महाराष्ट्र शासन
शालेय शिक्षण व क्रीडा विभाग
राज्य शैक्षणिक संशोधन व प्रशिक्षण परिषद, महाराष्ट्र
७०८ सदाशिव पेठ, कुमठेकर मार्ग, पुणे ४११०३०
संपर्क क्रमांक (०२०) २४४७ ६९३८ E-mail: evaluationdept@maa.ac.in

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Question Bank

Standard:- 12th (Science)

Subject:- **Chemistry (55)**

March 2021

सूचना

१. फक्त विद्यार्थ्यांना प्रश्नप्रकारांचा सराव करून देण्यासाठीच

२. सदर प्रश्नसंचातील प्रश्न बोर्डाच्या प्रश्नपत्रिकेत येतीलच असे नाही याची नोंद घ्यावी.

Question Bank

Std: XII

Subject: Chemistry (55)

Chapter wise Question distribution

Subject: Chemistry (55)

Chapter no.	MCQ	VSA	SA-I	SA-II	LA	Total
1	10	10	6	6	3	35
2	9	10	6	6	3	34
3	7	8	6	6	3	30
4	7	7	6	6	4	30
5	10	7	11	8	4	40
6	9	9	7	8	3	36
7	9	7	6	6	3	31
8	8	8	6	6	3	31
9	7	7	6	6	3	29
10	7	7	6	6	3	29
11	7	9	6	6	3	31
12	7	7	6	6	3	29
13	7	7	6	6	3	29
14	7	8	9	6	2	32
15	7	8	9	7	2	33
16	7	7	6	6	3	29
						Total Questions 509

Question Bank for XII Chemistry (55)

Chapter- 1

Solid State **Marks 3 with option 5**

Multiple choice questions (1 mark)

1. The following types of solids contain molecules as constituent particles? (page 4)
   a. molecular solids b. Ionic solids
   c. metallic solids d. covalent network solids

2. The following crystal systems contain 4 Bravais lattices? (page7)
   a. cubic b. tetragonal **c. orthorhombic** d. monoclinic

3. An octahedral void is surrounded by (page10)
   a. 4 spheres b. 3 spheres c. 8 spheres **d. 6 spheres**

4. Which of the following is an amorphous solid? (page2)
   a. Copper sulphate b. magnesium **c.tar** c. diamond

5. A paired cation-anion vacancy is called…… (page 17)
   a. Schottky defect b. Frenkel defect c. impurity defect d. vacancy defect

6. The unit cell of a simple cubic system has atoms at the eight corners. Hence, number of atoms in an unit cell is
   a. 8 b. 3 **c. 1** d. 2 (page6)

7. In crystal lattice formed by primitive unit cell, the space occupied by particles is (page12)
   a.47.6% **a. 52.4%** b. 32% c. 68%

8. The coordination number of spheres in hcp lattice in three dimension is (page11)
   a. 2 **b. 6** c. 4 d. 12

9. A compound is made up of two elements X and Y and crystallizes in bcc structure. Atoms of X are present at the corners of the cube. Atoms of Y are present at the centre of the cube. The formula of the compound is
   a. X_2Y **b. XY** c. XY_2 d. X_2Y_3 (page14)

10. Sodium crystallizes in bcc structure. If the edge length of unit cell is $4.3X10^{-8}$ cm, the radius of Na atom is
    a. 1.86×10^{-8}cm b. 1.52×10^{-8}cm
    c. 2.15×10^{-8}cm d. 4.3×10^{-8}cm (page12

Very short answer questions (1 Mark)

1. Write the effect on density of a substance in the Frenkel defect? (page18)
2. Name the bravais lattice in the triclinic system. (page7)
3. What are diamagnetic substances? (page25)
4. Give one property common to both hcp and ccp crystal lattices. (page11)
5. Write the relationship between radius of atom and edge length of fcc unit cell. (page13)
6. Draw diagram of bcc unit cell. (page6)
7. The number of tetrahedral voids are formed if the number of atoms in a crystal is N/2. (page 11)
8. Give the percentage of empty space in bcc lattice. (page13)
9. If the total volume of a simple cubic unit cell is 6.817×10^{-23} cm^3, what is the volume occupied by particles in unit cell? (page12)
   (Ans:3.57×10^{-23} cm^3)
10. The number of octahedral voids are formed in 0.5 mol of a compound forming hcp structure?
    (Ans:$3.011x10^{23}$) (page11)

