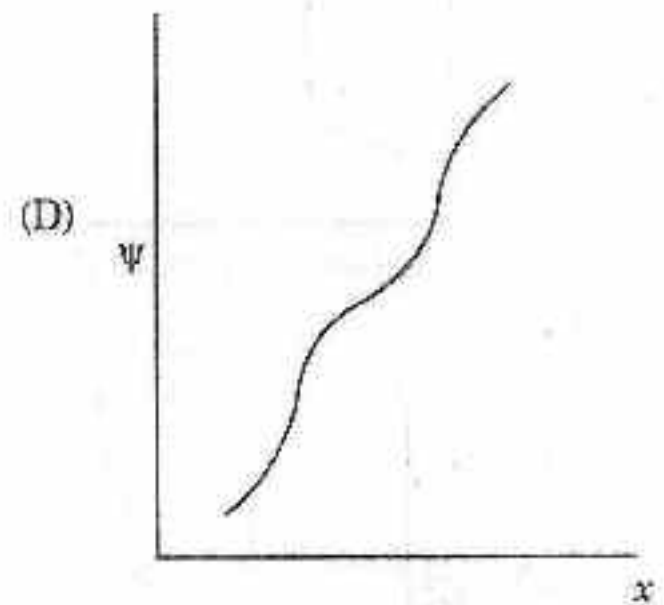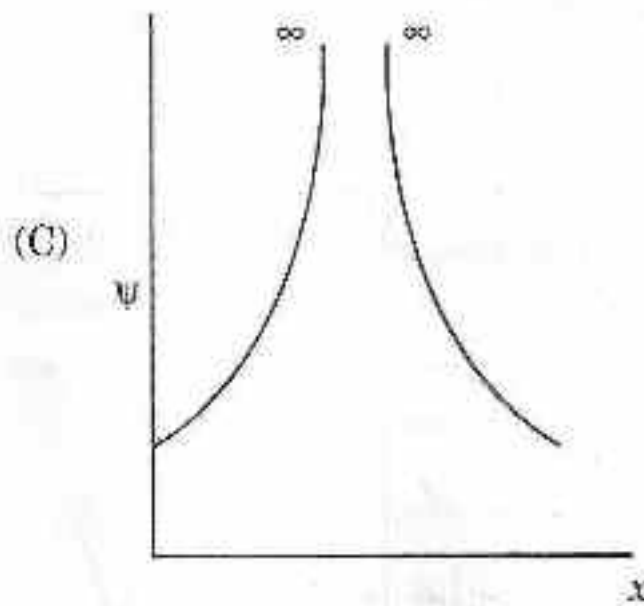
4. In a manner similar to H_2O pH scale in ammonia represents neutral if the pH is :

(A) 13.5   (B) 27
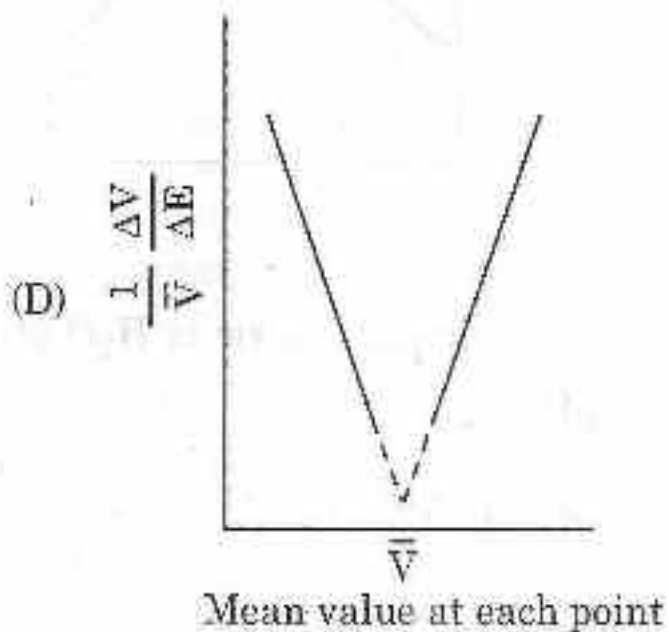
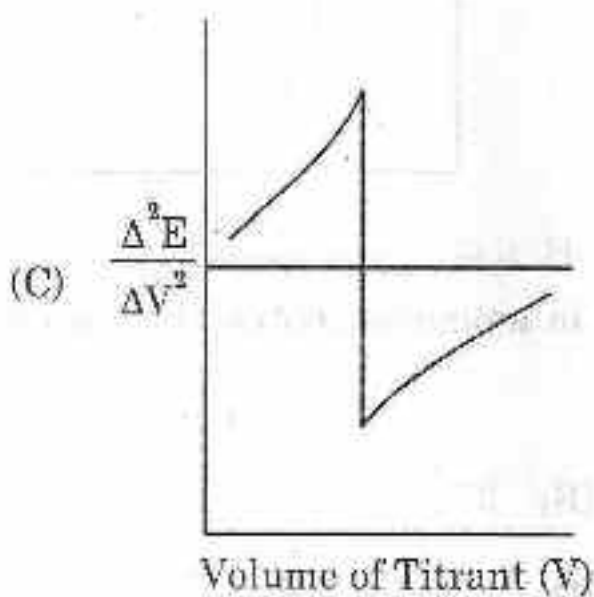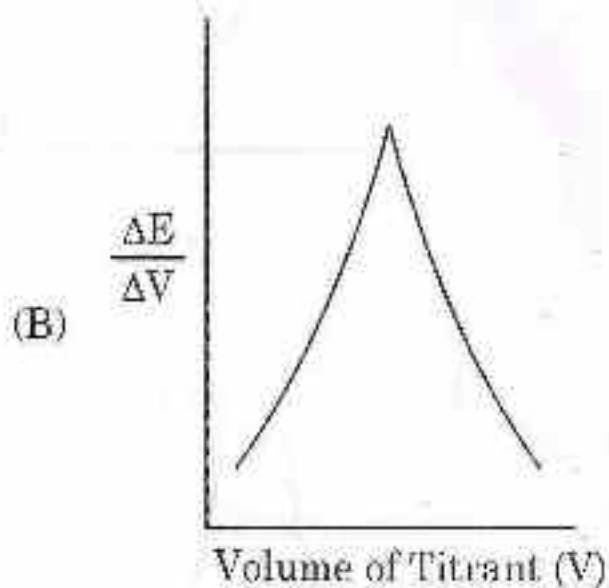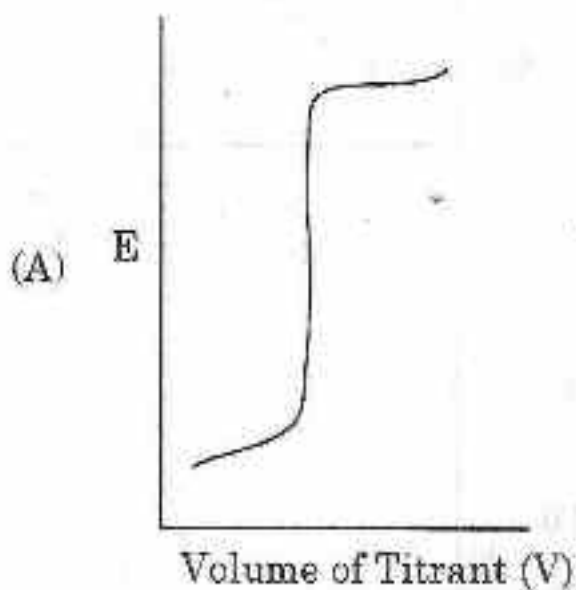(C) 0   (D) 7.0

5. The ionic strength of a 0.25 molal potassium sulphate solution is :
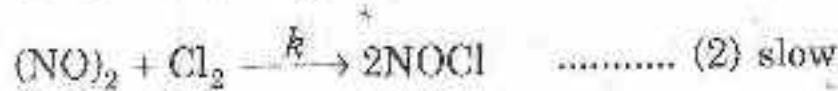
(A) 0.25

(B) 0.75

(C) 1.125

(D) 1.75

6. The graphical result of the potentiometric titration data are shown below. Which of the following is called Gran's plot or method :

(A)
Volume of Titrant (V)

(B)
Volume of Titrant (V)

(C)
Volume of Titrant (V)

(D)
Mean value at each point

7. If rate constant (k) is same for four reactions of zero, first, second and third order, which reaction out of these should be fastest ?

(A) First order reaction
(B) Zero order reaction
(C) Third order reaction
(D) Second order reaction

8. The mechanism for the reaction, $2NO + Cl_2 \rightarrow 2NOCl$, is suggested as :

$$2NO \underset{}{\overset{k}{\rightleftharpoons}} (NO)_2 \qquad \text{.......... (1) fast}$$

$$(NO)_2 + Cl_2 \xrightarrow{k} 2NOCl \qquad \text{.......... (2) slow}$$

The rate of disappearance of chlorine is :

(A) $-\dfrac{d[Cl_2]}{dt} = k[(NO)_2][Cl_2]$
(B) $-\dfrac{d[Cl_2]}{dt} = k[NO]^2[Cl_2]$

(C) $-\dfrac{d[Cl_2]}{dt} = k\ K\ [NO]^2[Cl_2]$
(D) $-\dfrac{d[Cl_2]}{dt} = k\ K\ [NO]^2$

9. What will be the pH of a buffer solution of acetic acid and sodium acetate if the ratio of concentration of CH_3COONa and acetic acid is increased ten fold. [pK_a of $CH_3COOH = 4.75$]

(A) 5.75
(B) 3.75
(C) 4.75
(D) 1.00

10. Which of the following postulates of Debye Hückel theory of strong electrolytes is *not* valid ?

(A) Strong electrolytes are considered to be almost completely ionised at all dilutions. Increase in molar conductance is due to increase in number of ions and degree of ionisation $\alpha = \dfrac{\lambda_v}{\lambda_\infty}$

(B) Each ion in solution is sorrounded by ions of opposite charge called ion atmosphere, the net charge on it is opposite to that of central ion. The drag on the central ion is called asymmetry effect. It arises due to lack of symmetry in the ionic atmosphere of a moving ion

(C) The motion of the ion gets slowed down from tendency of the ionic atmosphere to be associated with water of hydration and to move in a direction opposite to the movement of the central ion (electrophoretic effect)

(D) The mobility of an ion is affected by viscosity of the medium

11. Identify the vapour pressure-temperature diagram curve for a substance undergoing mesomorphic change :

(A)

(B)

(C)

