set A
Physical full length (1-6)

1. Express the relationship between radius (r) and the edge length in the *fcc* unit cell. (1)
2. The intermetallic compound LiAg crystallizes in cubic lattice in which both lithium and silver have coordination number of eight. What is the type of crystal lattice? (1)
3. Why is alum used for coagulation of blood? (1)
4. What are n-type semiconductors? (1)
5. Based on dispersed phase, which type of colloid micelles are? (1)
6. What is forbidden zone? (1)
7. If the density of some lake water is 1.25 g mL^{-1} and contains 92 g of Na$^+$ ions per kg of water, calculate the molarity of Na$^+$ ions in the lake. (2)
8. For a first order reaction, show that the time required for 99% completion is twice the time required for the completion of 90% of reaction. (2)
9. Consider the following cell reactions:
   $2Fe(s) + O_2(g) + 4H^+(aq) \rightarrow 2Fe^{2+}(aq) + 2H_2O(l)$ $E^0 = 1.67$ V. At Fe^{2+} = 10^{-3} M, pO$_2$ = 0.1 atm and pH = 3, calculate the cell potential at 25^{0}C. (2)
10. State Henry's law and give one of its applications. (2)
11. Vapour pressure of pure water at 298 K is 23.8 mm Hg. 50 g of urea (NH$_2$CONH$_2$) is dissolved in 850 g of water. Calculate vapour pressure of water for this solution and its relative lowering. (2)
12. How does molar conductivity of strong electrolyte and weak electrolyte vary with concentration? Explain. (2)
13. Calculate the mole fraction of ethylene glycol (C$_2$H$_6$O$_2$) in a solution containing C$_2$H$_6$O$_2$ by mass. (2)
14. What are reactions taking place at cathode and anode in lead storage battery while discharging? Also, write the reaction while recharging. (2)
15. State and explain Raoult's law for a binary solution containing volatile components. (2)
16. Equilibrium constant (Kc) for a given cell reaction is 10. Calculate E^0_{cell}
    $A(s) + B^+(aq) \rightleftharpoons A^+(aq) + B(s)$ (2)
17. Graph between log k Vs 1/T is a straight line with slope = 1/2.303. Calculate E$_a$ of the reaction. (2)
18. (a) Which of the following properties of colloids is not dependent on the charge on colloidal particles? Coagulation, electrophoresis, electro-osmosis. Tyndall effect.
    (b) Why is low temperature favourable for physisorption?
    (c) Why is chemisorptions specific in nature? (3)
19. (a) How do we separate PbS from ZnS in froth floatation process?
    (b) What is basic principle of Zone refining?
    (c) Why are sulphide ores converted into oxide ores before reduction? (3)

Set-B
Physical full length (1-6)

1. What type of forces is responsible for the occurrence of chemisorptions? (1)
2. What is meant by sorption? (1)
3. What is meant by CMC? (1)
4. If 'a' is the edge length of the cube, what will be the distance between the body centered atom and one corner atom in a cube? (1)
5. What is meant by critical micelle concentration? (1)
6. Which of the following is most effective electrolyte in coagulation of $Fe(OH)_3$ sol?
   $AlCl_3$, K_3PO_4, $K_4[Fe(CN)_6]$, $MgCl_2$. (1)
7. What is meant by intrinsic semiconductor? (1)
8. Calculate the weight of silver (At. mass = 108) deposited by a quantity of electricity which displaces 5600 mL of O_2 at STP. (2)
9. Can you store copper sulphate in zinc container? Give reason.
   $E^0Cu^{2+}/Cu = +0.34$ V, $E^0Zn^{2+}/Zn = -0.76$ V. (2)
10. $Zn(s)|Zn^{2+}(aq) || Cu^{2+}(aq)|Cu(s)$
    $E^0Zn^{2+}/Zn = -0.76V$, $E^0Cu^{2+}/Cu = +0.34V$
    Calculate E^0cell and equilibrium constant 'K'. (2)
11. Write two differences between order of reaction and molecularity of a reaction. (2)
12. Four metals A, B, C, D have their standard reduction potential values are equal to -0.14V, +0.34V, -1.66V and +0.80V respectively. Arrange these metals in decreasing order of reactivity. Give reason. (2)
13. Calculate EH^+/H_2 in contact with a solution whose pH is 10. (2)
14. A first order reaction is 50% complete in 30 minutes at 27^0C and in 10 minutes at 47^0C. Calculate the rate constant at 27^0C and the energy of activation of the reaction in kJ mol^{-1}. (2)
15. At 300K, 36g of glucose ($C_6H_{12}O_6$) present per litre inits solution has osmotic pressure of 4.98 bar. If the osmotic pressure of another solution is 1.52 bar at the same temperature, Calculate the concentration of the other solution. (2)
16. Describe how the molecular mass of a substance can be determined by method based on measurement of osmotic pressure. (2)
17. What are pseudo first order reactions? Give one example of such reactions. (2)
18. (a) The rate of reaction $X \rightarrow Y$ becomes 8 times when concentration of the reactant 'X' is doubled. Write the rate law of the reaction.
    (b) How does rate constant vary with reactant concentration?
    (c) What is specific reaction rate or rate constant? (3)
19. (a) What happens when Fe_3O_4 is heated at 850 K?
    (b) What is meant by anisotropy?
    (c) Why are solids having F-centres paramagnetic? (3)
20. An element crystallizes in fcc structure. Its edge length is 400 pm. Calculate its density and atomic radius if its molar mass is 60 g mol^{-1}. (3)

Set-C
Physical Chemistry full length (1-6)

1. Why is physical adsorption multilayered? (1)
2. Name a compound which shows both Frenkel and Schottky defects. (1)
3. Why do some glass objects from ancient civilization found to become milky? (1)
4. Why is enthalpy of physisorption low? (1)
5. What is the relationship between edge length 'a' and atomic radius 'r' in a simple cubic crystal lattice? (1)
6. Which homogenous catalyst is used in lead chamber process for manufacture of sulphuric acid during oxidation of sulphur dioxide? (1)
7. Why LiCl becomes pink on heating with lithium vapours? (1)
8. For a chemical reaction, a graph is shown:
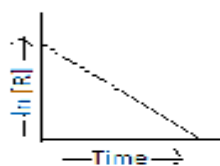
   (i) What is order of reaction?
   (ii) What are the units of rate constant 'k' for the reaction? (2)
9. 98%(w/w) H_2SO_4 has density 1.84 M. Calculate its molarity. (2)
10. Define the following: (2)
    (i) Ideal solution
    (ii) Osmotic pressure
11. Show that half life of first order reaction is independent of initial concentration. (2)
12. (a) What are collectors in froth floatation process?
    (b) Write the chemical reaction involved in the extraction of silver from silver ore. (2)
13. The unit cell of an element of atomic mass 108u and density 10.5 g cm^{-3} is a cube with edge length, 409 pm. Find the type of unit cell of the crystal. (2)
14. Explain the following terms with suitable example with suitable examples: Ferromagnetism and Ferrimagnetism (2)
15. 1.8 g of a compound (molar mass = 256 g mol^{-1}) to be dissolved in 75 g of benzene. Calculate depression in freezing point [K_f = 5.12 K Kg mol^{-1}]. (2)
16. Define the following:
    (i) Molarity
    (ii) Boiling point elevation constant (2)
17. In the reaction, P + Q → R + S, the time taken for 75% reaction of 'P' is twice the time taken for 50% of the reaction of 'P'. The concentration of 'Q' varies with reaction time

Set – A
Inorganic Chemistry (7-9)

1. (a) Why does NO_2 dimerise?
   (b) H_2S is less than H_2Te, why? (2)
2. (a) What are different oxidation states shown by actinoids?
   (b) Which of 4d-block elements may not be regarded as transition metal? (2)
3. How do you prepare:
   (i) $KMnO_4$ from K_2MnO_4 (ii) Na_2CrO_4 from $FeCr_2O_4$. (2)
4. (a) Write the IUPAC name of $[Co(NH_3)_6]^{3+}$.
   (b) What type of isomerism is shown by the following complex? $[Cr(NH_3)_6][Co(CN)_6]$
   (c) Why is $[Co(en)_3]^{3+}$ more stable than $[Co(NH_3)_6]^{3+}$? (3)
5. (a) Mn^{2+} compounds are more stable than Fe^{2+} towards oxidation to +3 state.
   (b) In 5d-transition series, which element is not regarded as transition metal and why?
   (c) Which bivalent cation in 3d-transition series is the most paramagnetic and why? (3)
6. (a) Write IUPAC name of $[Co(en)_3][Cr(C_2O_4)_3]$.
   (b) Predict the shape and magnetic behavior of
        (i) $[Cr(H_2O)_6]^{3+}$ (ii) $[Pt(NH_3)_2Cl_2]$
   [Atomic number of Cr = 24, Pt = 78] (3)
7. (a) Complete the following reactions:
        (i) $SF_4 + H_2O \rightarrow$ (ii) $PCl_3 + H_2O \rightarrow$
   (b) Why is H_3PO_2 better reducing agent than H_3PO_3? (3)
8. (a) Write IUPAC name of $[Co(H_2O)_4(NH_3)_2]Cl_2$.
   (b) Discuss the shape and magnetic moment of $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$. (3)
9. (a) Why is oxygen diatomic, whereas sulphur octaatomic?
   (b) Draw the shapes of (i) SO_2 (ii) IF_5
   (c) Out of F_2 and Cl_2 which is better oxidizing agent and why? (3)
10. (a) Why is NH_3 stronger base than PH_3?
    (b) What happens when white phosophorus is heated with NaOH solution? Give chemical equation.
    (c) Draw the structure of $HClO_4$. (3)
11. (i) When $KMnO_4$ is titrated with warm oxalic acid in acidic medium, the colour is discharged slowly in the beginning but after sometime, it disappears rapidly, why?
    (ii) It is necessary remove CO when NH_3 is obtained by Haber's process, why?
    (iii) What is the sign of ΔH and ΔS when gas gets adsorbed on the surface of a solid? (3)
12. (a) What happens when SO_2 (g) is passed through lime water? Write chemical equation.
    (b) Why does NH_3 have more proton affinity than PH_3?
    (c) Why does 'Xe' form compound with F_2 but not with Cl_2? (3)

Set – B
Inorganic Chemistry (7-9)

1. (a) Complete the following reactions:
   (i) $MnO_4^- + Fe^{2+} + H^+ \rightarrow$ (ii) $Cr_2O_7^{2-} + Sn^{2+} + H^+ \rightarrow$ (2)
2. (i) Why is Cu^{2+} paramagnetic whereas Cu^+ diamagnetic?
   (ii) Why is Fe^{2+} smaller than Mn^{2+}?   (2)
3. Complete the following reactions:
   (i) $XeF_6 + H_2O \rightarrow$
   (ii) $XeF_6 + NaF \rightarrow$ (2)
4. (a) Why is ICl more reactive than I_2?
   (b) Name two poisonous gases which can be prepared from chlorine gas.
   (c) Why does fluorine show anomalous behavior?   (3)
5. (a) Explain why $[Fe(H_2O)]^{3+}$ has magnetic moment value of 5.92 BM whereas $[Fe(CN)_6]^{3-}$ has a value of only 1.74 BM.
   (b) Which of the following complex is more stable and why?
      $[Fe(CN)_6]^{3-}$ or $[Fe(CN)_6]^{4-}$ (3)
6. Complete the following reactions:
   (i) $MnO_4^- + SO_2 + H_2O \rightarrow$ (ii) $CrO_4^{2-} + H^+ \rightarrow$ (iii) $Cr_2O_7^{2-} + Fe^{2+} \rightarrow$ (3)
7. What can be inferred from the magnetic moment values of the following species?
   Write their electronic configuration according to crystal field theory.