Short answer questions (Type- I) (2 Marks)

1. Distinguish between crystalline solids and amorphous solids.
2. Classify the following solids as molecular, ionic, covalent and metallic solids.
   Pb, MgF_2, SO_2 and quartz
3. Find the number of atoms in the fcc unit cell.
4. Explain with diagram, the vacancy defect.
5. Calculate the number of unit cells in 0.3 g of a species having density of 8.5 g/cm^3 and unit cell edge length 3.25×10^{-8} cm. (Ans:1.03×10^{21})
6. A compound crystallizes in bcc structure. What is unit cell edge length if diameter of its atom is 120 pm? (Ans:138.6 pm)

Short answer questions (Type- II) (3 Marks)

1. Calculate the packing efficiency for bcc lattice.
2. In case of hcp structure, how are spheres in first, second and third layers arranged?
3. A substance crystallizes in fcc structure. The unit cell edge length is 367.8pm. Calculate the molar mass of the substance if its density is 21.5 g/cm^3. (Ans:161 g/mol)
4. The unit cell of Na is bcc and its density is 0.97 g/cm^3. What is the radius of a sodium atom if the molar mass of Na is 23 g/mol? (Ans:1.86×10^{-8} cm)
5. How are non-stoichiometric point defects classified? Explain with diagram the metal deficiency defect.
6. Explain with one example each, the diamagnetic, paramagnetic and ferromagnetic substances.

Long answer questions (4 marks)

1. What are nonstoichiometric point defects? Explain with a diagram the formation of F-centers.
2. Give the classification of stoichiometric point defects. What is a substitutional impurity defect? Explain solid solutions of metals and vacancy through aliovalent cations.
3. Derive the relationship between density of substance, its molar mass and the unit cell edge length. Explain how you will calculate the number of particles, and number of unit cells in *x* g of metal.

Chapter-2

Solutions Marks 4 with option 6

Multiple choice questions (1 Mark)

1. Sugar dissolves in water because (page29)
   a. sugar is nonpolar
   b. water is polar
   c. it forms hydrogen bonding with water
   d. sugar and water are both polar

2. The solubility of a gas in water (page30)
   a. decreases with increase in temperature
   b. increases with increase in temperature
   c. decreases with decrease in temperature
   d. is not affected by temperature

3. The units of Henry's law constant are (page30)
   a. bar dm^3 mol^{-1}
   b. mol L^{-1} bar^{-1}
   c. L mol^{-1} bar^{-1}
   d. bar L^{-1} mol^{-1}

4. The colligative properties of solutions (page33)
   a. depend on nature of solute particles
   b. do not depend on number of solute particles
   c. do not depend on dissociation of solute in solvent
   d. depend on number of solute particles

5. The following solution /solvent has maximum vapour pressure (page33)
   a. 1M copper sulphate solution
   b. pure solvent water
   c. 0.5M copper sulphate solution
   d. 2M copper sulphate solution

6. According to Raoult's law, relative lowering of vapour pressure of solution containing dissolved non-volatile solute (page 34)
   a. is equal to mole fraction of solvent
   b. is equal to mole fraction of solute
   c. does not depend on mole fraction of solute
   d. is equal to molality of solution

7. Freezing point depression constant of a solvent is (page38)
   a. inversely proportional to molality of solution
   b. directly proportional to molarity of solution
   c. independent of molality of solution
   d. expressed in K kg mol^{-1}

8. Which of the following statements is applicable for 0.1M urea solution and 0.1M sucrose solution?
   a. osmotic pressure of urea solution is greater than that of sucrose solution
   b. osmotic pressure of sucrose solution is greater than that of the urea solution
   c. sucrose solution is not isotonic with urea solution
   d. both the solutions have the same osmotic pressure (page 40)

9. The Henry's law constant of a gas is 6.7×10^{-4} mol/(L bar). Its solubility when the partial pressure of the gas at 298K is 0.65 bar is
   a. 4.355×10^{-4} mol/L
   b. 4.355×10^{-2} mol/L
   c. 2.225×10^{-6} mol/L
   d. 2.225×10^{-2} mol/L (page30)

Very short answer questions (1 Mark)