(D)
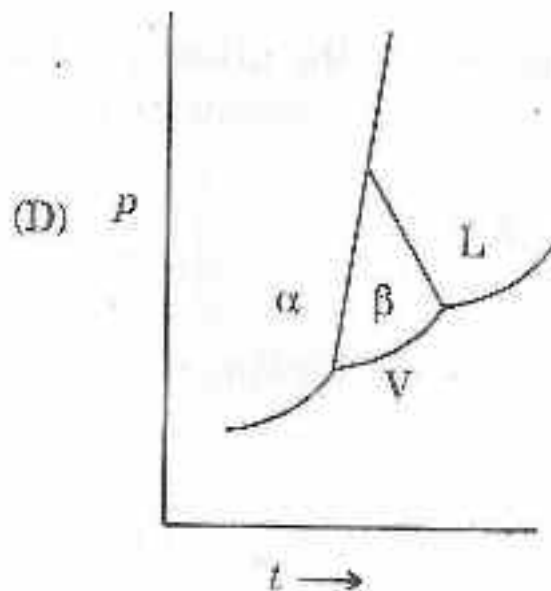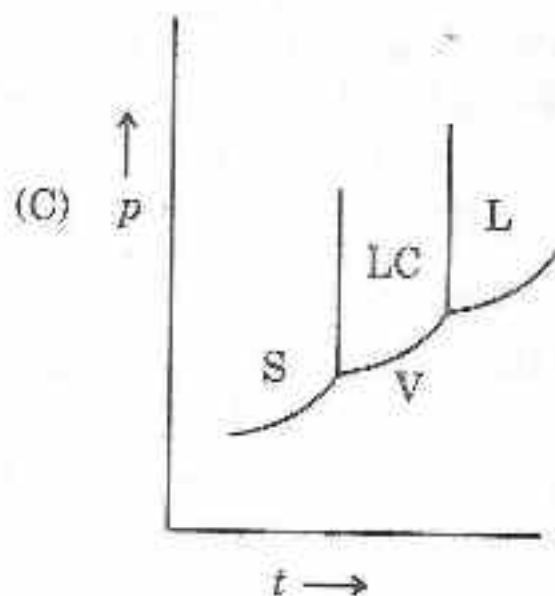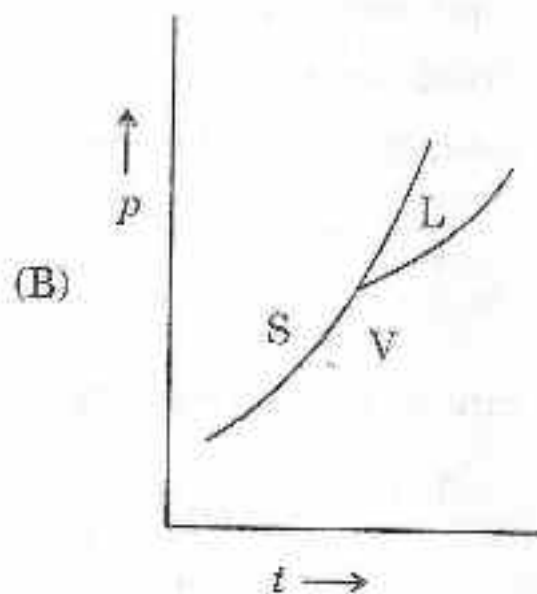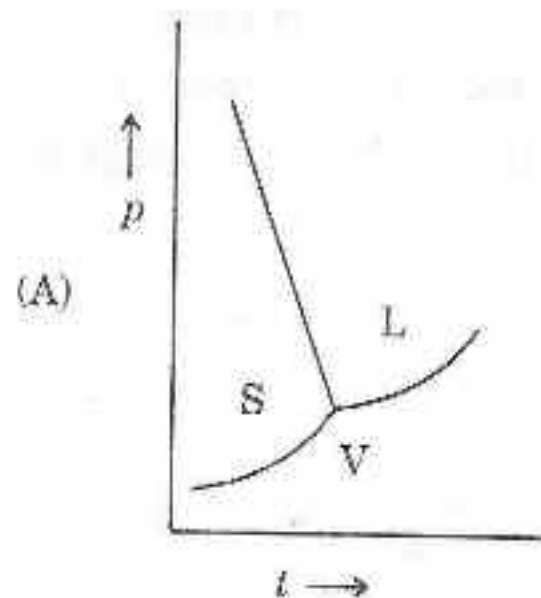
The symbols stand for

S = solid, V = vapour, L = liquid, LC = liquid crystal

α and β are allotropic forms (solid)

2. The system in which macroscopic properties do not undergo any change with time is called :

(A) Thermal equilibrium

(B) Thermodynamic equilibrium

(C) Mechanical equilibrium

(D) Chemical equilibrium

13. Which of the following is an expression for Nernst heat theorem ?

(A) $\left(\dfrac{\partial E}{\partial V}\right)_T = 0$

(B) $\left(\dfrac{\partial(\Delta H)}{\partial T}\right)_P = \Delta C_p$

(C) $\underset{T \to 0}{Lt}\left[\dfrac{\partial(\Delta G)}{\partial T}\right]_P = \underset{T \to 0}{Lt}\left[\dfrac{\partial \Delta H}{\partial T}\right]_P = 0$

(D) $\left(\dfrac{\partial T}{\partial P}\right)_H = -\dfrac{1}{C_p}\left(\dfrac{\partial H}{\partial P}\right)_T$

14. Which of the following is an expression for thermodynamic equation of state ?

(A) $\left(\dfrac{\delta \ln p_1}{\partial \ln N_1}\right)_{T,P} = \left(\dfrac{\partial \ln p_2}{\partial \ln N_2}\right)_{T,P}$

(B) $\Delta A = \Delta E + T\left(\dfrac{\partial A}{\partial T}\right)_V$

(C) $g^M = RT \Sigma x_i \ln x_i$

(D) $\mu_i = \left(\dfrac{\partial H}{\partial n_i}\right)_{s,\,p,\,n_2}$

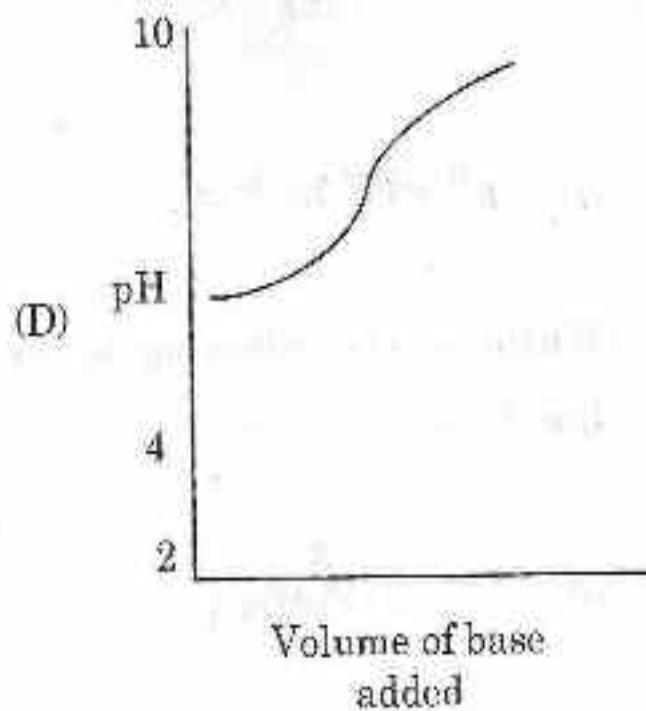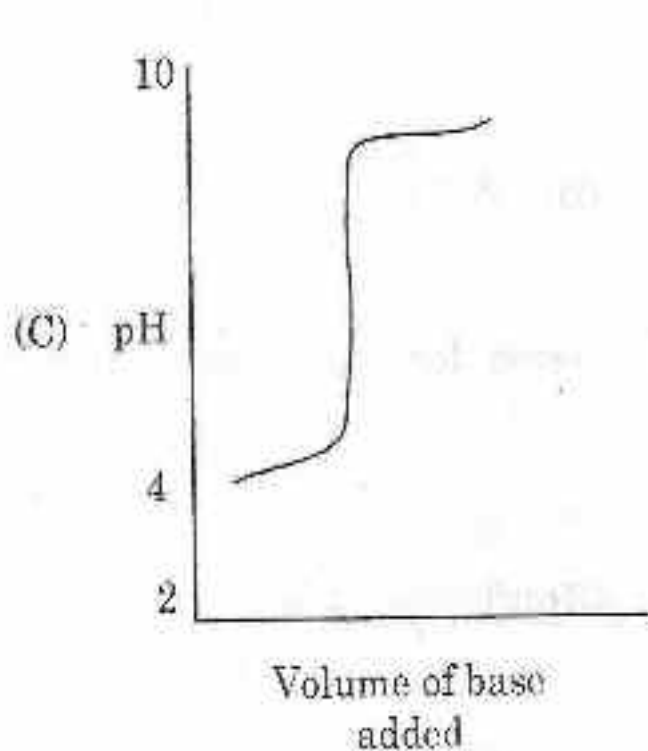15. Which of the following is an expression for Fermi-Dirac distribution law ?
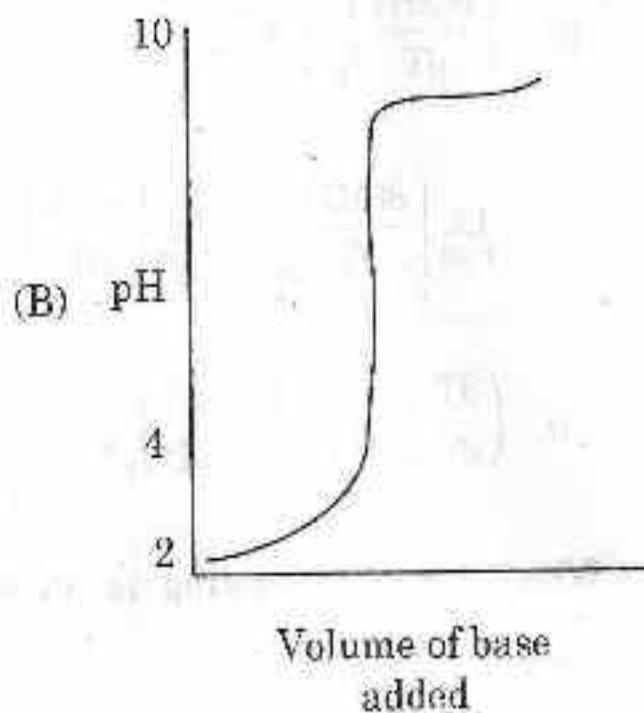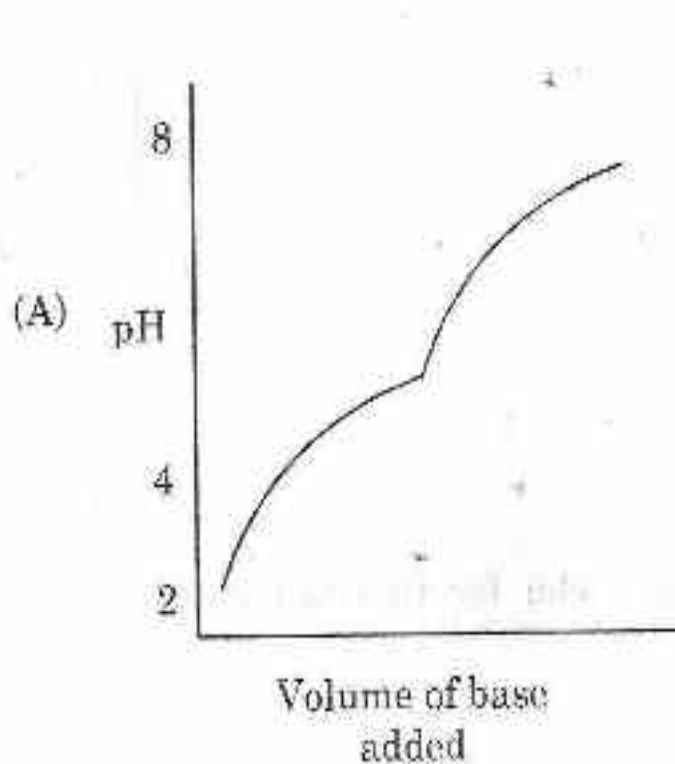
(A) $n_i = \dfrac{g_i}{e^{\alpha + \beta E_i /kT} + 1}$