Example	Magnetic moment(BM)
$K_4[Mn(CN)_6]$	2.2
$[Fe(H_2O)_6]^{2+}$	5.3
$K_2[MnCl_4]$	5.9

   (3)
8. (a) Which type of isomerism is shown by $[Cr(NH_3)_6][Co(CN)_6]$
   (b) Write the state of hybridization, shape and IUPAC name of the complex $[Ni(CO)_4]$.
   (Atomic number of Ni is 28)   (3)
9. (a) Complete the following reactions?
      (i) $SO_2 + Cr_2O_7^{2-} + H^+ \rightarrow$ (ii) $S_2O_3^{2-} + MnO_4^- + H_2O \rightarrow$
   (b) Which element of the first transition series has highest second ionization enthalpy and why?   (3)
10. (i) Which is the strongest reducing agent among hydrogen halide and why?
    (ii) Name one radioactive gaseous element.
    (iii) Which element has the higher ionization enthalpy in periodic table?   (3)
11. Write the state of hybridization, shape and IUPAC name of the complex $[FeF_6]^{3-}$.
    (Atomic number of Fe = 26)   (3)
12. Complete the following reactions:
    (i) $I_2 + NaOH$ (hot and conc.) $\rightarrow$

Set – C
Inorganic Chemistry (7-9)

1. Write the structure of the following:
   (i) dichromate ion
   (ii) permanganate ion   (2)
2. Complete the following reactions:
   (i) $MnO_4^- + H_2O + 3e^- \rightarrow$
   (ii) $MnO_4^- + H^+ + 5e^- \rightarrow$ (2)
3. (a) Why is the single O-O bond weaker than single S-S bond?
   (b) $SbCl_5$ is more covalent than $SbCl_3$, why?
   (c) Nitrogen exists as N_2, whereas phosphorus exists as P_4. Why?   (3)
4. (a) Why is Cu^{2+} more stable than Cu^+?
   (b) Why is Ti^{3+} coloured whereas Sc^{3+} colourless?
   (c) Why does zinc have lowest enthalpy of atomization in 3d-series?   (3)
5. (i) Why is white phosphorus more reactive than red phosphorus?
   (ii) Why is oxygen gas whereas sulphur solid?
   (iii) Why does sulphur show catenation to maximum extent in group 16?   (3)
6. (a) Write structure of isomer of $[CO(NH_3)_3Cl_3]$.
   (b) Discuss the hybridization, shape and magnetic behavior of $[Mn(CN)_6]^{4-}$
   (Atomic number of Mn = 25)   (3)
7. (a) What will be correct order for the wavelength of absorption in the visible region for the following:
   $$[Ni(NO_2)_6]^{4-}, [Ni(NH_3)_6]^{2+}, [Ni(H_2O)_6]^{2+}$$
   (b) Calculate the overall complex dissociation equilibrium constant for $[Cu(NH_3)_4]^{2+}$ ion, given B_4 for this complex is 2.1×10^{13}.
   (c) Name a ligand which can be used to estimate the hardness of water.   (3)
8. (a) Name two allotropes of sulphur. Which of them is more stable at room temperature? Which of them is formed at 369 K?
   (b) Why is sulphur paramagnetic in vapour state?   (3)
9. (a) Why do transition metals show variable oxidation states?
   (b) Name one lanthanoid which is radioactive.
   (c) What is meant by lanthanoid contraction?   (3)
10. Arrange the following in the order of property indicated for each set:
    (i) F_2, Cl_2, Br_2, I_2 – Increasing bond dissociation energy.
    (ii) $SO_2, SO_3, N_2O_5, Cl_2O_7$ – Increasing acidic character.
    (iii) $NH_3, PH_3, AsH_3, SbH_3, BiH_3$ – Increasing base strength.   (3)
11. Complete the following reactions:
   (i) $(NH_4)_2Cr_2O_7 \xrightarrow{\text{heat}}$

Set-A
Organic chemistry full length (10-13)

1. Draw the structure of 1-phenylethanol. (1)
2. What products are obtained when anisole reacts with HI? (1)
3. Write the IUPAC name of the following compound: (1)

4. Complete the following reaction: (1)

5. Write the IUPAC name of the following: (1)

   $CH_3-CH=CH-CH_2OH$

6. Write the IUPAC name of the following compound : (1)

   $CH_3-O-CH_2-CH-CH_3$
   |
   Br
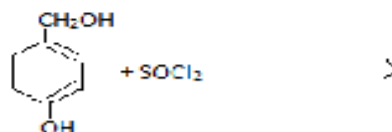
7. Why do ethers have dipole moment? (1)
8. Write IUPAC name of the following: (1)

9. Convert chlorobenzene to phenol. (1)
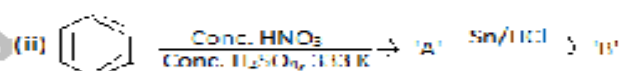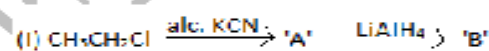10. Convert
    (i) Benzene to m-nitroaniline.
    (ii) 4-Nitrotoluene to 2-Bromobenzoic acid. (2)
11. Complete the following reaction:

    (i) $CH_3CH_2Cl \xrightarrow{alc. KCN}$ 'A' $\xrightarrow{LiAlH_4}$ 'B'

    (ii) $\xrightarrow[\text{Conc. } H_2SO_4, 333K]{\text{Conc. } HNO_3}$ 'A' $\xrightarrow{Sn/HCl}$ 'B'
    (2)

12. Convert
    (i) Aniline to 2,4,6-tribromoaniline   (ii) Aniline to p-nitroaniline (2)
13. A compound 'A' with molecular formula $C_3H_7O_2N$ on reaction with Fe and conc. HCl
   gives a compound 'B' (C_3H_9N), which on reaction with $NaNO_2$ and HCl gives 'C' (C_3H_8O).

Set-B
Organic chemistry full length (10-13)

1. Write the structure of phenyl ethyl ether. (1)
2. Why is chlorobenzene less reactive than ethyl chloride towards nucleophilic substitution reaction? (1)
3. Write IUPAC name of the following : (1)

   CH₃-C=CH-CH₂Br
       |
       CH₃

4. Arrange the following in increasing order of acidic character : (1)
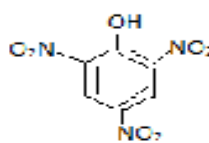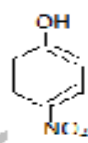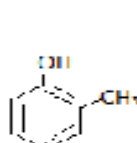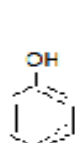
5. Convert phenol to picric acid. (1)
6. Arrange the following alcohols in increasing order of acidic character: (1)
   CH_3CH_2OH, CH_3OH, $CH_3CH_2CH_2OH$, $CH_3CH_2CH_2CH_2OH$.
7. What happens when $CH_2=CH-C\equiv CH$ reacts with one mole of HCl?
   Write chemical equation. (1)
8. What happens when ethyl chloride is treated with aq. KOH? Write chemical equation. (1)
9. Why are amines soluble in water? (1)
10. Distinguish between the following compounds by suitable chemical test:
    (i) CH_3NH_2 and $(CH_3)_2NH$ (ii)$C_2H_5NH_2$ and $C_6H_5NH_2$ (2)
11. Predict the reagent or the product in the following reaction sequence:

(2)
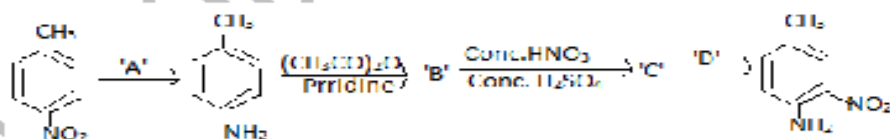
12. Give reason : (2)
    (i)   Aniline is weaker base than cyclohexylamine.
    (ii)   Ammonolysis of alkyl halide does not give corresponding amine in pure state.
13. Convert
    (i) Aniline to fluorobenzene
    (ii) p-Toluidine to 2-Bromo-4-methyl aniline. (2)
14. What happens when
    (i) Cyclohexanone is treated with Zn(Hg) and HCl?
    (ii) Benzaldehyde is heated with conc. NaOH? (2)

Set-C
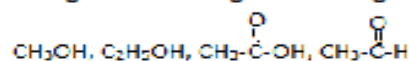# Organic chemistry full length (10-13)

1. Write IUPAC name of the following compound : (1)
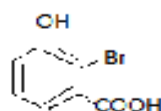
2. Write the structure of the 3-methyl but-2-enoic acid. (1)
3. Arrange the following in increasing order of boiling point : (1)

$$CH_3OH, \ C_2H_5OH, \ CH_3\text{-}\underset{\underset{O}{\|}}{C}\text{-}OH, \ CH_3\text{-}\underset{\underset{O}{\|}}{C}\text{-}H$$

4. Arrange the following in increasing order of reactivity towards Nucleophilic addition reaction :
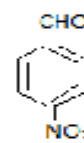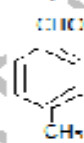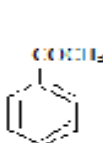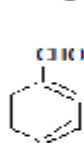
(1)

5. Write IUPAC name of the following compound: (1)

$$CH_3 \ CH=CH \ \underset{\underset{O}{\|}}{C} \ OH$$
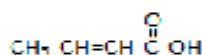
6. Write the structural formula of 2-methoxy-2-methylpentan-3-one. (1)
7. Write the IUPAC name of the following compound: (1)

$$CH_3\text{-}\underset{\underset{OH}{|}}{CH}\text{-}CH=CH\text{-}COOH$$

8. Write IUPAC name of the following compound: (1)

$$CH_3\text{-}CH\text{-}CH\text{-}CH\text{-}CH\text{-}CH_3$$
$$\quad\quad\ \ | \quad\quad\quad\ \ |$$
$$\quad\quad\ Cl \quad\quad\quad OH$$
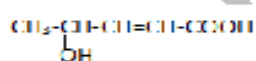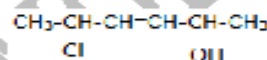
9. Why does phenol have lower dipole moment than methanol? (1)
10. Distinguish between following compounds by suitable chemical test: (2)
    (i)   Methanol and Ethanol
    (i)   Phenol and Benzyl alcohol
11. Complete the following reactions:

(a) $\xrightarrow{Sn/HCl}$ 'A' $\xrightarrow{Br_2(aq)}$ 'B'

(b) $CH_3COOH \xrightarrow[heat]{NH_3}$ 'A' $\xrightarrow{Br_2/KOH}$ 'B'
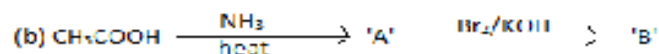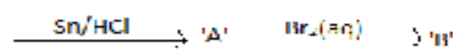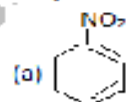
(2)

Set – A
Applied Chemistry (14-16)

1. Write the reaction of glucose with hydrazine. (1)

2. (i) Give one example of reducing and one example of non-reducing sugar.
   (ii) Give two differences between RNA and DNA. (3)

3. (a) What is the cause of feeling of depression in human beings? Name a drug which can be useful in treating this depression.
   (b) Explain 'Antifertility drug' with an example. (3)

4. (a) What is name polymer formed by condensation of phenol and formaldyhyde? Give its use.
   (b) Give two differences between elastomers and fibres. (3)

5. (a) What are antiseptics?
   (b) Name the sweetening agent used in preparation of sweet for a diabetic patient.
   (c) What is the side product of soap industry? (3)

6. (i) What are antacids? Give an example.
   (b) Why should we not take analgesics and antipyretics on an empty stomach?
   (c) What are tranquilizers? Give an example. (3)

7. (a) What is the advantage of soap over detergent?
   (b) What are non-ionic detergents? Give their use.
   (c) What are antacids? Give an example. (3)

8. (a) Give two differences between addition and condensation polymerization.
   (b) What is monomer of Nylon-6? Give its structure. (3)

9. (a) Give two differences between thermoplastics and thermosetting plastics.
   (b) What are the monomeric repeating units of Nylon-6 and Nylon-6,6? (3)

10. Ashish Mukherji has discovered a protein which can dissolve blood clots. It does not have side effects like earlier drugs used. Gastro-intestinal bleeding is most commonly found in many patients after treatment with clot bursting drugs.
    After reading the passage answer the following questions:
    (i) What values are associated with Dr. Ashish Mukherji?
    (ii) Which enzyme is used to dissolve blood clots?
    (iii) Why are enzyme highly specific in their action?
    (iv) To what class of compounds enzyme belong? (4)

11. Sachin took his father for medical check up. He told his doctor about the symptoms like increase in apetite, excessive thirst, frequent urination, feeling tired, depressed and eye sight problem. Doctor advised him to take balanced diet no sugar and do walking daily.
    After reading the passage, answer the following questions:
    (i) What values are associated with Sachin?
    (ii) From which disease Sachin's father is suffering?

Set – B
Applied Chemistry (14-16)

1. What are biocatalysts? Give an example. (2)
2. (a) What happens when glucose reacts with Br_2(aq)?
   Write chemical reaction reaction involved.
   (b) Give one difference between globular and fibrous proteins. (2)
3. (a) Which one of the following is a food preservative?
   Sodium benzoate, Alitame, Equanil, Chloramphenicol.
   (b) Why is bithional added to soap?
   (c) Which class of drugs is used in sleeping pills? (3)
4. Define the following terms:
   (a) Primary structure of protein (b) Non-essential amino acids. (2)
5. (a) Write reaction of glucose with pheny hydrazine.
   (b) What is meant by denaturation of proteins. (2)
6. (a) Name the base which is present in DNA but not in RNA.
   (b) Name the deficiency of which vitamin cause the following diseases?
       (i) Pernicious anaemia
       (ii) Xerophthalmia
   (c) Give one structural difference between amylase and amylopectin. (3)
7. (a) What type of synthetic detergents are biodegradable and why?
   (b) What are wide spectrum antibiotics? Give an example.
   (c) What are disinfectants? Give an example. (3)
8. (a) Write the monomers of Bakelite. What type of polymer is it?
   (b) Is natural rubber homopolymer or copolymer?
   (c) Arrange the following in increasing order of forces of attraction:
       Nylon 6, Neoprene, PVC. (3)
9. (a) Give one example of
       (i) Natural polymer. (ii) Chain growth polymer.
   (b) Arrange the following polymers in increasing order of interparticle attraction:
       Nylon-6, Buna-S, PVC
   (c) What is meant by vulcuanisation of rubber? (3)
10. (i) Name one narcotic used as analgesic.
    (ii) Give an example of artificial sweetener which can be used in cold food and drinks.
    (iii) what are cationic dergents? (3)
11. (a) Give example of an antihistamine drug.
    (b) Which one of the following drugs is a Tranquilizer:
        Morphine, Equanil, Asparine, Chloroxylenol?
    (c) Name artificial sweetener which is stable at cooking temperature. (3)

Set – C
Applied Chemistry (14-16)

1. Define the following:
    (i) Invert sugar   (ii) Nucleoside   **(2)**
2. What are anomers? Give examples. Give two differences between them. **(2)**
3. (a) Name sodium salt of organic acid used as preservative in cold drinks.
    (b) Define chemotherapy.
    (c) Give one example of wide spectrum antibiotic. **(3)**
4. (a) Give one example of thermosetting plastic.
    (b) What is meant by condensation polymerization?
    (c) Is nylon 6,6 homopolymer or copolymer? **(3)**
5. (i) What is the structure of monomer of Teflon.
    (ii) What are thermoplastics? Give an example.
    (iii) Which of the following is elastomer.
          Nylone, Neoprene, PVC, Bakelite. **(3)**
6. (a) How is soap prepared? Give chemical reaction.
    (b) Why do we require artificial sweetening agents?
    (c) Why do soaps not work in hard water? **(3)**
7. Students of a school decided to create awareness among the people about harmful effects of plastic bags. They made paper bags and distributed to vegetable vendors, shopkeepers and departmental stores. All students pledged not to use plastic bags in future. After reading the passage, answer the following questions:
    (i) What values are shown by students?
    (ii) What are natural polymers? Give one example.
    (iii) Name a monomer which will lead to formation of Neoprene.
    (iv) Is polystyrene homopolymer or copolymer? **(4)**
8. Ramesh takes a lot of junk food, such as burger, French fries and Pizza. His teacher Mr. Manish got his medical check up in school and found that he is suffering from hypertension. The doctor gave him advice not to take junk food and do exercise dail. He should take balanced diet rich in proteins, vitamins and minerals.
    (i) What are the values associated with Mr. Manish?
    (ii) Why should children take milk and its products?
    (iii) Which protein is present in milk and egg?
    (iv) What is meant by denaturation of proteins? **(4)**
9. Mohan was suffering from cough and cold. He took Benadryl cough syrup to get relief. His friend Vinay took him to Dr. Mukherji. He gave him Azithral and told him not to take Benadryl as it has lot of side effects.
    (i) What values are associated with Dr. Mukherji and Vinay?

Solid State

1. ZnO turns yellow on heating. Why? (1)

2. Analysis shows that FeO has a non-stoichiometric composition with formula $Fe_{0.95}O$. Give reason. (1)

3. Calculate the number of unit cells in 8.1 g of aluminium if it crystallizes in a face-centred cubic (fcc) structure. (Atomic mass of Al = 27 g mol^{-1}). (1)

4. An element 'X' (At. mass = 40 g mol^{-1}) having f.c.c. structure, has unit cell edge length of 400 pm. Calculate the density of 'X' and the number of unit cells in 4 g of 'X'. (NA = 6.022 x 1023 mol^{-1}).

5. An element crystallizes in a f.c.c. lattice with cell edge of 400 pm. The density of the element is 7 g cm^{-3}. How many atoms are present in 280 g of the element? (3)

6. What is the formula of a compound in which the element Y forms hcp lattice and atoms of X occupy $1/3^{rd}$ of octahedral voids? (1)

7. Examine the given defective crystal :

   ```
   X⁺     Y⁻     X⁺     Y⁻     X⁺
   Y⁻  ˣ⁺  O     Y⁻     X⁺     Y⁻
   X⁺     Y⁻     X⁺     Y⁻     X⁺
   Y⁻     X⁺     Y⁻     X⁺     Y⁻
   ```

   Answer the following questions:
   (i) Is the above defect stoichiometric or non-stoichiometric?
   (ii) Write the term used for this type of defect.
   (iii) Why do silver halides show this type of defect? (3)

8. Account for the following:
   (i) Why does presence of excess of lithium makes LiCl crystal pink?
   (ii) A solid with cubic crystal is made of two elements P and Q. Atoms of Q are at the corners of the cube and P at the body-centre. What is the formula of the compound? (2)

9. Aluminium crystallizes in an fcc structure. Atomic radius of the metal is 125 pm. What is the length of the side of the unit cell of the metal? (2)

10. (a) What change occurs when AgCl is doped with $CdCl_2$?
    (b) What type of semiconductor is produced when silicon is doped with boron? (2)

11. Name the non stoichiometric point defect responsible for colour in alkali metal halides. (1)

12. An element occurs in the bcc structure with cell edge of 288 pm. The density of the element is 7.2 g cm^{-3}. How many atoms of the element does 208 g of the element contain? (3)

13. What is the formula of a compound in which the element Y forms hcp lattice and atoms of X occupy $2/3^{rd}$ of tetrahedral voids? (1)
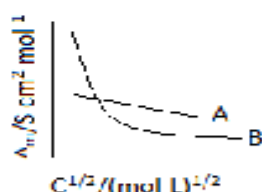
Solution

1. Will the elevation in boiling point be same if 0.1 mol of Sodium chloride or 0.1 mol of sugar is dissolved in 1 L of water? Explain. (2)

2. Calculate the boiling point of a 1M aqueous solution (density 1.04 g ml^{-1}) of Potassium chloride (K_b for water = 0.52 K Kg mol^{-1}, Atomic masses : K = 39u, Cl = 35.5u). Assume Potassium chloride is completely dissociated in solution. (3)

3. What is meant by positive deviations from Raoult's las? Give an esample. What is the sign of Δ_{mix} H for positive deviation? (2)

4. Define azeotropes. What type of azeotrope is formed by positive deviation from Raoult's law? Give an example. (2)

5. 3.9 g of benzoic acid dissolved in 49 g of benzene shows a depression in freezing point of 1.62 K. Calculate the van't Hoff factor and predict the nature of solute (associated or dissociated)(Given : Molar mass of benzoic acid = 122 g mol^{-1}, K_f for benzene = 4.9 K Kg mol^{-1}) (3)

6. State Henry's law. Why do gases always tend to be less soluble in liquids as the temperature is raised? (2)

7. State Raoult's law for the solution containing volatile components. Write two differences between an ideal solution and a non-ideal solution. (2)

8. Calculate the amount of CaCl$_2$ (molar mass = 111 g mol^{-1}) which must be added to 500 g of water to lower its freezing by 2 K, assuming CaCl$_2$ is completely dissociated. (K_f for water = 1.86 K Kg mol^{-1}) (3)