1. What are hypertonic solutions? (page40)
2. What is a cryoscopic constant? (page38)
3. Write the effect of dissolution of a nonvolatile solute on the freezing point of solvent. (page37)
4. Write the expression for relative lowering of vapour pressure. (page34)
5. State Raoult's law. (page31)
6. State Henry's law. (page30)
7. What type of solutions exhibit positive deviations from Raoult's law? (page33)
8. What is enthalpy change and volume change of mixing of two components forming an ideal solution? (page32)
9. The vapour pressures of pure liquids A and B are 0.600 bar and 0.933 bar respectively, at a certain temperature. What is the mole fraction of solute when the total vapour pressure of their mixture is 0.8 bar? (Ans:0.600) (page31)
10. The vapour pressure of a pure liquid is 0.043 bar at a certain temperature. When a nonvolatile solute is dissolved into it, the vapour pressure of the solution is found to be 0.041 bar. What is the relative lowering of vapour pressure?(Ans:0.0465) (page34)

Short answer questions (Type- I) (2 Marks)

1. For a very dilute solution, the osmotic pressure is given by $\pi = n_2RT/V$ where V is the volume in L containing n_2 moles of nonvolatile solute. Establish the equation for molar mass of solute.
2. Distinguish between ideal and non-ideal solutions.
3. Give two points to explain why vapour pressure of solvent is lowered by dissolving nonvolatile solute into it.
4. In what way K_f and K_b are similar and in what way they are different?
5. Calculate total moles after dissociation in 0.1M KCl solution and 0.05M aluminium sulphate solution. Hence, decide which of the two solutions will have higher freezing point depression.
6. When 50 g of a nonvolatile solute is dissolved in a certain quantity of solvent, the elevation of boiling point is 2.0 K. What will be the elevation of boiling point when 30 g of solute is dissolved in the same amount of the same solvent? (Ans:1.2 K)

Short answer questions (Type- II) (3 Marks)

1. Derive the expression for molar mass of solute in terms of boiling point elevation of solvent.
2. Explain the osmotic pressure of a solution with the help of thistle tube.
3. Explain the phenomenon of osmosis.
4. With the help of vapour pressure-temperature curves for solution and solvent, explain why boiling point of solvent is elevated when a nonvolatile solute is dissolved into it.
5. A solution containing 3 g of solute A (M=60 g/mol) in 1L solution is isotonic with a solution containing 8.55 g of solute B in 500 mL solution. What is the molar mass of B? (Ans:342 g/mol)
6. The vapour pressure of a pure solvent at a certain temperature is 0.0227 bar. What is the vapour pressure of a solution containing 6 g of solute (M=60 g/mol) in 50 g of solvent? (Ans:0.022 bar)

Long answer questions (4 Marks)

1. What are non-ideal solutions? Explain with reasons and diagrams the positive and negative deviations from Raoult's law shown by non-ideal solutions.
2. Explain with vapour pressure-temperature curves that the freezing point of a solvent is lowered by dissolving a nonvolatile solute into it. Give reason for such lowering of freezing of solvent.
3. Explain the terms semipermeable membrane, osmosis and osmotic pressure. What are isotonic solutions? Explain with one example.

Chapter-03

Ionic Equilibria — Marks 4- with option 06

Multiple choice questions (1 Mark)

i) What is the percentage dissociation of 0.1 M Solution of acetic acid?
[$k_a(CH_3COOH) = 10^{-5}$]
a) 0.01% **b) 1%** C) 10% d) 100% P-50

ii) For a reaction $HCl_{(aq)} + H_2O_{(1)} \rightleftharpoons H_3O^+_{(aq)} + C1^{(-)}_{(aq)}$
Which of the following is a conjugate acid-base pair?
a) HCl and H_2O b) $H_3O^{(+)}$
c) $H_3O^{(+)}$ and H_2O d) HCl and $H_3O^{(+)}$ P-48

iii) In biochemical system, pH of blood in our body is maintained due to following buffer
a) $NH_4OH + NH_4Cl$ **b) HCO_3^- + H2CO3**
c) CH3 COOH + CH3COONa d) citric acid + $Mg(OH)_2$ P-56

iv) If 'IP' is the ionic product and 'k_{sp}' is the solubility product, precipitation of the compound will occur under the condition when .
a) IP = k_{sp} **b) IP > k_{sp}**
c) IP < k_{sp} d) IP < k_{sp} P-59

v) NH_4F is a salt of weak acid HF ($k_a = 7.2 \times 10^{-4}$) and weak base NH_4OH ($k_b = 1.8 \times 10^{-5}$), the solution of NH_4F will be
a) slightly acidic b) slightly basic P-55
c) strongly basic d) neutral

vi) The theory which explain amphoteric nature of water is
a) Arrhenius theory b) Lewis theory
c) Ostwald theory **d) Bronsted - Lowry theory** P-48

vii) The pKb of weak base BOH [Kb(BOH) = 1×10^{-5}] will be
a) -5 **b) 5** c) 1 d) 10^{-5} P-56