(B) $n_i = \dfrac{g_i}{e^{\alpha + \beta E_i /kT} - 1}$
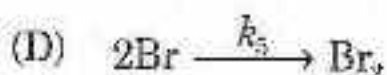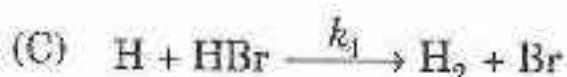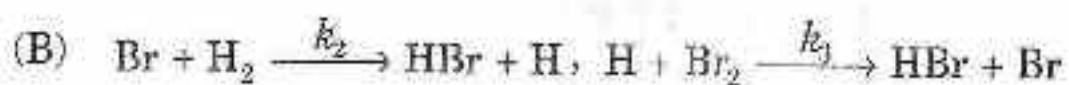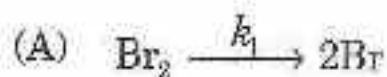
(C) $n_i = g_i\, e^{-\alpha - iE_i/kT}$

(D) $\dfrac{g_i}{n_i} + \delta = e^{\alpha + E_i /kT}$

16. Which of the following pH titration curves indicate a titration curve of a strong acid and weak base ?

(A) pH

Volume of base added

(B) pH

Volume of base added

(C) pH

Volume of base added

(D) pH

Volume of base added

[pH given not to scale]

17. Which of the following is a chain inhibition step in hydrogen-bromine chain reaction mechanism to form HBr ?

(A) $Br_2 \xrightarrow{k_1} 2Br$

(B) $Br + H_2 \xrightarrow{k_2} HBr + H$, $H + Br_2 \xrightarrow{k_3} HBr + Br$

(C) $H + HBr \xrightarrow{k_4} H_2 + Br$

(D) $2Br \xrightarrow{k_5} Br_2$

18. Which of the following is a cause for high quantum yield ?

(A) Excited states may get deactivated before they form products

(B) Collisions of excited molecules with non-excited molecules may cause to lose energy

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

(D) A reaction in which the excited atoms or free radicals produced in the primary stage react further to give the products

19. Which of the following is *not* a correct difference between physisorption and chemisorption ?

(A) Physisorption occurs appreciably only at very low temperature, chemisorption occurs at all temperatures

(B) Physisorption is irreversible whereas chemisorption is reversible as the gas adsorbed can be recovered from the adsorbent easily

(C) The heat liberated in physisorption is quite low, 4-40 kJ/mol whereas in chemisorption it is between 40-400 kJ/mol

(D) In physisorption the adsorbate molecules are held by van der Waal forces, activation energy is very low in this process whereas in chemisorption the adsorbate molecules are held by strong valence forces, activation energy is very high

20. Which of the following relation represents Freundlich adsorption isotherm ?

(A) $\theta = \dfrac{KP_A}{1 + KP_A}$

(B) $\dfrac{P}{V_{total}(P_0 - P)} = \underset{Mono}{\dfrac{1}{V \times C}} + \underset{Mono}{\dfrac{C-1}{V \times C}}\left(\dfrac{P}{P_0}\right)$

(C) $\dfrac{x}{m} = kp^{1/n}$

(D) $\Gamma = \dfrac{1}{RT}\dfrac{dr}{d\ln p}$

21. Which of the following mixture of gases has the maximum attainable flame temperature ?

(A) Cyanogen $[(CN)_2]$ and oxygen

(B) Acetylene and oxygen

(C) Methane-air

(D) Propane-air

22. For the reaction $A \to B + C$ the initial concentration of A is 0.010 M. After 100 secs the concentration of A becomes 0.001 M. The rate constant of the reaction has the numerical magnitude 9.0. The order of reaction is :

(A) Second order

(B) Zero order

(C) Third order

(D) First order

23. In terms of reaction kinetics which of the following statements is *correct* ?

(A) A catalyst increases the activation energy

(B) a decrease in temperature causes a greater fraction of the molecules to have an energy at least equal to the activation energy

(C) A decrease in concentration causes a greater number of effective collisions per second

(D) The number of molecules exceeding the activation energy approximately doubles per $10°$ rise in temperature

24. The molar masses of polymers are expressed as number-average molar mass or mass-average molar mass. The methods of determining molar mass are given below. Which of the method gives number average molar mass (M_n) of a polymer ?

(A) Sedimentation velocity method

(B) Viscosity method

(C) Light scattering method

(D) Sedimentation equilibrium method

25. The standard hydrogen electrode (SHE) whose potential is taken as zero under standard conditions is usually not taken in practice in laboratories. Which of the following statements is *not* correct in this connection ?

(A) SHE is very sensitive to dissolved oxygen, H_2S and other reducible species

(B) SHE is susceptible to electrode poisoning

(C) SHE requires a constant supply of H_2 gas at one atmosphere

(D) SHE has not been accepted as standard by IUPAC

26. The battery which is generally used in cordless appliances is a :

(A) Leclanche or dry cell
(B) Alkaline battery

(C) Mercury battery
(D) Nickel-Cadmium battery

27. Which of the following elements/compound has primitive cubic lattice ?

(A) Polonium
(B) Caesium

(C) Diamond
(D) Sodium chloride

28. Which of the following term symbol *does not* exist ?

(A) $^4S_{3/2}$
(B) $^2P_{3/2}$

(C) $^2P_{3/2}$
(D) $^2S_{1/2}$

29. A $[FeF_6]^{-3}$ and $[Ni(NH_3)_6]^{+2}$ have magnetic moments corresponding to five and two unpaired electrons respectively. Neither of these complexes can have $3d^2\,4s\,4p^3$ hybridisation to occur. Which of the following terms were used by Tanabe to explain these complexes ?

(A) high spin and low spin

(B) spin free and spin paired

(C) hypoligated and hyperligated

(D) inner orbital and outer orbital

30. Which of the following pair of compounds have an odd electron molecule ?

    (A) NO and NO_2

    (B) N_2O_4 and N_2O

    (C) N_2O_3 and N_2O_5

    (D) N_2O_5 and N_2O

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

    (A) BF_3 is an electron deficient compound and can accept a lone pair of electron even from F^- ion. Thus, it behaves as a Lewis acid

    (B) Boric acid acts as a monobasic acid by donating a proton itself

    (C) Sodium borohydride is used for removal of potentially harmful metal ions from effluent of a chemical or sewage treatment plant

    (D) Sodium borohydride ($NaBH_4$) readily reduces metal ions to metal which can be plated on surfaces without using electrodes

32. Which of the following is *not* a truly organometallic compound ?

    (A) ferrocene

    (B) η^5-pentacarbonyl iron

    (C) di-μ-methyl bis (dimethyl aluminum)

   (D) potassium trichloro (η^2-ethene) platinate (II)

33. A qualitative temperature dependence of magnetic susceptibility is shown below for diamagnetic, paramagnetic, ferromagnetic and antiferromagnetic substances :


(i)

(ii)

(iii)

(iv)
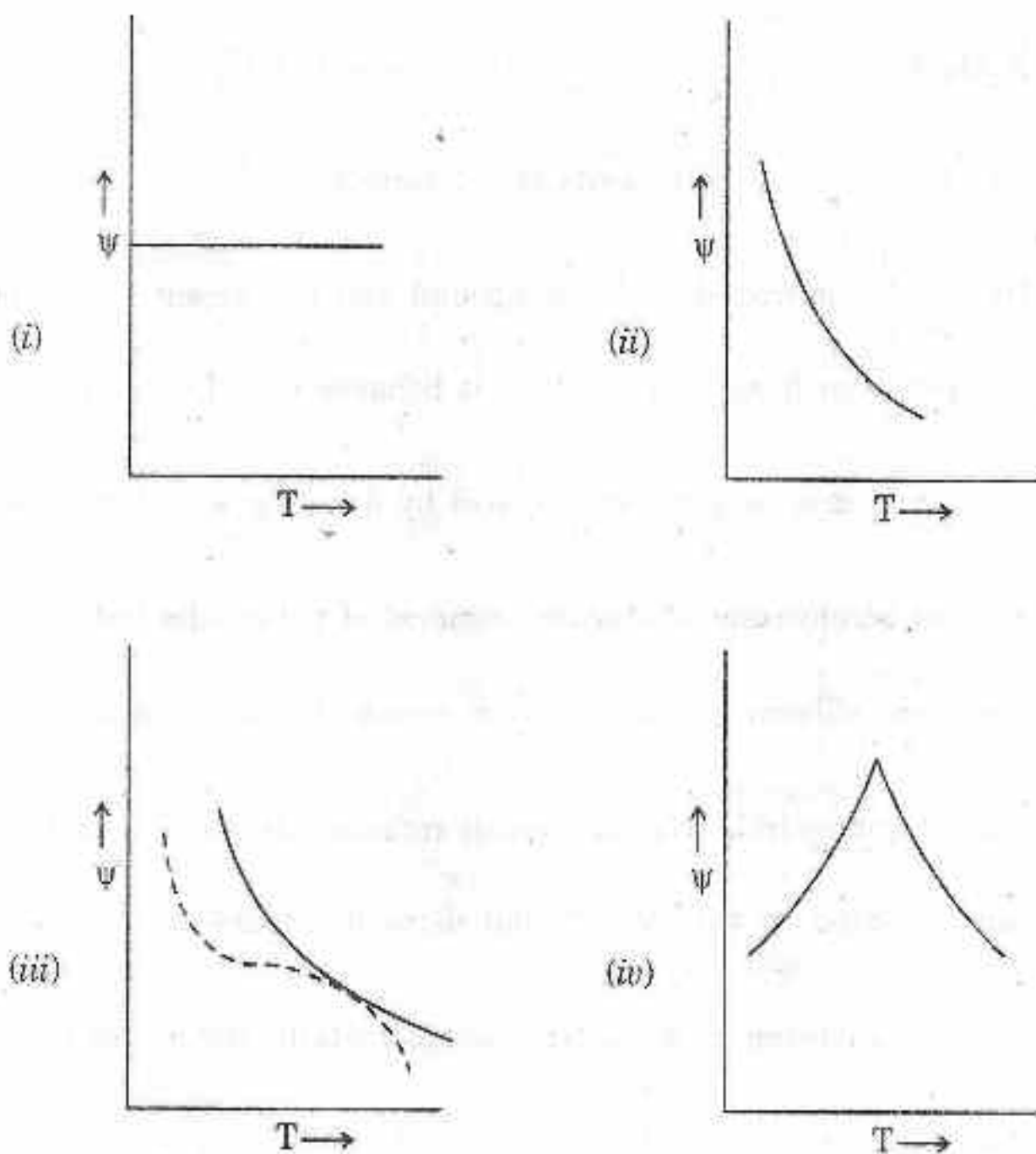
An antiferromagnetic substance shows a behaviour of simple paramagnetism but below this temperature magnetic susceptibility (ψ) drops with decreasing temperature. This temperature is called :

(A) Boyle temperature

(B) Critical temperature

(C) Curie temperature

(D) Neel temperature

14

34.	Which of the following pair of trivalent lanthanide ions are diamagnetic ?

(A)	Dy^{+3} and Ho^{+3}

(B)	Gd^{+3} and Tm^{+3}

(C)	La^{+3} and Lu^{+3}

(D)	Tb^{+3} and Er^{+3}
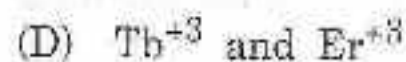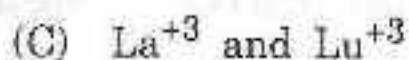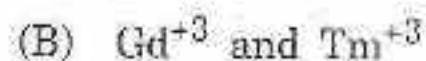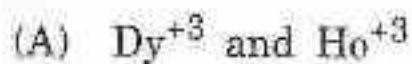
35.	Which of the following lanthanide complexes has the highest coordination number ?