9. What are isotonic solutions? (2)

10. Calculate the mass of compound of compound (molar mass = 256 g mol^{-1}) to be dissolved in 75 g of benzene to lower its freezing point by 0.48 K (K_f = 5.12 K kg mol^{-1}) (2)

11. Define an ideal solution and write one of its characteristics. (2)

12. Some liquids form 'azeotropes'. What are azeotropes? (1)

13. State Henry's law. What is the effect of temperature on the solubility of a gas in a liquid? (2)

14. State Raoult's law for the solution containing volatile components. What is the similarity between Raoult's law and Henry's law? (2)

15. (a) Define the following terms:
    (i) Molarity
    (ii) Molal elevation constant (K_b)
    (b) A solution containing 15g urea (molar mass = 60 g mol^{-1}) per litre of solution in water has the same osmotic pressure (isotonic) as a solution of glucose (molar mass = 180 g mol^{-1}) in water. Calculate the mass of glucose present in one litre of its solution. (5)

16. (a) what type of deviation is shown by a mixture of ethanol and acetone? Give reason.
    (b) A solution of glucose (molar mass = 180 g mol^{-1}) in water is labeled as 10% (by mass). What would be the molality and molarity of the solution? (Density of solution = 1.2 g mol^{-1}) (5)

17. 18 g of glucose (molar mass = 180 g mol^{-1}) is dissolved in 1 Kg of water in a sauce pan. At what temperature will this solution boil (K_b for water = 0.52 K Kg mol^{-1}, boiling point of pure water = 373.15 K). (2)

Electrochemistry
ASSIGNMENT (Academic)

1. The following curve is obtained when molar conductivity (Λ_m) is plotted against the square root of concentration, $C^{1/2}$ for two electrotytes A and B.

   (a) How do you account for the increase in the molar conductivity of the electrolyte A on dilution.

   (b) As seen from the graph, the value of limiting molar conductivity ($\Lambda^0 m$) for electrolyte B cannot be obtained graphically. **(3)**

2. A galvanic cell consists of a metallic zinc plate immersed in 0.1 M $Zn(NO_3)_2$ solution and metallic plate of lead in 0.02M $Pb(NO_3)_2$ solution. Calculate the emf of the cell. Write the chemical equation for the electrode reactions and represent the cell.

   (Given : $E^0_{Zn2+/Zn}$ = -0.76V; $E^0_{Pb2+/Pb}$ = -0.13V) **(3)**

3. (a) Following reactions occur at cathode during the electrolysis of aqueous silver chloride solution :

   $Ag^+ (aq) + e^- \rightarrow Ag (s)$ $E^0 = 0.80$ V

   $H^+ (aq) e^- \rightarrow \frac{1}{2} H_2 (g)$ $E^0 = 0.00$ V

   On the basis of their standard electrode potential (E^0) values which reaction is feasible at the cathode and why?

   (b) Define limiting molar conductivity. Why conductivity of an electrolyte solution decreases with the decrease in concentration? **(2)**

4. Calculate emf of the following cell at 25^0C :

   $Fe| Fe^{2+} (0.001M) || H^+(0.01M) | H_2(g) (1bar) | Pt(s)$

   $E^0 (Fe^{2+} | Fe) = -0.44$ V, $E^0(H^+ | H_2) = 0.00$ V **(3)**

5. (a) Following reactions occur at cathode during the electrolysis of

   $Na^+(aq) + e^- \rightarrow Na(s)$ $E^0 = -2.71$ V

   $H^+(aq) + e^- \rightarrow \frac{1}{2} H_2 (g)$ $E^0 = 0.00$ V

   on the basis of their standard reduction electrode potential (E^0) values which reaction feasible at the cathode and why?

   (b) Why does the cell potential of mercury cell remain constant throughout its life? **(2)**

6. (a) Calculate E^0_{cell} for the following reaction at 298 K :

   $2Cr(s) + 3Fe^{2+} (0.01M) \rightarrow 2Cr^{3+} (0.01M) + 3Fe(s)$

   Given : $E_{cell} = 0.261$ V

Assignment Academic
CHEMICAL KINETICS

1. What is the effect of adding a catalyst on
   (a) Activation energy (E_a), and   (b) Gibbs energy (ΔG) of a reaction?   (1)

2. A first order reaction takes 20 minutes for 25% decomposition. Calculate the time when 75% of the reaction will be completed.
   (Given : log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021)   (3)

3. For a reaction : $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$, rate = K
   (i) Write the order and molecularity of this reaction.   (ii) Write the unit of K.   (2)

4. The rate constant for the first order decomposition of H_2O_2 is given by the following equation:
   $\log k = 14.2 - 1.0 \times 10^4$ K/ T
   Calculate E_a for this reaction and rate constant k for its half-life period be 200 minutes.   (3)

5. For the hydrolysis of methyl acetate in aqueous solution, the following results were obtained:

t/s	0	30	60
[CH3COOH]/mol L^{-1}	0.60	0.30	0.15

   (i) Show that it follows pseudo first order reaction, as the concentration of water remains constant.
   (ii) Calculate the average rate of reaction between the time interval 30 to 60 seconds.   (5)

6. (a) For a reaction $A + B \rightarrow P$, the rate is given by
   Rate = k [A] $[B]^2$
   (i) How is rate of reaction affected if the concentration of B is doubled ?
   (ii) What is the overall order of a reaction if A is present in large excess ?
   (b) A first order reaction takes 30 minutes for 50% completion. Calculate the time required for 90% completion of this reaction.   (5)

7. (a) What is rate of reaction? Write two factors that effect the rate of reaction.
   (b) The rate constant of a first order reaction increases from 4×10^{-2} to 8×10^{-2} when the temperature changes from 27^0C to 37^0C. Calculate the energy of activation (E_a).
   (log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021).   (5)

8. A first order reaction takes 23.1 minutes for 50% completion. Calculate the time required for 75% completion of this reaction.   (2)

9. The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume :
   $SO_2Cl_2 (g) \rightarrow SO_2 (g) + Cl_2(g)$

Experiment	Time/s	Total pressure/atm
1	0	0.4
2	100	0.7

   Calculate the rate constant.   (3)

Assignment Academic
SURFACE CHEMISTRY

1. What type of colloid is formed when a liquid is dispersed in a solid? Give an example.   (1)
2. What type of colloid is formed when a gas is dispersed in a liquid? Give an example.   (1)
3. What type of colloid is formed when a solid is dispersed in a liquid? Give an example.   (1)
4. Write one difference in each of the following:
    (a) Multimolecular colloid and Associated colloid
    (b) Coagulation and Peptization
    (c) Homogenous catalysis and Heterogeneous catalysis   (3)
5. (a) Write the dispersed phase and dispersion medium of milk.
    (b) Write one similarity between physisorption and chemisorptions.
    (c) Write the chemical method by which $Fe(OH)_3$ sol is prepared from $FeCl_3$.   (3)
6. Write the reason for stability of colloidal sols.   (1)
7. Define the following terms :
    (i) O/W Emulsion   (ii) Zeta potential   (iii) Multimolecular colloids
8. Answer the following questions:
    (a) What happens when a freshly precipitated $Fe(OH)_3$ is shaken with a little amount of dilute solution of $FeCl_3$?
    (b) Why are lyophilic colloidal sols more stable than lyophobic colloidal sols?
    (c) What form Freundlich adsorption equation will take at high pressure?   (3)
9. What are emulsions? Name an emulsion in which water is a dispersed phase. (1)
10. Describe the following processes:
    (i) Dialysis   (ii) Electrophoresis   (iii) Tyndal effect   (3)
11. Describe the following:
    (i) Adsorption   (ii) Gel   (iii) Heterogenous catalysis   (3)
12. A delta is formed at the meeting point of sea water and river water. Why ?   (1)
13. Out of $BaCl_2$ and KCl, which one is more effective in causing coagulation of a negatively charged colloidal sol? Give reason.   (1)
14. Give reasons for the following observation :
    (i) Leather gets hardened after tanning.
    (ii) Lyophilic sol is more stable than lyophobic sol.
    (iii) It is necessary to remove CO when ammonia is prepared by Habber's process.   (3)
15. What is the difference between lyophilic and lyphobic sol?   (1)
16. Define the following terms : (1) Peptization   (ii) Sol   (iii) Enthalpy of adsorption (3)
17. What is the effect of temperature on chemisorptions?   (1)
18. What are different types of emulsions? Give one example of each type.   (3)
19. Why is adsorption always exothermic?   (1)

Academic Assignment
ISOLATION OF ELEMENTS

1. (a) Write the principle of vapour phase refining.
   (b) Write the role of dilute NaCN in the extraction of silver.
   (c) What is the role of collectors in the froth floatation process? Give an example of a collector. (3)
2. (a) write the principle of electrolytic refining.
   (b) Why does copper obtained in the extraction from copper pyrites have a blistered appearance?
   (c) What is the role of depressants in the froth floatation process? (3)
3. Write the principle of the following:
   (a) Zone refining
   (b) Froth floatation process
   (c) Chromatography (3)
4. (i) Name the method of refining which is based on the principle of adsorption.
   (ii) What is the role of depressant in froth floatation process?
   (iii) What is the role of limestone in the extraction of iron from its oxides? (3)
5. Answer the following:
   (i) What is the role of cryolite in the metallurgy of aluminium?
   (ii) Difference between roasting and calcinations.
   (iii) What is meant by the term 'chromatography? (3)
6. (i) Name the method of refining to obtain silicon of high purity.
   (ii) What is the role of SiO_2 in the extraction of copper?
   (iii) What is the role of depressants in froth floatation process? (3)
7. (i) Indicate the principle behind the method used for the refining of zinc.
   (ii) What is the role of silica in the extraction of copper?
   (iii) Which form of the iron is the purest form of commercial iron? (3)
8. Describe the underlying principle of each of the following processes:
   (i) Recovery of silver from the solution obtained by leaching silver ore with a solution of NaCN
   (ii) Electrolytic refining of a crude metal. (2)
9. What are the collectors used in froth floatation process? Name a substance that can be used as such. (1)
10. What is the role of CO_2 in the extractive metallurgy of aluminium from its ore? (1)
11. What is the role of coordination compound in metallurgy of metals. (1)
12. Describe the principle involved in each of the following processes:
    (i) Zone refining of metals   (ii) Vapour phase refining of metals. (2)
13. What is the role on NaOH in the metallurgy of aluminium? (1)
14. Describe the underlying principle of the Froth floatation process of concentration of ores. (1)

Academic Assignment
p-block elements

1. Write the formula of the compound of phosphorus which is obtained when conc. HNO_3 oxidises P_4. (1)

2. Draw the structures of the following:
   (a) H_2SO_3
   (b) $HClO_3$ (2)

3. Give reasons for the following:
   (a) Red phosphorus is less reactive than white phosphorus.
   (b) Electron gain enthalpies of halogens are largely negative.
   (c) N_2O_5 is more acidic than N_2O_3. (3)