Very short answer questions (1 Mark)

i) Name the buffer which is use to maintained p^H of 8 to 10 for precipitation of cations III A group in qualitative analysis P-57

ii) Write the solubility product of sparingly soluble salt Bi_2S_3 P-58

iii) What is the p^{OH} if the hydrogen ion concentration in solution is $1x\ 10^{-3}$ mol dm^{-3} (Ans:11) P-52

iv) Write the relationship between molar Solubility (S) and solubility product (k_{sp}) for CaF_2 P-58

v) Give any one example of salt derived from weak acid and weak base. P-53

vi) Write the formula to calculate p^H of buffer solution. P-56

vii) Label the one conjugate acid-base pair in the following reaction.
$CO_3^{2+}{}_{(oq)} + H_2O_{(l)} \rightleftharpoons OH^{(-)} + HCO_3^{(-)}$ P-48

viii) Calculate the P^{OH} of 10^{-8} M of HCl (Ans:6) P-52

Short answer questions (Type- I) (2 Marks)

1) Calculate the p^H and p^{OH} of 0.0001MHCl Solution Ans: (p^H= 4 and p^{OH} = 10)
2) The solubility product of $BaCl_2$ is 4.0 x 10^{-8} what will be its molar solubility in mol dm $^{-3}$? Ans: (S = 1x10^{-2} mol dm-3)
3) Classify the following species into Lewis acids and Lewis bases
i) $CI^{(-)}$ ii) NH^+_4 iii) BCl_3 iv) NH_3
4) Define the following terms i) p^H ii) p^{OH}
5) Define molar solubility. Write it's unit.
6) Write solubility product of following sparingly soluble salt.
i) $BaSO_4$ ii) CaF_2

Short answer questions (Type- II) (3 Marks)

1) Define buffer solution. Explain its types.
2) Write one application of each of the following buffers.
i) citrate buffer ii) $HCO_3^- + H_2CO_3$ iii) $NH_4OH + NH_4Cl$
3) Derive the equation which implies that the degree of dissociation of weak acid is inversely proportional to the square root of its concentration .
4) A buffer solution contains 0.3 mol dm-3 NH_4OH is 1.8 x10^{-5}.Calculate pOH of the solution. Ans: (4.8686)
6) The solubility of AgBr in water is 1.20 x 10^{-5} mol dm $^{-3}$. Calculate the solubility product of Ag Br. (Ans. K_{sp} = 1.44 x10^{-10})

Long answer questions (4 Marks)

1) Derive the equation $p^H + p^{OH} = 14$
Distinguish between strong electrolyte and weak electrolyte
2) If 'S' is solubility in mol dm-3 and k_{sp} is the solubility product. Then write the relation between them for the CaF_2 and $BaSO_4$
Calculate the concentration of H_3O^+ ion in Soft drink whose P^H is 3.5 (Ans.: 3.162 x 10^{-4})
3) Explain the amphoteric nature of water.
Define a) Solubility product b) Hydrolysis of salt

Chapter-04

Chemical Thermodynamics Marks 6- with option 08

Multiple choice questions (1 Mark)

i. An intensive property amongst the following is……. pg 64

a) Mass b) Volume

c) Number of moles **d) Temperature**

ii. The value of 1dm^3 bar is …….. pg 68

a) 10 J **b) 10^2 J**

c) 10^3 J d) 10^{-2} J

iii. The work done in the dm3 bar when 200 mL of ethylene gas and 150 mL of HCl gas were allowed to react at 1 bar pressure is…. pg 68

a) 0.10 **b) 0.15**

c) 0.20 d) 0.2

iv. The work done in vacuum when 300 m mole of an ideal gas expands until its volume is increased by 2.3 dm^3 at 1 bar pressure is……. mole. pg 70