(A)	$[Nd(H_2O)_9]^{+3}$

(B)	$Er(NCS)_6$

(C)	$Ce(ac\ ac)_4$

(D)	$Ce(NO_3)_6$
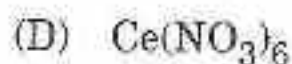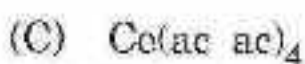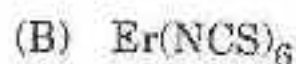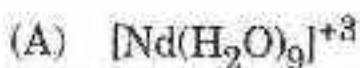
[ac ac = acetyl acetone]

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

(A)	The transfer of oxygen through haemoglobin in blood in arteries to various parts of the body is a remarkable phenomena since it involves Fe (III) and not Fe (II)

(B)	Haemocyanin is an oxygen carrier in snails, octopauses, scorpion etc. through two copper (II) ions. The oxygenated Haemocyanins are blue coloured and have an dioxygen molecule attached to two copper ions

(C)	Na^+ ions are expelled from the cell i.e. concentrates outside the cell whereas K^+ ions are not i.e. they concentrate inside the cell. Thus the balance between Na^+ and K^+ ions is maintained across the cell membrane

(D)	Ca^+ ions are important in blood clotting and are required to trigger contraction of muscles and to maintain regular beating of heart
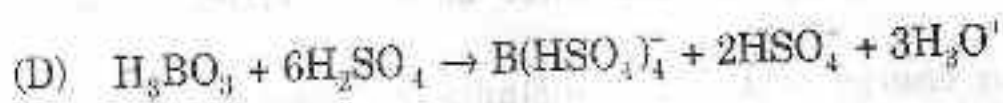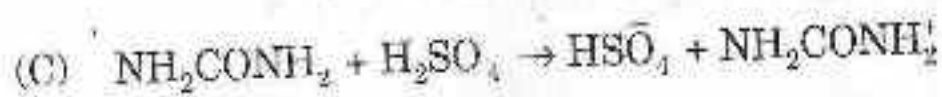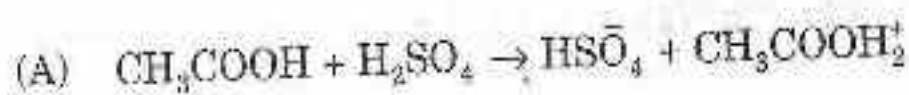
37. Which of the following statements is *not* correct ?

(A) Alkali or alkaline earth metal dissolve in liquid ammonia giving a deep blue solution. Metal in the solution is present as solvated or ammoniated as cation $M(NH_3)_6^+$

(B) On increasing the concentration of metal ion in ammonia solution caesium like other alkali metals gives blue solution which changes to bronze colour

(C) The blue colour of the dilute solution is independent of the metal dissolved and has a broad maxima at 1450 nm

(D) The blue solution acts as a powerful reducing agent due to the presence of free electrons $[e(NH_3)_x]^-$

38. Crystal field theory is able to explain satisfactorily :

(A) delocalisation of ligand electrons

(B) relative strength of the ligands

(C) possibility of double bonding between metal ion and ligand

(D) thermodynamic properties

39. Which of the following is an electronic configuration of oxygen molecule ?

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

(B) $kk\ \sigma(2s)^2\ \sigma^*(2s)^2\ \sigma(2p_z)^2\ \sigma^*(2p_z)^2\ \pi(2p_x)^2\ \pi(2p_y)^2\ \pi^*(2p_x)^0\ \pi^*(2p_y)^0$

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

(D) $kk\ \sigma(2s)^2\ \sigma^*(2s)^2\ \sigma(2p_z)^2\ \pi(2p_x)^2\ \pi(2p_y)^2\ \pi^*(2p_x)^2\ \pi^*(2p_y)^0$

40. The qualitative relationship between three bond properties – bond length, bond dissociation energy and force constants are useful in predicting or interpreting physical and chemical properties. Each of them depends on bond order. Which of the following inference is *correct* ?

As the bond order increases :

(A) bond length decreases, dissociation energy increases, force constant increases

(B) bond length increases, dissociation energy increases, force constant decreases

(C) bond length increases, dissociation energy increases, force constant increases

(D) bond length decreases, dissociation energy increases, force constant decreases

41. Which of the following substances acts as an acid in anhydrous sulphuric acid solvent ?

(A) $CH_3COOH + H_2SO_4 \rightarrow HS\bar{O}_4 + CH_3COOH_2^+$

(B) $NH_3 + H_2SO_4 \rightarrow HS\bar{O}_4 + NH_4^+$

(C) $NH_2CONH_2 + H_2SO_4 \rightarrow HS\bar{O}_4 + NH_2CONH_2^+$

(D) $H_3BO_3 + 6H_2SO_4 \rightarrow B(HSO_3)_4^- + 2HSO_4^- + 3H_3O^+$

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

(A) Most Mn^{+2} complexes are octahedral and these have high spin arrangement

(B) Mn^{+2} complexes have pale yellow colours due to d-d transition from t_{2g} to e_g level. The d-d transition in high spin d^5 complexes requires reversing of its spin also

(C) In low spin d^5 complexes d-d transitions are spin permitted and the compounds are strongly coloured

(D) Mn^{+7} is permanganate ion and has intense violet colour due to d-d transition

43. Give the *correct* order of ligands in which Δ crystal field splitting increases from left to right in the series for all metal ions :

(A) $\bar{F} < H_2O < NH_3 <$ dipyridyl $<$ phenanthroline $< \bar{CN}$

(B) $H_2O < \bar{F} < NH_3 <$ phenanthroline $<$ dipyridyl $< \bar{CN}$

(C) $\bar{F} < NH_3 < H_2O < \bar{CN} <$ phenanthroline $<$ dipyridyl

(D) $NH_3 < H_2O < \bar{F} <$ phenanthroline $< CN <$ dipyridyl

44. Stability constant (log k) increases in the order for bivalent cations (Irving William order) as :

(A) $Fe^{+2} < Mn^{+2} < Ni^{+2} < Co^{+2} < Cu^{+2} > Zn^{+2}$

(B) $Mn^{+2} < Fe^{+2} < Co^{+2} < Ni^{+2} < Cu^{+2} > Zn^{+2}$

(C) $Ni^{+2} < Co^{+2} < Fe^{+2} < Mn^{+2} < Cu^{+2} < Zn^{+2}$

(D) $Co^{+2} < Ni^{+2} < Mn^{+2} < Fe^{+2} < Zn^{+2} > Cu^{+2}$

45. Which of the following species shows mer and fac isomerism ?

(A) $[Cr(oxalate)]^{-3}$

(B) $Cr(NH_3)_4Cl_2$

(C) $Cr(NH_3)_3Cl_3$

(D) $Cr(NH_3)_5Cl$

46. The element whose atomic number is 106, is called :

   (A) Bhorium

   (B) Rutherfordium

   (C) Dubnium

   (D) Seaborgium

47. Which of the following radioactive series end in $^{209}_{93}$Bi ?

   (A) Thorium series

   (B) Neptunium

   (C) Uranium

   (D) Actinium

48. Neutrons ejected from a nucleus have very high energy and are called fast neutrons. These are to be slowed down to cause fission and maintain a chain reaction. A moderator is used to slow down the fast neutrons. Which of the following reactors *does not* use any moderator ?

   (A) Advance gas cooled thermal reactors

   (B) High temperature reactors

   (C) Water cooled thermal reactors

   (D) Fast breeder reactor

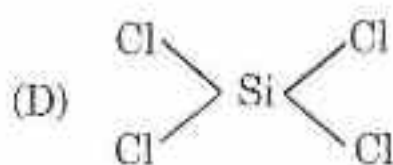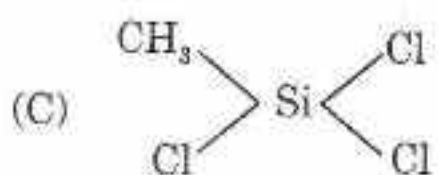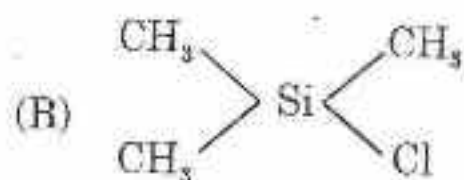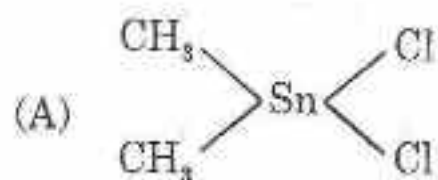49. Which of the following diagram represents a random substitution alloy ? Metal

and alloy structures are given below (A to D) :

(A)

(B)

(C)

(D)

LAS&H—A

21

P.T.O.
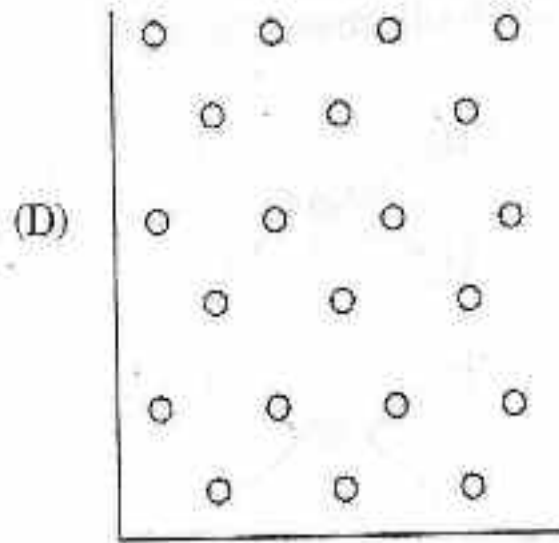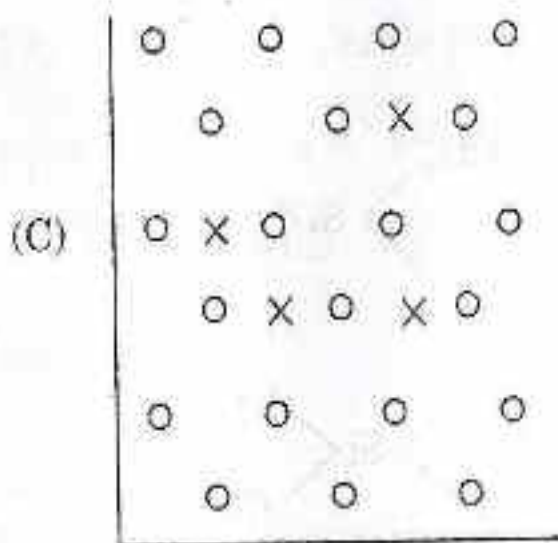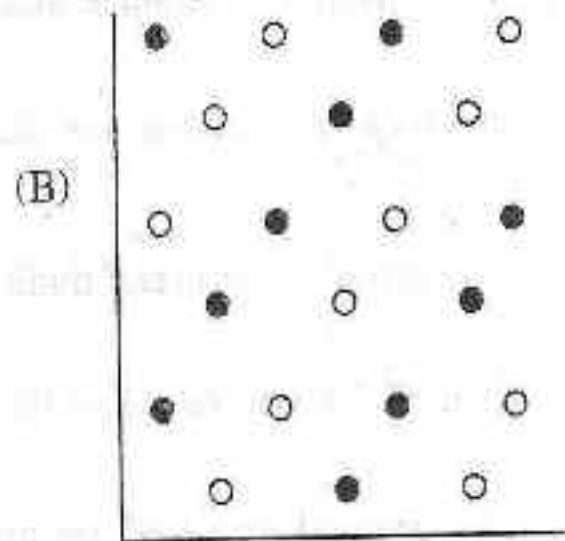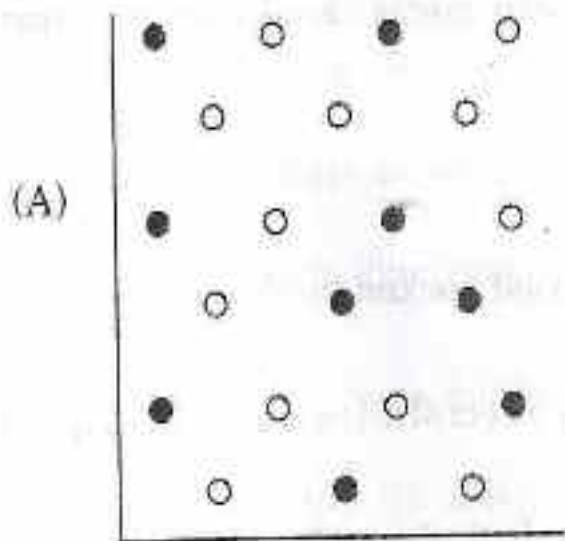
50. Which of the following is *not* a condition for the formation of a substitution alloy ?