4. Write the formula of the compound of sulphur which is obtained when conc. HNO_3 oxidises S_8. (1)

5. Draw the structures of the following:
   (a) $H_2S_2O_8$
   (b) ClF_3 (2)

6. Write the formula of the compound of iodine which is obtained when conc. HNO_3 oxidises I_2. (1)

7. Draw the structure of the following:
   (a) XeF_4
   (b) BrF_6 (2)

8. On heating $Pb(NO_3)_2$ a brown gas is evolved which undergoes dimerization on heating. Identify the gas. (1)

9. Write the structures of the following: (i) $(HPO_3)_3$ (ii) XeF_2 (2)

10. Assign reason for the following:
    (i) H_3PO_2 is a strong reducing agent than H_3PO_4.
    (ii) Sulphur shows more tendency for catenation than Oxygen.
    (iii) Reducing character increases from HF to HI. (3)

11. Draw the structures of the following: (i) H_2SO_4 (ii) XeF_4 (2)

12. (a) Complete the following chemical equations:
    (i) $Cu + HNO_3(dil) \rightarrow$ (ii) $P_4 + NaOH + H_2O \rightarrow$
    (b) (i) Why does $R_3P=O$ exist but $R_3N=O$ does not? (R = alkyl group)
    (ii) Why is dioxygen a gas but sulphur a solid?
    (iii) Why are halogens coloured? (5)

13. (a) Write balanced equations for the following reactions:
    (i) Chlorine reacts with dry slaked lime.   (ii) Carbon reacts with concentrated H_2SO_4
    (b) Describe the contact process the manufacture of sulphuric acid with special reference to the reaction conditions, catalysis used and the yield in the process. (5)

Academic assignment
Transition Elements and Inner Transition elements

1. (a) Account for the following:
   (i) Transition metals show variable oxidation states.
   (ii) Zn, Cd and Hg are soft metals.
   (iii) E^0 value for the Mn^{3+}/Mn^{2+} couple is highly positive (+1.57 V) as compared to Cr^{3+}/Cr^{2+}.
   (b) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements. (5)

2. (a) Following are the transition metal ions of 3d series:
   Ti^{4+}, V^{2+}, Mn^{3+}, Cr^{3+}
   (Atomic numbers: Ti = 22, V = 23, Cr = 24, Mn = 25)
   Answer the following:
   (i) Which ion is most stable in an aqueous solution and why?
   (ii) Which ion is a strong oxidizing agent and why?
   (iii) Which ion is colourless and why?
   (b) Complete the following equations:
   (i) $2\,MnO_4^- + 16\,H^+ + 5S^{2-} \rightarrow$
   (ii) $KMnO_4 \xrightarrow{}$ (5)

3. (a) Account for the following:
   (i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4.
   (ii) Zirconium and Hafnium exhibit similar properties.
   (iii) Transition metals act as catalysts.
   (b) Complete the following equations:
   (i) $2MnO_2 + 4KOH + O_2 \xrightarrow{}$ (ii) $Cr_2O_7^{2-} + 14\,H^+ + 6I^- \rightarrow$ (2)

4. The elements of 3d transition series are given as:
   Sc   Ti   V   Cr   Mn   Fe   Co   Ni   Cu   Zn
   Answer the following:
   (i) Write the element which is not regarded as a transition element. Give reason.
   (ii) Which element has the highest m.p.?
   (iii) Write the element which can show an oxidation state of +1.
   (iv) Which element is a strong oxidizing agent in +3 oxidation state and why? (5)

5. Name the following:
   (i) A transition metal which does not exhibit variation in oxidation state in its compounds.
   (ii) A compound where the transition metal is in the +7 oxidation state.

Academic assignment
Coordination compounds

1. (a) What type of isomerism is shown by the complex $[Co(NH_3)_5(SCN)]^{2+}$?
   (b) Why is $[NiCl_4]^{2-}$ paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic? (Atomic number of Ni = 28)
   (c) Why are low spin tetrahedral complexes rarely observed? (3)

2. When a coordination compound $NiCl_2.6H_2O$ is mixed with $AgNO_3$, 2 moles of AgCl are precipitated per mole of the compound. Write
   (i) Structural formula of the complex   (ii) IUPAC name of the complex. (2)

3. (a) For the complex $[Fe(CN)_6]^{4-}$, write the hybridization, magnetic character and spin type of the complex. (At. Number: Fe = 26)
   (b) Draw one of the geometrical isomers of the comples $[Co(en)_2Cl_2]^+$ which is optically active.(3)

4. How many ions are produced from the complex, $[Co(NH_3)_6]Cl_2$ in solution? (1)

5. What is meant by chelate effect? (1)

6. Write the IUPAC name of the following:
   (i) $[Co(NH_3)_6]Cl_3$ (ii) $[NiCl_4]^{2-}$ (iii) $K_3[Fe(CN)_6]$ (3)

7. What is the IUPAC name of the complex $[Ni(NH_3)_6]Cl_2$? (1)

8. Indicate the types of isomerism exhibited by following complexes:
   (i) $[Co(NH_3)_5(NO_2)]^{2+}$ (ii) $[Co(en)_3]Cl_3$ (iii) $Pt(NH_3)_2Cl_2$ (3)

9. (i) Write down the IUPAC name of the following complex:
   $[Co(NH_3)_3Cl]^{2+}$
   (ii) Write the formula for the following complex:
   Potassium tetrachloridonickelate (II) (2)

10. (i) Write down the IUPAC name of the following complex: (ii)
    Write the formula for the following complex:
    Pentaamminenitrito-o-Cobalt(III) (2)

11. (i) Draw the gemetical isomers of complex $[Pt(NH_3)_2Cl_2]$.
    (ii) On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$.
    (iii) Write the hybridization and magnetic behavior of the complex $[Ni(CO)_4]$. (3)

12. Write the IUPAC name and draw the structure of each of the following complex entities :
    (i) $[Co(ox)_3]^{3-}$ (ii) $[Cr(CO)_6]$ (iii) $[PtCl_3(C_2H_4)]$ (3)

13. What are ambident nucleophiles? Explain with an example. (2)

14. Write down the IUPAC names of the following complexes and also give stereochemistry and magnetic moment of the complexes :
    (i) $[Co(NH_3)_5Cl]$ (ii) $[CrCl_3(py)_3]$ (iii) $K_4[Mn(CN)_6]$ (3)

15. Write down the IUPAC name for each of the following complexes:
    (i) $[Co(NH_3)_5Cl]Cl_2$ (ii) $K_3[Fe(CN)_6]$ (iii) $[NiCl_4]^{2-}$ (3)

16. Draw the structures of optical isomers of each of the following complex ions:
    $[Cr(C_2O_4)_3]^{3-}$, $[PtCl_2(en)_2]^{2+}$, $[Cr(NH_3)_2Cl_2(en)]^+$ (3)
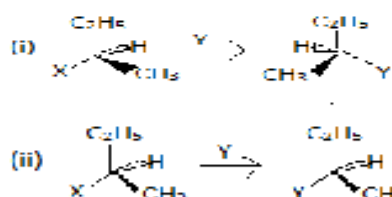
Academic assignment
Chapter – 10
Haloalkanes and Haloarenes

1. Which of the following two reactions is S_N^2 and why? (1)

   (i)

   (ii)

2. Draw the structure of 4-tertbutyl-3-iodopentane. (1)
3. Write the structure of 1-bromo-4-chlorobut-2-ene. (1)
4. Write the structure of 2,4-dinitrochlorobenzene. (1)
5. Write the structure of 3-Bromo-2-methylprop-1-ene. (1)
6. Out of the given two compounds, which is an example of vinylic halide?

   (1)
7. Following compounds are given to you:

   2-Bromopentane, 2-Bromo-2-methylbutane, 1-Bromopentane
   (i)   Write the compound which is most reactive towards S_N^2 reaction.
   (ii)   Written the compound which is optically active.
   (iii)   Write the compound which is most reactive towards β-elimination reaction. (3)
8. Give reasons for the following observations:
   (i)   p-dichlorobenzene has higher melting point than those of o- and m- isomers.
   (ii)   Haloarenes are less reactive than haloalkanes towards nucleophilic substitution
           reaction.
   (iii)   The treatment of alkyl chloride with aqueous KOH leads to the formation of alcohol but
           in the presence of alcoholic KOH, alkene is the major product. (3)
9. Write the major monohalo product(s) in each of the following reactions: (3)

   (i) + Br₂ $\xrightarrow{UV}$?

   (ii) + HBr $\xrightarrow{peroxide}$?

   (iii) + HCl $\xrightarrow{Heat}$?
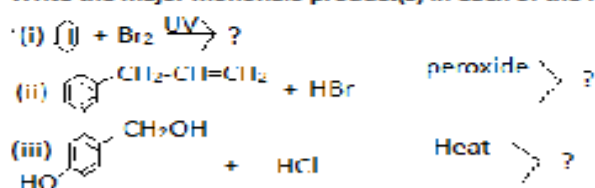
Academic Assignment
Chapter 11 Alcohols and Phenols

1. Write the IUPAC name of the following compound: (1)

$$H_3C-C=C-CH_2-CH$$
$$\quad\quad |\quad\ |$$
$$\quad CH_3\ CH_3$$

2. Write the IUPAC name of the following compound : (1)

-CH–CH-CH$_2$-OH

3. (a) Arrange the following compounds in the increasing order of their acid strength :
   p-cresol, p-nitrophenol, phenol
   (b) Write the mechanism (using curved arrow notation) of the following reaction :

   $$CH_2-CH_2 \xrightarrow{H_3O^+} CH_3-CH_2^+ + H_2O$$ (2)

4. Write the structures of the products when Butan-2-ol reacts with the following :
   (a) CrO_3 (b) $SOCl_2$ (2)

5. Write the chemical equations involved in the following reactions:
   (i) Kolbe's reaction   (ii) Friedal – Crafts acetylation of anisole. (2)

6. How do you convert:
   (i) Phenol to toluene   (ii) Formaldehyde to Ethanol (2)

7. Give reasons for the following:
   (a) Protonation of Phenols is difficult whereas ethanol easily undergoes protonation.
   (b) Boiling point of ethanol is higher than that of dimethyl ether.
   (c) Anisole on reaction with HI gives phenol and CH_3-I as main products and not iodobenzene and CH_3OH. (3)

8. (a) Predict the major product of acid catalysed dehydration of 1-Methylcyclohexanol.
   (b) You are given benzene, conc. H_2SO_4, NaOH and dil. HCl. Write the preparation of phenol using these reagents. (2)

9. Draw the structures of any two isomeric alcohols (other than 1^0 alcohols) having molecular formula $C_5H_{12}O$ and give their IUPAC names. (2)

10. The following is not an appropriate reaction for the preparation of tert.-butyl ethyl ether :
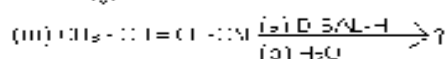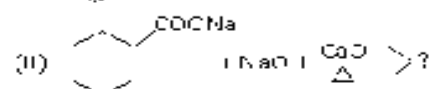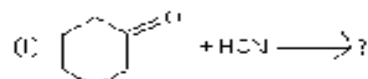 $C_2H_5ONa + (CH_3)_3C$-Cl → $(CH_3)_3C$-OC_2H_5
    (i) What would be the major product of the given reaction?
    (ii) Write a suitable reaction for the preparation of ter.-butyl ethyl ether, sepecifying the names of reagent used. Justify your answer in both cases. (3)

11. Write the mechanism of acid dehydration of ethanol to yield ethane. (2)

12. How are the following conversions carried out?
    (i) Benzyl chloride to Benzyl alcohol

Academic Assignment
Chapter 12 Aldehyde and Ketones

1. (a) Write the product(s) in the following reactions: (3+2)

   (i)   [structure] $+ HCN \longrightarrow$?