(A) Two metals must be similar in size, the difference between their radii should not be more than 14-15%

(B) Both metals must have same crystal structure

(C) The number of valency electron of both metal should be the same, their chemical properties are similar

(D) The structure of many metals is a closed packed lattice of spherical atoms or ions. There are many tetrahedral or octahedral holes in it and should be occupied or fitted by atoms of other element

. Which of the following alkyl substituted chlorosilane is *not* a chain building unit of silicones (polymer) ?

(A) $\begin{array}{c} CH_3 \\ CH_3 \end{array} Sn \begin{array}{c} Cl \\ Cl \end{array}$

(B) $\begin{array}{c} CH_3 \\ CH_3 \end{array} Si \begin{array}{c} CH_3 \\ Cl \end{array}$

(C) $\begin{array}{c} CH_3 \\ Cl \end{array} Si \begin{array}{c} Cl \\ Cl \end{array}$

(D) $\begin{array}{c} Cl \\ Cl \end{array} Si \begin{array}{c} Cl \\ Cl \end{array}$

52. Which of the following statements is *not* correct with the formation of complexes of π-acceptor ligands ?

(A) The π-acceptor ligands can stabilise low oxidation states of the metal, high electron density on the metal atom can be delocalised onto the ligands

(B) These ligands possess vacant π-orbitals in addition to lone pair

(C) The vacant π-orbitals of the ligand accept electron density from filled metal orbitals to form a type of π-bonding that supplements σ-bonding arising from lone pair donation of the ligand

(D) The ligands form bonds to the metal by using σ-orbitals and exercise their π-acidity by using π-orbitals whose nodal planes excludes the axis of σ-bond i.e. the metal atom lies out of the molecular plane of the ligand

53. The nitrioxide molecule is closely akin to CO molecule except it contains one more electron in π^* orbital. CO and NO form metal complexes which are quite comparable. Which of the following compounds is purely nitrosyl compound ?

(A) $Fe(NO)_4$

(B) $Cr(NO)_4$
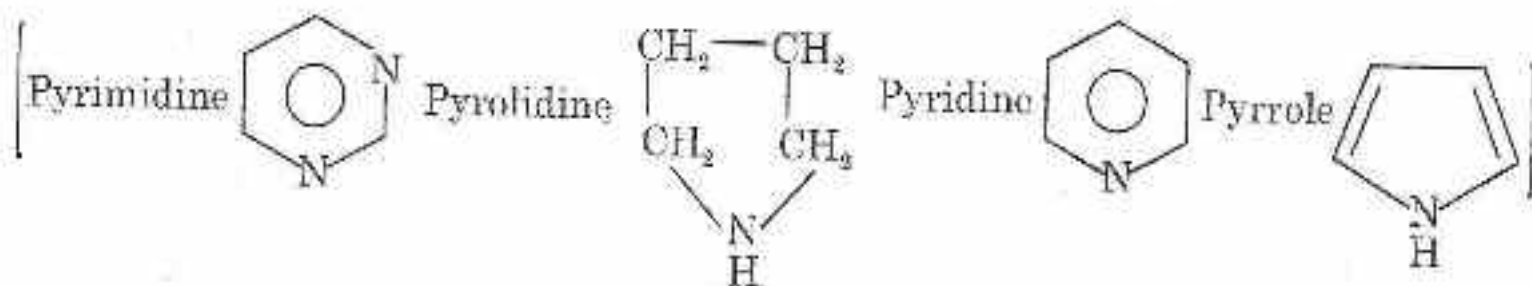
(C) $Co(NO)_3$

(D) $Fe(CO)_2(NO)_2$
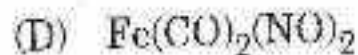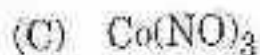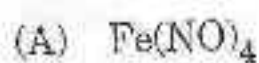
54. The *correct* basicity sequence of the following compounds is as follows :
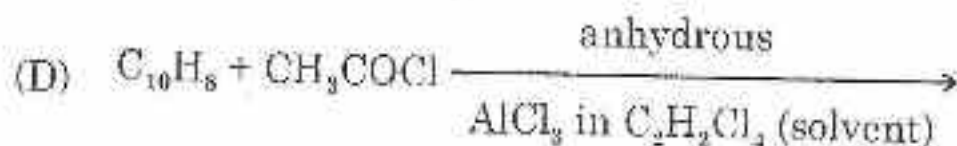
(A) pyrrole < pyridine < pyrolidine < pyrimidine

(B) pyridine < pyrolidine < pyrimidine < pyrrole

(C) pyrolidine < pyrrole < pyridine < pyrimidine

(D) pyrimidine < pyridine < pyrrole < pyrolidine

55. Which of the following Friedel-Craft reaction *does not* take place ?

(A)

(B) $C_6H_5NO_2 + C_6H_5COCl \xrightarrow[AlCl_3]{anhydrous}$

(C) $C_{10}H_8 + CH_3COCl \xrightarrow[AlCl_3 \text{ in } C_6H_5NO_2 \text{ (solvent)}]{anhydrous}$

(D) $C_{10}H_8 + CH_3COCl \xrightarrow[AlCl_3 \text{ in } C_2H_2Cl_4 \text{ (solvent)}]{anhydrous}$
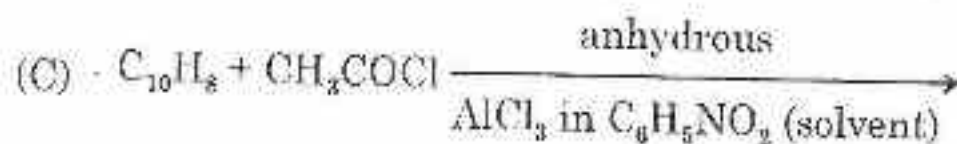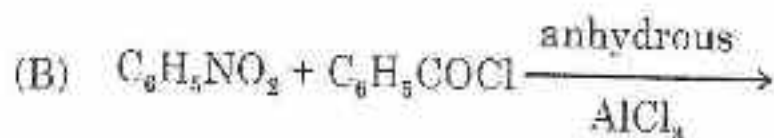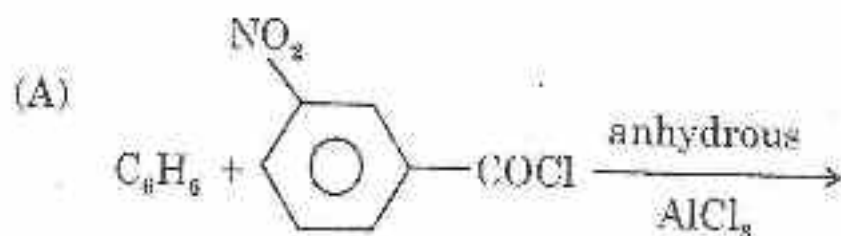
56. Aldoses on oxidation gives aldonic acid. The oxidising agent for this purpose is :

(A) Fehling solution

(B) Tollens reagent

(C) Bromine water

(D) Nitric acid

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

(A) D-(+)-glucose exists in two isomeric forms, α-D-(+)-glucose and β-D-(+)-glucose, which do not undergo mutarotation.

(B) D-(+)-glucose forms two isomeric methyl D-glucosides, methyl α-D-glucoside and methyl β-D-glucoside. These neither undergo mutarotation nor reduce Tollens or Fehling solution.

(C) α-D-(+)-glucose and β-D-(+)-glucose are distereomers differing in configuration about C-1. These are called epimers.

(D) A pair of distereomeric aldoxes that differ in configuration about C-2 only are called anomers. Glucose and mannose differ in configuration about C-2 only.
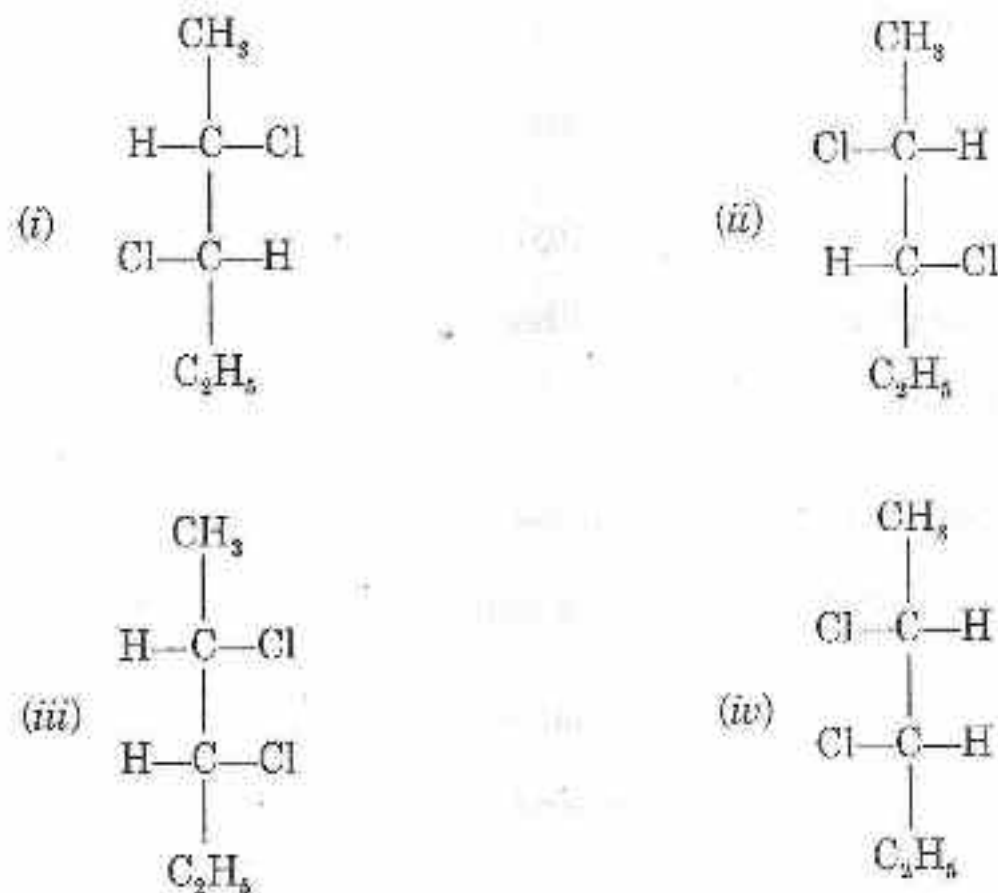
58. Which of the following is an example of Sendmeyer reaction ?

(A) $C_6H_5N=N-Cl + H_3PO_2 + H_2O \rightarrow C_6H_6 + N_2 + H_3PO_3 + HCl$

(B) $C_6H_5N=N-Cl \xrightarrow{HBF_4} C_6H_5N = \overset{+}{N} - B\bar{F}_4 \downarrow \xrightarrow{Heat} C_6H_5F$

(C) $C_6H_5N=N-Cl + KI \rightarrow C_6H_5I + N_2 + KCl$

(D) $C_6H_5N=N-Cl \xrightarrow{Cu_2(CN)_2} C_6H_5CN + N_2$

59. Which of the following substances *does not* give Grignard reagent ?

(A) C_2H_5Br

(B)
$$\begin{array}{c} CH_2OH \\ | \\ CH_2Br \end{array}$$

(C) C_6H_5Br

(D) $CH_3CH_2CH_2CH_2Br$

60. 2, 3-dichloropentane has the following structures (I to IV) :

(i)
$$\begin{array}{c} CH_3 \\ | \\ H-C-Cl \\ | \\ Cl-C-H \\ | \\ C_2H_5 \end{array}$$

(ii)
$$\begin{array}{c} CH_3 \\ | \\ Cl-C-H \\ | \\ H-C-Cl \\ | \\ C_2H_5 \end{array}$$

(iii)
$$\begin{array}{c} CH_3 \\ | \\ H-C-Cl \\ | \\ H-C-Cl \\ | \\ C_2H_5 \end{array}$$

(iv)
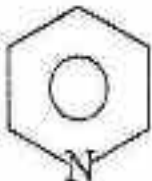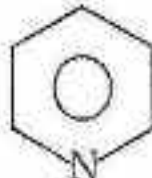$$\begin{array}{c} CH_3 \\ | \\ Cl-C-H \\ | \\ Cl-C-H \\ | \\ C_2H_5 \end{array}$$

Which of the following statements is *not* correct ?

(A) 2, 3-dichloropentane has two chiral centres

(B) Structures I and II, III and IV are not superimposable and are enantiomers

(C) Structures III and I, III and II are diastereomers

(D) Stereoisomer I has (2S 3R) configuration and similarly II has (2R, 3S) configuration

61. Under suitable conditions which of the following reaction mixture will react with anthracene to produce 9-nitroanthracene ?

(A) nitric acid and acetic acid

(B) nitric acid and ethyl alcohol

(C) nitric acid and acetic anhydride

(D) nitric acid in excess

62. In which of the following reactions n-pentane is obtained from pyridine ?

(A) [pyridine structure] $\xrightarrow[\text{reduction}]{\text{HI}}$ ....

(B) [pyridine structure] $\xrightarrow[\text{H}_2\text{SO}_4 \text{ at } 350°\text{C}]{\text{concen.}}$ ....

(C) [pyridine structure] $\xrightarrow[\text{Ni reduction}]{\text{H}_2}$ ....

(D) [pyridine structure] $\xrightarrow[\text{oxidation}]{\text{perbenzoic acid}}$ ....

63. In which of the following structures aromatic sextet is disrupted ?

(A)

(B)

(C)

(D)
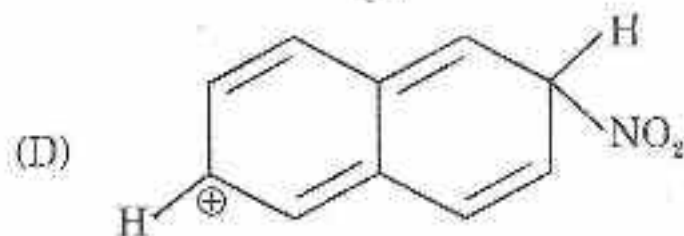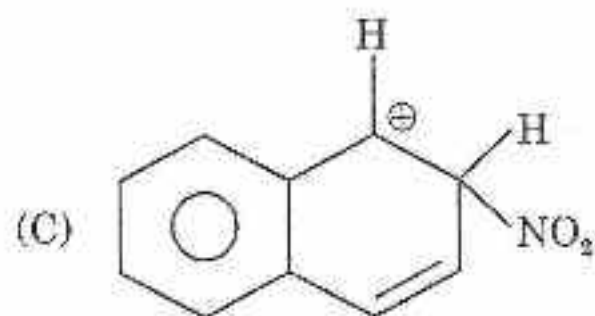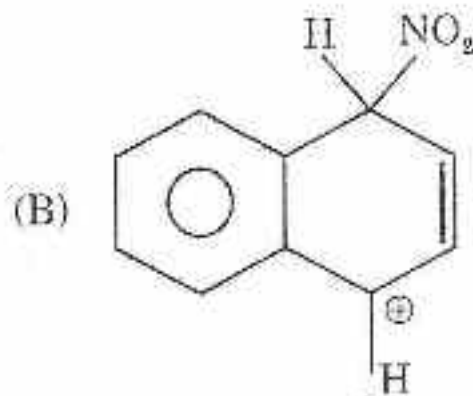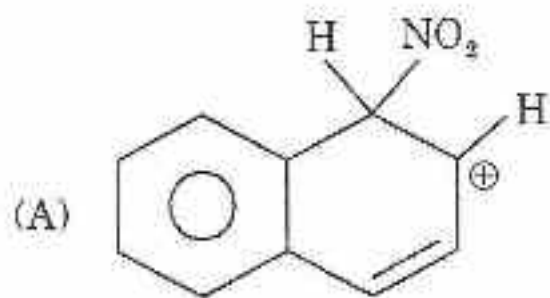
64. Which of the following derivatives of pyridine is used in the treatment of tuberculosis ?

(A) isonicotinic acid hydrazide

(B) nicotinic acid

(C) nicotinamide

(D) pyridoxine
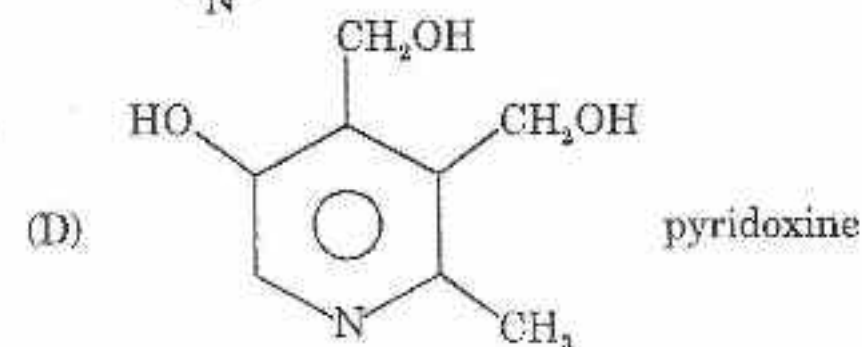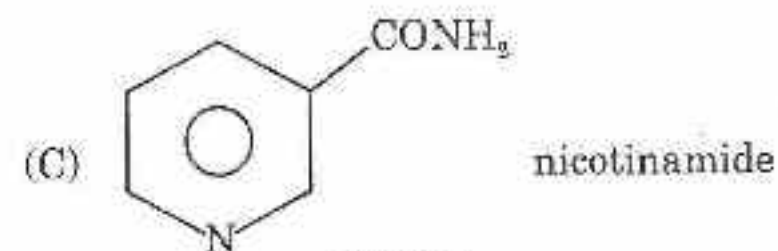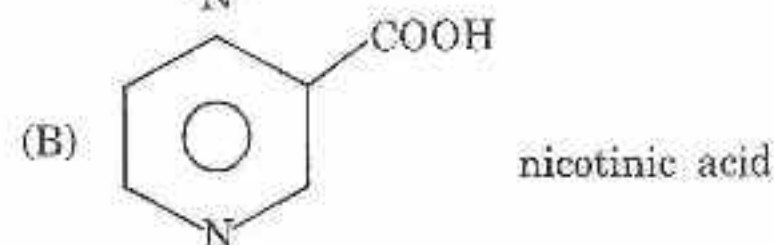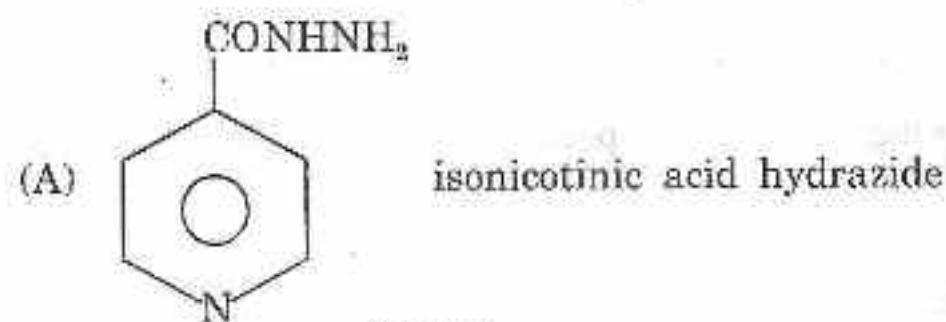
65. Ethyl acetate is treated with C_2H_5ONa and the resulting mixture is acidified to obtain ethyl acetoacetate $(CH_3COCH_2COOC_2H_5)$. This reaction, i.e. formation of β-ketoesters, is called :

(A) Knoevenagel reaction

(B) Dieckmann condensation

(C) Claisen condensation

(D) Perkin condensation

66. The reaction :

$$CH_3COCH_3 + BrCH_2COOC_2H_5$$
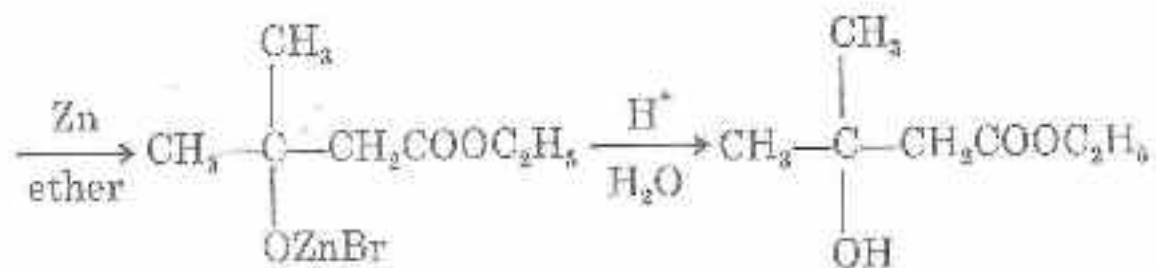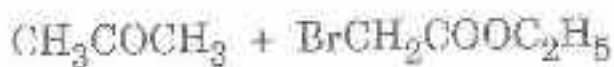
is an example for preparation of β-hydroxy ester. This is called :

(A) Reformatsky reaction

(B) Wittig's reaction

(C) Kolbe's reaction

(D) Wurtz reaction

67. The mass spectrum of ethyl alcohol gave the peaks with a prominent signal at m/e 31 and the other main peaks are at m/e 15, 28, 31 and 46. Which of the following species corresponds to the prominent signal ?