   (ii) [structure with COCNa] $+ NaOH \xrightarrow{CaO, \Delta}$?

   (iii) $CH_3-CH=CH-CN \xrightarrow[\text{(b) } H_2O]{\text{(a) DIBAL-H}}$?

   (b) Give simple chemical tests to distinguish between the following pairs of compounds :
   (i)   Butanal and Butan-2-one
   (ii)   Benzoic acid and Phenol

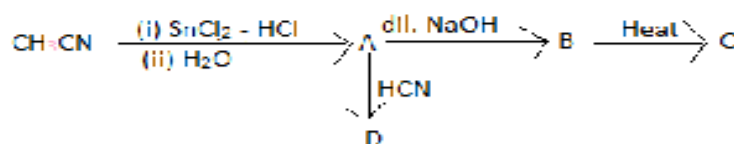2. (a) Write the reactions involved in the following :   (2+3)
   (i)   Etard reaction
   (ii)   Stephen reduction

3. How will you convert the following in not more than two steps :
   (i)   Benzoic acid to Benzaldehyde
   (ii)   Acetophenone to Benzoic acid
   (iii)   Ethanoic acid to 2-Hydroxyethanoic acid

4.   (a) Write the structures of A, B, C and D in the following reactions: (3)

   $CH_3CN \xrightarrow[\text{(ii) } H_2O]{\text{(i) } SnCl_2 - HCl} A \xrightarrow{\text{dil. NaOH}} B \xrightarrow{\text{Heat}} C$

   A $\xrightarrow{HCN}$ D

   (b) Distinguish between:
        (i) $C_6H_5-CH=CH-COCH_3$ and $C_6H_5-CH=CH-COCH_2CH_3$
        (ii) CH_3CH_2COOH and $HCOOH$
   (c) Arrange the following in the increasing order of their boiling points:
        CH_3CH_2OH, $CHCOCH_3$, CH_3COOH.   (5)

5. (a) Write the chemical reaction involved in Etard reaction.
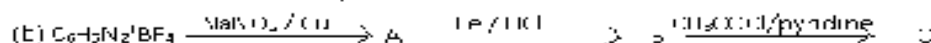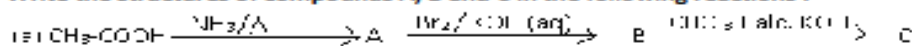   (b) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction:
   CH_3-CHO, $C_6H_5COCH_3$, $HCHO$
   (c) Why pKa of $Cl-CH_2-COOH$ is lower than the pKa of CH_3COOH?

Academic Assignment
Chapter 12 Amines

1. Write the structures of compounds A, B and C in the following reactions : (3)

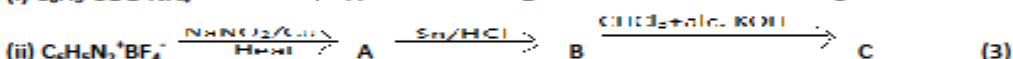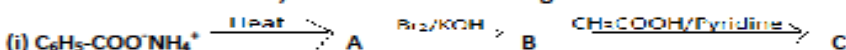   (a) $CH_3-COOH \xrightarrow{NH_3/\Delta} A \xrightarrow{Br_2/KOH\ (aq)} B \xrightarrow{CHCl_3+alc.\ KOH} C$

   (b) $C_6H_5N_2^+BF_4 \xrightarrow{NaNO_2/Cu} A \xrightarrow{Fe/HCl} B \xrightarrow{CH_3COCl/pyridine} C$

2. Give reasons for the following : (3)
   (a) Aceylation of aniline reduces its activation effect.
   (b) CH_3NH_2 is more basic than $C_6H_5NH_2$.
   (c) Although $-NH_2$ is o/p directing group, yet aniline on nitration gives a significant amount of m-nitroaniline.
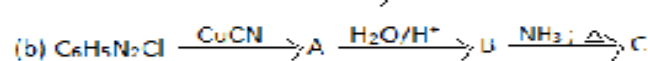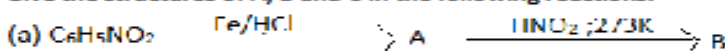
3. Write the IUPAC name of the given compound:
   $CH_3-NH-CH_2-CH(CH_3)-CH_3$ (1)

4. Write the structures of A, B and C in the following reactions:

   (i) $C_6H_5-COO^-NH_4^+ \xrightarrow{Heat} A \xrightarrow{Br_2/KOH} B \xrightarrow{CH_3COOH/Pyridine} C$
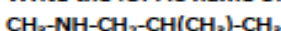
   (ii) $C_6H_5N_2^+BF_4^- \xrightarrow[Heat]{NaNO_2/Cu} A \xrightarrow{Sn/HCl} B \xrightarrow{CHCl_3+alc.\ KOH} C$ (3)

5. Give the IUPAC name and structure of the amine obtained when 3-chlorobutanamide undergoes Hoffmann-bromamide reaction. (1)

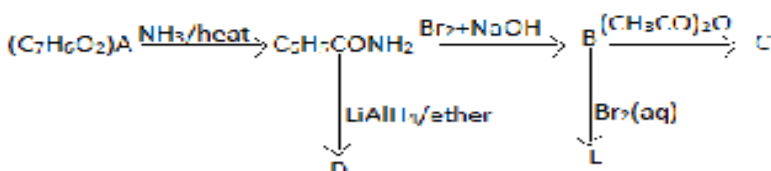6. Give the structures of A, B and C in the following reactions: (3)

   (a) $C_6H_5NO_2 \xrightarrow{Fe/HCl} A \xrightarrow{HNO_2\ ;273K} B$

   (b) $C_6H_5N_2Cl \xrightarrow{CuCN} A \xrightarrow{H_2O/H^+} B \xrightarrow{NH_3\ ;\ \Delta} C$

7. Arrange the following in increasing order of basic strength
   Aniline, p-Nitroaniline and p-Toluidine (1)

8. Complete the following reaction equation: $C_6H_5N_2Cl + H_3PO_2 + H_2O \rightarrow$ (1)

9. An aromatic compound 'A' of molecular formula $C_7H_6O_2$ undergoes a series of reactions as shown below. Write the structures of A, B, C, D and E in the following reactions: (5)

   $(C_7H_6O_2)A \xrightarrow{NH_3/heat} C_5H_7CONH_2 \xrightarrow{Br_2+NaOH} B \xrightarrow{(CH_3CO)_2O} C$

   $C_5H_7CONH_2 \xrightarrow{LiAlH_4/ether} D$

   $B \xrightarrow{Br_2(aq)} E$

10. Write the structures of main products when benzene diazonium chloride reacts with the following reagents:
   (i) $H_3PO_2 + H_2O$

Academic Assignment
Chapter 13 Biomolecules

1. After watching a programme on TV about the presence of carcinogens (cancer causing agents) Potassium bromated and Potassium iodate in bread and other bakery products, Rupali a Class XII student decided to make others aware about the adverse effects of these carcinogens in foods. She consulted the school principal and requested him to instruct the canteen contractor to stop selling sandwiches, pizzas, burgers and other bakery products to the students. The principal took an immediate action and instructed the canteen contractor to replace the bakery products with some protein and vitamin rich food like fruits, salads, sprouts, etc. the decision was welcomed by the parents and the students.

   After reading the above passage, answer the following questions:
   (i)   What are the values (at least two) displayed by Rupali?
   (ii)   Which polysaccharide component of carbohydrates is commonly present in bread?
   (iii)   Write the two types of secondary structures of proteins.
   (iv)   Give two examples of water soluble vitamins.   (4)

2. (i) Write one reaction of D-Glucose which cannot be explained by its open chain structure.
   (ii) What type of linkage is present in Nucleic acids?
   (iii) Give one example each for water-soluble vitamins and fat-soluble vitamins?   (3)

3. (a) A non reducing disaccharide 'A' on hydrolysis with dilute acid gives an equimolar mixture of D-(+)-glucose and D-(-)-Fructose.

   $$A + H_2O \xrightarrow{HCl} C_6H_{12}O_6 + C_6H_{12}O_6$$
   $$[alpha]_D = 166.5^0 \quad +52.5^0 \quad 92.4^0$$
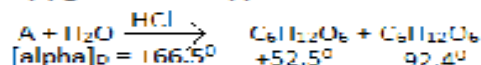
   Identify A. What the mixture of D-(+)-glucose and D-(-)-Fructose known as?
   Name the linkage that holds the two units in the disaccharide.
   (b) α-amino acids have relatively higher melting point than the corresponding halo acids. Explain.   (3)

4. Define the following as related to proteins:
   (i) Peptide linkage   (ii) Primary structure   (iii) Denaturation   (3)

5. How are vitamins classified? Name the vitamin responsible for the coagulation of blood. (3)

6. (i) Which one of the following is a polysaccharide:
   Starch, Maltose, Fructose, Glucose?
   (ii) What one difference between α-helix and β-pleated sheet structure of protein.
   (iii) Write the name of the disease caused by the deficiency of Vitamin B_{12}.   (3)

7. (i) Which one of the following is a disaccharide : Starch, Maltose, Fructose, Glucose?
   (ii) What is the difference between fibrous protein and globular protein?
   (iii) Write the name of vitamin whose deficiency causes bones deformities in children. (3)