(A) C_2H_5OH

(B) $C_2H_5OH^+$

(C) $CH_2=OH^+$

(D) $C_2H_4^+$

68. An infrared absorption spectrum of the compound 'A' was obtained in KBr wafer phase on Perkin Elmeyer infrared spectrophotometer. The important absorption bands with their relative intensities in parenthesis are given below in cm^{-1}.

3333(Vs), 3125(s), 2580(w), 1653(s), 1562(Vs), 1290(s)

[Regions of absorption as per standard text are as follows :

$v_{NH(trans-bonded)}^{secondary}$ = 3320 – 3270 cm^{-1}, 3100 – 3070 cm^{-1};

v_{SH} = 2600 – 2550 cm^{-1}, amide I 1680 – 1630 cm^{-1}, amide III near 1290 cm^{-1},

and amide II 1570 – 1515 cm^{-1}. (Hint : identify v_{NH} and v_{SH} and conclude)]

The compound 'A' is :

(A) CH_3CONH_2

(B) $CH_3CONHCH_3$

(C) $CH_2(SH)CONHCH_3$

(D) $CH_2(SH)CON(CH_3)_2$

69. In order to identify a compound a researcher was asked to obtain a ^1H-resonance spectrum of a compound in $CDCl_3$ using tetramethyl silane (TMS) as an internal standard on 60 MHz nmr spectrometer. A doublet with intensity 1 : 1 was observed at upfield whereas a quartet with intensity 1 : 3 : 3 : 1 was observer at downfield. The spectrum corresponds :

(A) CH_3CHO

(B) C_2H_5OH

(C) CH_3COOH

(D) t-$(CH_3)_3OH$

70. Which of the following species is likely to give a three line esr spectrum with intensity ratio $1:1:1$ on an e.s.r. 9.5 GHz spectrometer in a magnetic field 0.34 T :

(A) benzene anion $[C_6H_6]^-$

(B) naphthalene anion

(C) p-benzoquinone $[\dot{O}=\bigcirc=\bar{O}]$

(D) $[(SO_3)_2NO]^-$ free radical ion

71. Benzene shows an absorption band in UV region at about 203 nm due to $\pi \rightarrow \pi^*$ transition. A student was asked to obtain absorption spectra of the compounds given below in UV and visible region on Carlzeiss UV and visible spectrophotometer. The wavelength corresponding to maximum absorption (λ_{max}) was found in each case. The compound showing the longest wavelength (λ_{max}) could be :

(A) anthracene

(B) naphthacene

(C) pentacene

(D) hexacene

72. Aniline shows two absorption bands in UV region at 230 nm and 280 nm corresponding to 203 nm and 255 nm absorption bands of benzene. When aniline is dissolved in HCl and UV absorption spectra is obtained. The absorption bands were found very close to that of benzene. Which of the following statements is *correct* ?

   (A) The intense absorption band at 230 nm gets bathochromically shifted to 203 nm

   (B) The weak absorption band at 280 nm shows a bathochromic shift to 255 nm

   (C) The bathochromic shift of absorption bands is due to non-availability of p-electrons on nitrogen

   (D) The low intensity absorption band of aniline due to $n \rightarrow \pi^*$ transition goes undetected and might have merged with B-band of aniline (280 nm)

73. Which of the following compounds react to form addition polymer ?

   (A) Styrene and butadiene

   (B) Dihydroxy silane

   (C) Adipic acid and hexamethylene diamine

   (D) Aminocaproic acid

74. Which of the following reactions takes by S_N^2 mechanism ?

   (A) Neopentyle chloride $Me_3C.CH_2Cl$ hydrolyses to give neopentyl alcohol

   (B) 3-chloro but 1-ene (Me CHCl CH=CH$_2$) undergoes solvolysis in ethanol

   (C) 3-chloro but 1-ene (Me CHCl CH=CH$_2$) reacts with ethanol in the presence of C_2H_5ONa gives only the product (Me CH(OEt) CH=CH$_2$)

   (D) $(Me)_3CCl$ hydrolyses to give $(Me)_3C$—OH

75. 1, 2-dimethyl cyclohexane exists as cis- and trans-geometric isomers, trans-1, 2-dimethyl cyclohexane has two conformation [Structures (a) and (b)]. Similarly cis-isomer has also two conformational isomers as shown [Structures (c) and (d)]
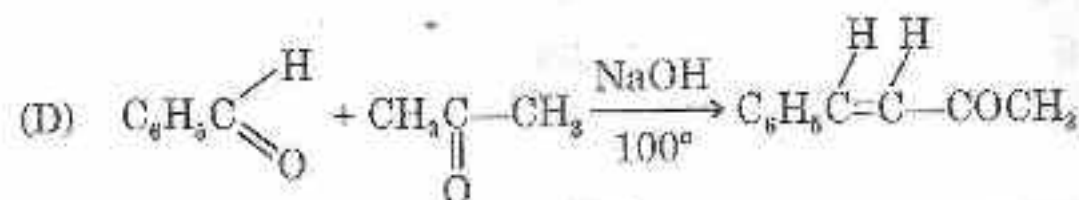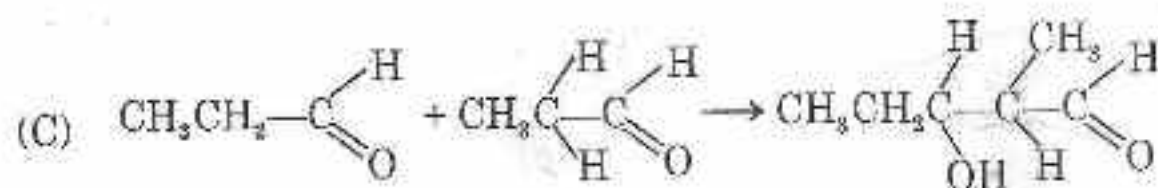

trans-

cis-
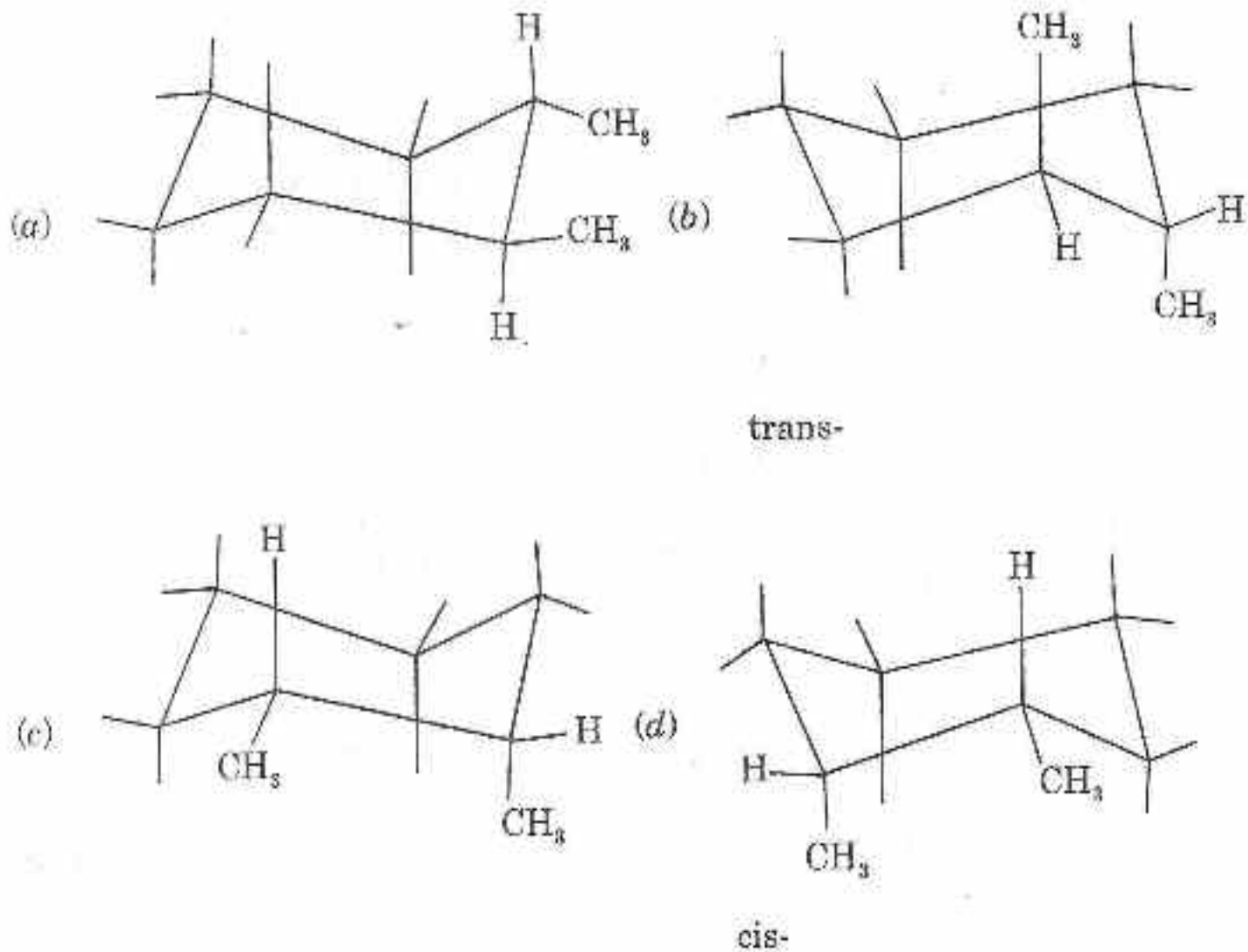
Which of the conformational isomers of the compound is most stable ?

(A) Structure (a)

(B) Structure (b)

(C) Structure (c)

(D) Structure (d)

76. Which of the following is an example of crossed aldol condensation reaction ?

(A)

$$O_2N-\langle O \rangle-CHO + O_2N-\langle O \rangle \xrightarrow[\text{NaOH}]{\text{concen.}} O_2N-\langle O \rangle-CH_2OH + O_2N-\langle O \rangle-COONa$$

(B) $CH_3COOC_2H_5 + C_6H_5COOC_2H_5 \xrightarrow{C_2H_5ONa} C_6H_5COCH_2COOC_2H_5$
$$+ C_2H_5OH$$

(C) $CH_3CH_2-C\overset{H}{\underset{O}{\diagup}} + CH_3C\overset{H}{\underset{H}{-}}C\overset{H}{\underset{O}{\diagup}} \rightarrow CH_3CH_2\overset{H}{\underset{OH}{C}}-\overset{CH_3}{\underset{H}{C}}-C\overset{H}{\underset{O}{\diagup}}$

(D) $C_6H_5C\overset{H}{\underset{O}{\diagup}} + CH_3C\underset{\overset{\|}{O}}{}-CH_3 \xrightarrow[100°]{\text{NaOH}} C_6H_5\overset{H}{C}=\overset{H}{C}-COCH_3$
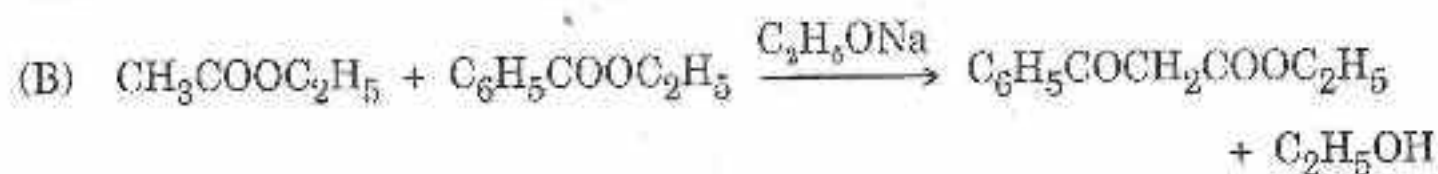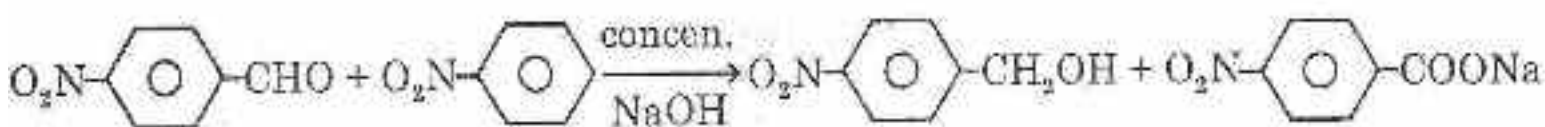
77. Which of the following statements is *correct* with regard to nucleophilic addition reaction ?