8. Define a 'Peptide linkage'.   (1)

Academic Assignment
Chapter 15 Polymers

1. Write the structures of the monomers used for getting the following polymers : (3)
   (a) Nylon-6,6
   (b) Melamine-formaldehyde polymer
   (c) Buna-S
2. (i) What is role of benzoyl peroxide in the polymerization of ethane?
   (ii) Identify the monomers in the following polymer: -(-HN-$(CH_2)_6$-NH-CO-$(CH_2)_4$-CO-)$_n$-
   (iii) Arrange the following polymers in the increasing order of their intermolecular forces:
   Nylon-6,6 Polythene, Buna-S (3)
3. Write the mechanism of free radical polymerization of ethane. (3)
4. Study the given passage carefully and answer the questions that follow:
   Shalini studied a chapter on Polymers in school and came across the following paragraph:
   The durability, strength, low cost, water and chemicals resistance, welding properties, lesser energy, fewer atmosphere emissions and light weight are advantages of plastic bags.
   Shalini is confused as she has been reading in the newspaper about the ban on the usage of plastic substances.
   She further finds that despite the durability, the use of these materials has presented mankind with serious waste disposal problems as these materials do not disintegrate by themselves. In view of this, certain polymers are being developed which are broken down rapidly by microorganisms. Shalini feels relaxed that such kinds of biomaterials are being developed.
   (a) Name the calss of these useful polymers which do not harm the environment.
   (b) Give any one example of these polymers and name its monomers.
   (c) Comment on the qualities of Shalini. (4)
5. Explain the term 'coplymerization' and give two examples of copolymerization. (3)
6. Write the names and structures of the monomers of the following polymers:
   (i) Buna-S   (ii) Neoprene   (iii) Teflon (3)
7. (i) What type of isomerism is shown by the complex $[Cr(H_2O)Cl_3]$?
   (ii) On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o > P$.
   (iii) Write the hybridization and shape of $[CoF_6]^{3-}$ (3)
8. Write the names and structures of the monomers of the following polymers:
   (i) Nylon-6,6   (ii) PHBV   (iii) Neoprene (3)
9. How does a homopolymer differ from a copolymer? (1)
10. Write the names of the monomers of the following polymers:
    (i) Polythene   (ii) Polyvinyl chloride   (iii) Bakelite (3)
11. Give names of the monomers of the following polymers :
    (i) Neoprene   (ii) Polystyrene   (iii) Polypropene (3)

Academic Assignment
Chapter 16 Chemistry in everyday life

1. Define the following : (3)
   (a) Anionic detergents
   (b) Limited spectrum antibiotics
   (c) Antiseptics
2. Define the following : (3)
   (i) Cationic detergents
   (ii) Broad spectrum antibiotics
   (iii) Antacids
3. Due to hectic and busy schedule, Mr. Awasthi made his life full of tensions and anxiety. He started taking sleeping pills to overcome the depression without consulting the doctor, Mr. Roy, a close friend of Mr. Awasthi advised him to stop taking sleeping pills and suggested to change his lifestyle by doing Yoga, meditation and some physical exercise. Mr. Awasthi followed his friend's advice and after few days he started feeling better.
   After reading the above passage answer the following:
   (i) What are the values (at least two) displayed by Mr. Roy?
   (ii) Why it is not advisable to take sleeping pills without consulting doctor?
   (iii) What are tranquilizers? Give two examples. (4)
4. (a) Pick out the odd one from among the following on the basis of their medicinal properties mentioning the reason: Luminal, Seconal, Phenacetin, Equanil.
   (b) Give an example of a substance that can act as a disinfectant as well as antiseptic depending upon its concentration. (Specify concentration).
   (c) Name any two macromolecules chosen as drug targets. (3)
5. Neeraj went to the departmental store to purchase groceries. On one of the shelves he noticed sugar free tablets. He decided to buy them for his grandfather who was a diabetic. There were three types of sugar free tablets. He decided to buy sucrolose which was good for his grandfather's health.
   (i) Name another sugar free tablet which Neeraj did not purchase.
   (ii) Was it right to purchase such medicines without doctor's prescription?
   (iii) What quality of Neeraj is reflected above? (4)
6. Seeing the growing cases of diabetes and depression among young children, Mr. Chopra, the principal of one reputed school organized a seminar in which he invited parents and principals. They all resolved this issue by strictly banning junk food in schools and introducing healthy snacks and drinks like soup, lassi, milk etc. in school canteens. They also decided to make compulsory half an hour of daily physical activities for the students in the morning assembly. After six months, months, Mr. Chopra conducted the health survey in most of the schools and discovered a tremendous improvement in the health of the students.

Applied Chemistry full length (14-16)

1. Write the reaction of glucose with hydrazine. (1)
2. Define the following terms:
   (a) Primary structure of protein   (b) Non-essential amino acids. (2)
3. What are biocatalysts? Give an example.
4. (a) Write reaction of glucose with pheny hydrazine.
   (b) What is meant by denaturation of proteins. (2)
5. Define the following:
           (i) Invert sugar   (ii) Nucleoside (2)
6. What are anomers? Give examples. Give two differences between them. (2)
7. (a) What happens when glucose reacts with $Br_2(aq)$?
           Write chemical reaction reaction involved.
   (b) Give one difference between globular and fibrous proteins. (2)
8. (i) Give one example of reducing and one example of non-reducing sugar.
   (ii) Give two differences between RNA and DNA. (3)
9. (a) What is the cause of feeling of depression in human beings? Name a drug which
   can be useful in treating this depression.
   (b) Explain 'Antifertility drug' with an example. (3)
10. (a) What is name polymer formed by condensation of phenol and formaldyhyde?
    Give its use.
    (b) Give two differences between elastomers and fibres. (3)
11. (a) What are antiseptics?
    (b) Name the sweetening agent used in preparation of sweet for a diabetic patient.
    (c) What is the side product of soap industry? (3)
12. (i) What are antacids? Give an example.
    (b) Why should we not take analgesics and antipyretics on an empty stomach?
    (c) What are tranquilizers? Give an example. (3)
13. (a) What is the advantage of soap over detergent?
    (b) What are non-ionic detergents? Give their use.
    (c) What are antacids? Give an example. (3)
14. (a) Give two differences between addition and condensation polymerization.
    (b) What is monomer of Nylon-6? Give its structure. (3)
15. (a) Give two differences between thermoplastics and thermosetting plastics.
    (b) What are the monomeric repeating units of Nylon-6 and Nylon-6,6? (3)
16. (a) Name the base which is present in DNA but not in RNA.
    (b) Name the deficiency of which vitamin cause the following diseases?
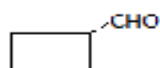   (i) Pernicious anaemia

Inorganic chemistry full length(7-9)

1. (a) Why does NO_2 dimerise?
    (b) H_2S is less than H_2Te, why? (2)
2. (a) What are different oxidation states shown by actinoids?
    (b) Which of 4d-block elements may not be regarded as transition metal? (2)
3. How do you prepare:
    (i) $KMnO_4$ from K_2MnO_4 (ii) Na_2CrO_4 from $FeCr_2O_4$. (2)
4. (a) Complete the following reactions:
    (i) $MnO_4^- + Fe^{2+} + H^+ \rightarrow$ (ii) $Cr_2O_7^{2-} + Sn^{2+} + H^+ \rightarrow$ (2)
5. (i) Why is Cu^{2+} paramagnetic whereas Cu^+ diamagnetic?
    (ii) Why is Fe^{2+} smaller than Mn^{2+}? (2)
6. Complete the following reactions:
    (i) $XeF_6 + H_2O \rightarrow$
    (ii) $XeF_6 + NaF \rightarrow$ (2)
7. Write the structure of the following:
    (i) dichromate ion
    (ii) permanganate ion (2)
8. Complete the following reactions:
    (i) $MnO_4^- + H_2O + 3e^- \rightarrow$
    (ii) $MnO_4^- + H^+ + 5e^- \rightarrow$ (2)
9. (a) Write the IUPAC name of $[Co(NH_3)_6]^{3+}$.
    (b) What type of isomerism is shown by the following complex? $[Cr(NH_3)_6][Co(CN)_6]$
    (c) Why is $[Co(en)_3]^{3+}$ more stable than $[Co(NH_3)_6]^{3+}$? (3)
10. (a) Mn^{2+} compounds are more stable than Fe^{2+} towards oxidation to +3 state.
    (b) In 5d-transition series, which element is not regarded as transition metal and why?
    (c) Which bivalent cation in 3d-transition series is the most paramagnetic and why? (3)
11. (a) Write IUPAC name of $[Co(en)_3][Cr(C_2O_4)_3]$.
    (b) Predict the shape and magnetic behavior of
    (i) $[Cr(H_2O)_6]^{3+}$ (ii) $[Pt(NH_3)_2Cl_2]$
    [Atomic number of Cr = 24, Pt = 78] (3)
12. (a) Complete the following reactions:
    (i) $SF_4 + H_2O \rightarrow$ (ii) $PCl_3 + H_2O \rightarrow$
    (b) Why is H_3PO_2 better reducing agent than H_3PO_3? (3)
13. (a) Write IUPAC name of $[Co(H_2O)_4(NH_3)_2]Cl_2$.
    (b) Discuss the shape and magnetic moment of $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$. (3)
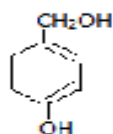
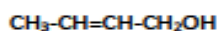# CLASS-XII
ORGANIC FULL LENGTH TEST

1. Draw the structure of 1-phenylethanol. (1)
2. What products are obtained when anisole reacts with HI? (1)
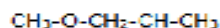3. Write the IUPAC name of the following compound:

(1)

4. Complete the following reaction:

(1)

5. Write the IUPAC name of the following: (1)

$CH_3-CH=CH-CH_2OH$

6. Write the IUPAC name of the following compound : (1)

$CH_3-O-CH_2-CH-CH_3$
                    |
                    Br
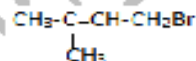
7. Why do ethers have dipole moment? (1)
8. Write IUPAC name of the following:

(1)
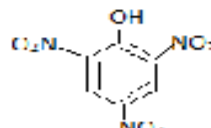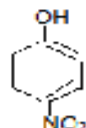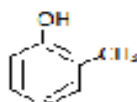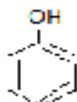
9. Convert chlorobenzene to phenol. (1)
10. Write the structure of phenyl ethyl ether. (1)
11. Why is chlorobenzene less reactive than ethyl chloride towards nucleophilic substitution reaction? (1)
12. Write IUPAC name of the following : (1)

$CH_3-C-CH-CH_2Br$
          |
          CH_3

13. Arrange the following in increasing order of acidic character : (1)

14. Convert phenol to picric acid. (1)

Class-XII
Physical Chemistry full length(1-6)