(A) A positively charged intermediate ion is formed

(B) An electron withdrawing deactivates a C=C bond toward electrophilic addition

(C) An electron withdrawing group stabilises the transition state leading to the formation of an intermediate anion by dispersal of negative charge

(D) An electron releasing group stabilises a transition state leading to the formation of carbocation by dispersing the positive charge

78. Which of the following examples illustrates the electrophilic addition reaction ?

(A)

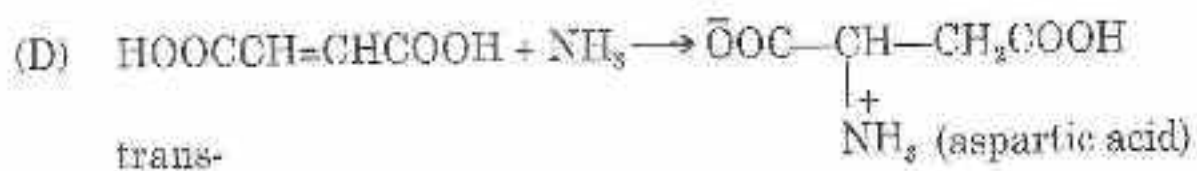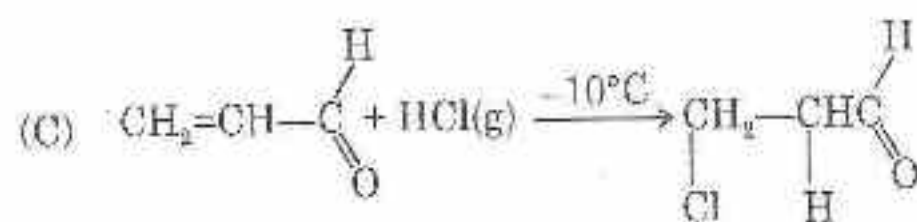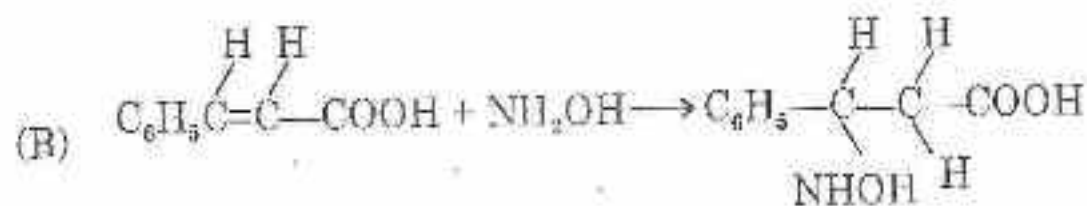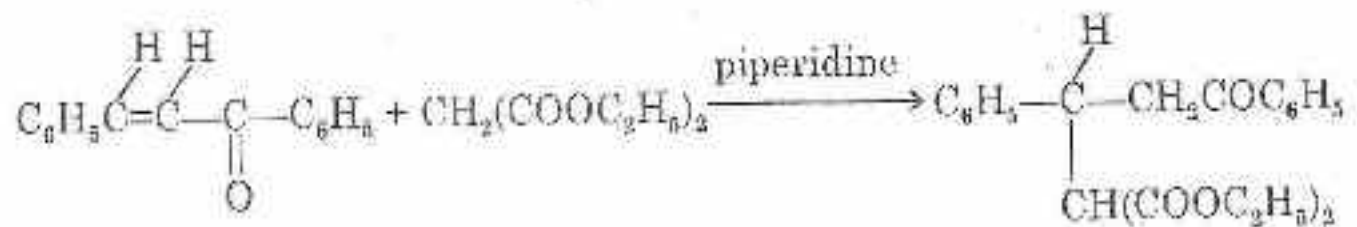$$C_6H_5C\overset{H}{=}C\overset{H}{-}\underset{\underset{O}{\parallel}}{C}-C_6H_5 + CH_2(COOC_2H_5)_2 \xrightarrow{\text{piperidine}} C_6H_5-\underset{\underset{CH(COOC_2H_5)_2}{\mid}}{\overset{H}{\underset{\mid}{C}}}-CH_2COC_6H_5$$

(B)

$$C_6H_5C\overset{H}{=}C\overset{H}{-}COOH + NH_2OH \longrightarrow C_6H_5-\underset{\underset{NHOH}{\mid}}{\overset{H}{\underset{\mid}{C}}}-\underset{\underset{H}{\mid}}{\overset{H}{\underset{\mid}{C}}}-COOH$$

(C) $CH_2=CH-\underset{\underset{O}{\parallel}}{C}\overset{H}{\diagup} + HCl(g) \xrightarrow{-10°C} CH_2-\underset{\underset{H}{\mid}}{\overset{Cl}{\underset{\mid}{CH}}}C\overset{H}{\diagdown}_{O}$

(D) $HOOCCH=CHCOOH + NH_3 \longrightarrow \bar{O}OC-\underset{\underset{NH_3}{\overset{+}{\mid}}}{CH}-CH_2COOH$

trans- NH_3 (aspartic acid)

79. Which of the following compounds gives iodoform test ?

(A) $C_6H_5CH_2OH$

(B) $CH_3CH_2\underset{\underset{OH}{\mid}}{\overset{H}{\underset{\mid}{C}}}-CH_2CH_3$

(C) $CH_3-\underset{\underset{CH_3}{\mid}}{\overset{CH_3}{\underset{\mid}{C}}}-OH$

(D) $C_6H_5\underset{\underset{OH}{\mid}}{\overset{H}{\underset{\mid}{C}}}-CH_3$
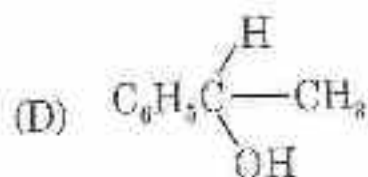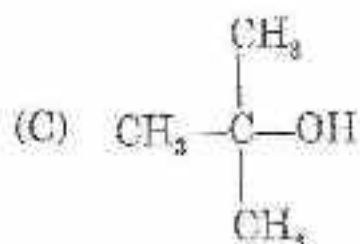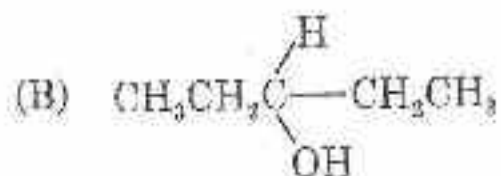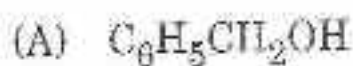
80. Which of the following hormones is present in upper intestine and stimulates contraction of gall bladder ?

   (A) Thyroid hormones (T_3, T_4)   (B) Glucagon

   (C) Cholecystokinin   (D) Insulin

81. Who is the author of *Travels in the Western Himalayas* ?

   (A) G.C. Barnes   (B) M.S. Randhawa

   (C) J.B. Lyall   (D) A.F.P. Harcourt

82. Which pass joins Kangra to Bharmaur ?

   (A) Jalsu   (B) Dulchi

   (C) Tamsar   (D) Chobia

83. Which raja of Kangra fell in love with a gaddi girl ?

   (A) Ghammad Chand   (B) Megh Chand

   (C) Bidhi Chand   (D) Sansar Chand

84. From which country were Angora rabbits originally imported by the Himachal Pradesh Government ?

   (A) Australia   (B) West Germany

   (C) Soviet Union   (D) USA

85. In which district of Himachal Pradesh is Sainj Valley situated ?

(A) Chamba   (B) Shimla

(C) Kullu   (D) Kangra

86. In which year did Mandi conspiracy, led by Mian Jawahar Singh and Rani Khairgarhi, take place ?

(A) 1909-10   (B) 1914-15

(C) 1933-34   (D) 1944-45

87. Which rani of Chamba's sacrifice is rendered in a song called *Sukrat* ?

(A) Champavati   (B) Sarda

(C) Sampurna Devi   (D) Suhi (Naina Devi)

88. Where is carp fish seed farm in Bilaspur District of H.P. ?

(A) Kandraur   (B) Jeori

(C) Deoli   (D) Jhabola

89. According to 2012-13 Economic survey who operationalises the Rural Self Help Employment Institutions in Himachal Pradesh ?

(A) NGOs   (B) Banks

(C) Cooperative Societies   (D) Education Department

90. In the Crop Insurance Scheme of H.P. Government, what is the extent of subsidy (on the premium) to the small and marginal farmers ?

   (A) ten percent

   (B) thirty percent

   (C) forty percent

   (D) fifty percent

91. Which is the longest railway tunnel in India ?

   (A) Ukashi-Bhoke (in Maharashtra)

   (B) Balli-Canocona (in Goa)

   (C) Banihal-Kazigund (in J & K)

   (D) Karwar-Harwada (in Karnataka)

92. When was telegraph service made available by the East India Company to the General Public ?

   (A) 1852 A.D.

   (B) 1854 A.D.

   (C) 1856 A.D.

   (D) 1857 A.D.

93. Who is called *Deshbandhu* ?

   (A) C.R. Das

   (B) Subhas Chandra Bose

   (C) C.F. Andrews

   (D) Bal Gangadhar Tilak

94. Which family owned the Lakshadweep Islands from 1545 A.D. to 1819 A.D. ?

   (A) Namoondiri

   (B) Nair

   (C) Ezwaha

   (D) Arakkal

95. Who is the author of *Satyarth Prakash* ?

(A) Swami Vivekananda

(B) Aurobindo Ghosh

(C) Dayanand Saraswati

(D) Balraj Madhok

96. Who is Nicolas Maduro ?

(A) President of Venezuela

(B) President of Uruguay

(C) President of Chile

(D) President of Argentina

97. To which country does sprinter Usain Bolt belong ?

(A) Russia

(B) Ghana

(C) USA

(D) Jamaica

98. Which day is observed as anti-tobacco day ?

(A) March 24

(B) May 31

(C) June 14

(D) December 1

99. Which Polish astronomer put forward the theory that earth revolves round the sun ?

(A) Charles Darwin

(B) William Harvey

(C) Nicolus Copernicus

(D) Isaac Newton

100. Which is the largest planet ?

(A) Venus

(B) Mars

(C) Saturn

(D) Jupiter