1. Express the relationship between radius (r) and the edge length in the *fcc* unit cell. (1)
2. The intermetallic compound LiAg crystallizes in cubic lattice in which both lithium and silver have coordination number of eight. What is the type of crystal lattice? (1)
3. Why is alum used for coagulation of blood? (1)
4. What are n-type semiconductors? (1)
5. Based on dispersed phase, which type of colloid micelles are? (1)
6. What is forbidden zone? (1)
7. What type of forces are responsible for the occurrence of chemisorptions? (1)
8. What is meant by sorption? (1)
9. What is meant by CMC? (1)
10. If 'a' is the edge length of the cube, what will be the distance between the body centered atom and one corner atom in a cube? (1)
11. What is meant by critical micelle concentration? (1)
12. Which of the following is most effective electrolyte in coagulation of $Fe(OH)_3$ sol? $AlCl_3$, K_3PO_4, $K_4[Fe(CN)_6]$, $MgCl_2$. (1)
13. What is meant by intrinsic semiconductor? (1)
14. Why is physical adsorption multilayered? (1)
15. Name a compound which shows both Frenkel and Schottky defects. (1)
16. Why do some glass objects from ancient civilization found to become milky? (1)
17. Why is enthalpy of physisorption low? (1)
18. What is the relationship between edge length 'a' and atomic radius 'r' in a simple cubic crystal lattice? (1)
19. Which homogenous catalyst is used in lead chamber process for manufacture of sulphuric acid during oxidation of sulphur dioxide? (1)
20. Why LiCl becomes pink on heating with lithium vapours? (1)
21. If the density of some lake water is 1.25 g mL^{-1} and contains 92 g of Na^+ ions per kg of water, calculate the molarity of Na^+ ions in the lake. (2)
22. For a first order reaction, show that the time required for 99% completion is twice the time required for the completion of 90% of reaction. (2)
23. Consider the following cell reactions:
$2Fe(s) + O_2(g) + 4H^+(aq) \rightarrow 2Fe^{2+}(aq) + 2H_2O(l)$ $E^0 = 1.67$ V. At $Fe^{2+} = 10^{-3}$ M, $pO_2 = 0.1$ atm and pH = 3, calculate the cell potential at 25^0C. (2)
24. State Henry's law and give one of its applications. (2)
25. Vapour pressure of pure water at 298 K is 23.8 mm Hg. 50 g of urea (NH_2CONH_2) is dissolved in 850 g of water. Calculate vapour pressure of water for this solution and its relative lowering. (2)

XII
FULL LENGTH (SET - A)

1. A crystalline solid has a cubic structure in which tungsten (W) atoms are located at cube corners of the unit cell, oxygen atoms at the cube edges and sodium atom at the centre. What is the molecular formula of the compound? (1)

2. Which of the following is more stable and why?
   $[Fe(CN)_6]^{3-}$ and $[Fe(CN)_6]^{4-}$ (1)

3. What is the main cause of charge on a colloidal solution? (1)

4. Write the structure and IUPAC name of the amide which gives propanamine by Hoffmann bromamide reaction. (1)

5. What are enantiomers? (1)

6. (i) On mixing liquid X and liquid Y, volume of the resulting solution decreases. What type of deviation from Raoult's law is shown by the resulting solution? What change in temperature would you observe after mixing liquids X and Y?

   (ii) What happens when we place blood cell in water (hypotonic solution)? Give reason. (2)

7. Give reasons for the following:
   (i) Value of standard electrode potential for the oxidation of Cl^- is more positive than that of water, even then in the electrolysis of aqueous sodium chloride, why is Cl^- oxidized at anode instead of water?
   (ii) Galvanic cell becomes dead after some time. (2)

8. Arrange the following in order of property indicated for each set.
   (i) PH_3, NH_3, AsH_3, SbH_3 – increasing boiling point.
   (ii) HOCl, HOBr, HOI – increasing acid strength. (2)

9. Name the following:
   (i) A compound where the transition metal is in the +6 oxidation state.
   (ii) Lanthanoid which is radioactive.
   (iii) Transition metal which has the highest density.
   (iv) A member of lanthanoid which is known to exhibit +4 oxidation state. (2)

10. (i) Give major product of acid catalysed dehydration of *n*-butyl alcohol.
    (ii) How will you prepare *tert*-butyl alcohol from acetone? (2)

    OR

    Alcohols react both as nucleophiles as well as electrophiles. Write one reaction of each type and describe its mechanism.

11. Tungsten has the density of 19.35 g cm-3 and the cell edge of unite cell is 316 pm. The unit cell in the most important crystalline form tungsten is the body centered cubic unit cell. Calculate the number of atoms present in 50 g of the element. (3)

XII
FULL LENGTH (SET-B)

1. What is the formula of a compound in which the element Y forms hcp lattice and atoms of X occupy $2/3^{rd}$ of tetrahedral voids? **(1)**

2. The following figure shows the variation of adsorption of N2 on charcoal with pressure at different constant temperature:
   Arrange the temperatures T_1, T_2 and T_3 in the increasing order.

   (1)
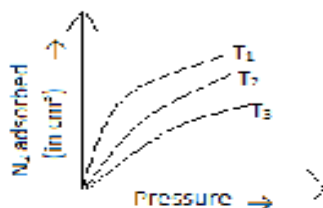
3. Give IUPAC name of linkage isomer of $[Co(NH_3)_5(NO_2)]^{2+}$. **(1)**

4. Of the two bromoderivatives, $C_6H_5CH(CH_3)Br$ and $C_6H_5CH(C_6H_5)Br$, which one is more reactive in S_N^1 substitution reaction and why? **(1)**

5. Give the structural formula and IUPAC name of allyl amine. **(1)**

6. 0. 5 g of KCl was dissolved in 100 g of water and the solution originally at 20^0C, froze at -0.24^0C. Calculate the percentage dissociation of the salt.
   (Given : K_f for water = 1.86 K kg/mol, K = 39 u, Cl = 35.5 u) **(2)**

7. Calculate the time to deposit 1.5 g of silver at cathode when a current of 1.5 A was passed through the solution of $AgNO_3$.
   (Molar mass of Ag = 108 g mol^{-1}, 1 F = 96500 C mol^{-1}) **(2)**

8. Write the structures of the following molecules
   (i) H_2SO_3 (ii) $XeOF_4$ **(2)**

9. (i) Why do actinoids show wide range of oxidation states?
   (ii) Why is actinoid contraction greater than lanthanoid contraction? **(2)**

10. Write mechanism of the reaction of HI with methoxymethane. **(2)**

    OR

    An organic compound 'A' having molecular formula C_3H_6 on treatment with aqueous H_2SO_4 gives 'B' which on treatment with $HCl/ZnCl_2$ gives 'C'. The compound C on treatment with ethanolic KOH gives back the compound 'A'. Identify the compounds A, B, C.

11. An element X with an atomic mass of 60 g/mol has density of 6.23 g cm^{-3}. If the edge length of its cubic unit cell is 400 pm, identify the type of cubic unit cell. Calculate the radius of an atom of this element. **(3)**

12. (i) What type of deviation from Raoult's law is observed, when two volatile liquids A and B on mixing produce a warm solution? Explain with the help of a well labeled vapour pressure
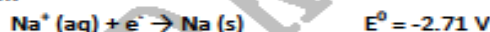
XII
FULL LENGTH (SET-C)

1. Tertiory amines do not undergo acylation. Why? **(1)**
2. What do you meant by selectivity of a catalyst? **(1)**
3. Out of white phosphorus and red phosphorus, which one is more reactive and why? **(1)**
4. Write the IUPAC name of the given compound: $HO-CH_2-CH=C(CH_3)_2$ **(1)**
5. Write down the IUPAC name of the following complex: $[Co(NH_3)_5Cl]^{2+}$ **(1)**
6. (i) With reference to crystal structure what is meant by coordination number?
   (ii) what is the coordination number of atoms
   (a) In a hexagonal close packed structure?
   (b) In a body centred cubic structure? **(2)**
7. Copper crystal has a face-centred cubic lattice structure. Atomic radius of copper is 128 pm. Calculate the density of copper (Atomic mass of copper = 63.5 amu). **(2)**
8. With the help of a neat diagram explain why does the solution of a non-volatile and a volatile solvent boil at a temperature higher than the boiling point of the pure solvent.

   OR

   Give reasons for the following:
   (a) At higher altitudes, people suffer from a disease called anoxia. In this disease, they become weak and cannot think clearly.
   (b) When mercuric iodide is added to an aqueous solution of KI, the freezing point is raised. **(2)**
9. (i) Following reactions occur at cathode during the electrolysis of aqueous sodium chloride solution:
 $$Na^+ (aq) + e^- \rightarrow Na (s) \qquad E^0 = -2.71 \ V$$
   $$H^+ (aq) + e^- \rightarrow \tfrac{1}{2} H_2 (g) \qquad E^0 = 0.00 \ V$$
   On the basis of their standard reduction electrode potential (E^0) values, which reaction is feasible at the cathode and why?
   (ii) Why does the cell potential of mercury cell remain constant throughout its life? **(2)**
10. Complete the following reactions:
    (i) $\quad P_4 + NaOH + H_2O \rightarrow$
    (ii) $\quad NaOH$ (cold, dil) $+ Cl_2 \rightarrow$ **(2)**
11. (i) Indicate the principle behind the method used for the refining of zinc.
    (ii) What is the role of silica in the extraction of copper?
    (iii) Which form of the iron is the purest form of commercial iron? **(3)**
12. KI and sucrose solution with 0.1 M concentration have osmotic pressure of 0.465 atm and 0.245 atm respectively. Find the van't Hoff factor of KI and its degree of dissociation. **(3)**
13. (i) Heat of adsorption is greater for chemisorptions than physisorption. Why?
    (ii) Mention two common properties of sol and emulsion.
    (iii) Differentiate between peptization and coagulation. **(3)**

XII
CHEMISTRY FULL LENGTH

1. What is Frenkel defect? (1)

2. Which compound in the following pair undergoes faster S_N^1 reaction and why? (1)
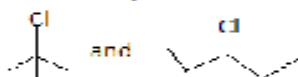
3. Give the IUPAC name of the following compound: (1)

$(CH_3)_3$-C-C-COOH
    |
    O
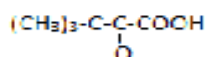
4. Explain why $MeNH_2$ is stronger base than $MeOH$? (1)

5. Write the reaction when glucose is heated with excess of HI. (1)

6. (i) State the law which helps to determine the limiting molar conductivity of weak electrolyte.
   (ii) Calculate limiting molar conductivity of $CaSO_4$ (limiting molar conductivity of calcium and sulphate ions are 119.0 and 160.0 S cm^2 mol^{-1} respectively). (2)

7. Rate constant k for first order reaction has been found to be 2.54×10^{-3} s^{-1}. Calculate its three-fourth life. (2)

OR

A first order gas reaction A_2B_2 (g) → 2 A (g) + 2 B (g) at the temperature 400°C has the rate constant k = 2.0×10^{-4} s^{-1}. What percentage of A_2B_2 is decomposed on heating for 900 seconds?

8. Draw the molecular structures of the following species:
   (i) $H_2S_2O_8$
   (ii) XeF_2

9. Write the mechanism for preparation of ethanol from ethane.

10. How may the following conversions be carried out:
    (i)   Propene to propan-2-ol
    (ii)   Anisole to phenol (2)

11. An element X with an atomic mass of 60 g/mol has density of 6.23 g cm^{-3}. If the edge length of its cubic unit cell is 400 pm, identify the type of cubic unit cell. Calculate the radius of an atom of this element. (3)

12. A voltaic cell is set up at 25°C with the following half cells:

    Al/Al^{3+} (0.001 M) and Ni/Ni^{2+} (0.50 M)

    Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential.

    $E^0_{Ni^{2+}/Ni}$ = -0.25 V ; $E^0_{Al^{3+}/Al}$ = - 1.66 V (log 8×10^{-6} = - 0.54) (3)