a)Zero b) One

c) Two d) Three

v. For an Isothermal process pg71

a) W = - Q b) $\Delta U = W$

c) $\Delta U = Q + W$ d) $\Delta U = Q$

vi For an Isochoric process pg 65

a) $\Delta U = 0$ **b) $\Delta V = 0$**

c) $\Delta P = 0$ d) $Q = 0$

vii. The change in internal energy in a reaction when 2kJ of heat is released by the system and 6 kJ of work is done on the system will be…… pg 73

a) +4 kJ b) 4kJ c) +3 kJ d) – 8 kJ

Very short answer questions (1 Mark)

i. Write the expression to calculate maximum work done when 1 mole of an ideal gas expands isothermally and reversibly from V_1 to V_2. pg 69

ii. Write the mathematical relation between ΔH and ΔU during formation of one mole of CO_2 under standard conditions. pg 73

iii. Standard enthalpy of formation of water is -286 kJ mol^{-1}. Calculate the enthalpy change for formation of 0.018 kg of water. pg 76

iv. Write the expression of first law of thermodynamics for an isothermal process. pg 71

v. What is the sign convention when work is done on the system by the surrounding? pg 67

vi. Write the expression showing relation between enthalpy change and internal energy change for gaseous phase reaction pg 73

vii. Calculate enthalpy of formation of HCl if Bond enthalpies of H_2, Cl_2 and HCl are 434 kJ mol^{-1}, 242 kJ mol^{-1} and 431 kJ mol^{-1} respectively. pg 87

Short answer questions (Type- I) (2 Marks)

1) Define the terms:- (i) Standard enthalpy of combustion (ii) Enthalpy of sublimation.
2) State and explain Hess's law of constant heat summation.
3) Write the features of reversible processes.
4) Derive an expression for pressure- volume work.
5) The enthalpy change of the following reaction

$CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$,
$\Delta H^0 = -104$ kJ. Calculate C-Cl bond enthalpy.
The bond enthalpies are

Bond	C-H	Cl-Cl	H-Cl
ΔH^0/kJ mol^{-1}	414	243	431

(Ans:- 330 kJ mol^{-1})

6) Calculate the standard enthalpy of combustion of $CH_4(g)$ if $\Delta_f H^0(CH_4) = -74.8$ kJ mol^{-1}, $\Delta_f H^0(CO_2) = -393.5$ kJ mol^{-1} and $\Delta_f H^0(H_2O) = -285.8$ kJ mol^{-1} (Ans:- -890.3 kJ)

Short answer questions (Type- II) (3 Marks)

1) Define an isolated system.
Three moles of an ideal gas are expanded isothermally from 15 dm^3 to 20 dm^3 at constant external pressure of 1.2 bar, calculate the amount of work in Joules.
(Ans -600J)
2) Define enthalpy of fusion.
Derive an expression for the maximum work.
3) Derive the expression .Write the relationship between for an isochoric process.
4) Define standard enthalpy of formation.
5) 0.022 kg of CO_2 is compressed isothermally and reversibly at 298 K from initial pressure of 100 kPa when the work obtained is 1200 J, calculate the final pressure. (Ans=263.4kPa)
6) Define the following terms:-
(i) Enthalpy of vaporization (ii) Standard enthalpy of combustion.
Why work done in vacuum is zero?

Long answer questions (4 Marks)

1) Define the following terms:-
(i)Enthalpy of atomisation (ii) Extensive properties.

Calculate the standard enthalpy of formation of liquid methanol from the following data

(i) $CH_3OH_{(l)} + \frac{3}{2}O_{2(g)} \longrightarrow CO_{2(g)} + 2\,H_2O_{(l)}$ $\Delta H^0 = -726$ kJmol^{-1}

(ii) $C_{(Graphite)} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta_C H^0 = -393$ kJmol^{-1}

(iii) $H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta_f H^0 = -286$ kJmol^{-1}

(Ans=-239kJmol^{-1})

1) Define the following terms:-

(i) Bond Enthalpy (ii) Enthalpy of ionisation.

Calculate the standard enthalpy of the reaction.

$$2Fe_{(s)} + \frac{3}{2}O_{2(g)} \longrightarrow Fe_2O_3(s)$$

Given (*i*) $2Al_{(s)} + Fe_2O_{3(s)} \longrightarrow 2Fe_{(s)} + Al_2O_{3(s)}$, $\Delta_r H^0 = -847.6$ kJ

(ii) $2Al(s) + 3/2\ O_2(g) \longrightarrow Al_2O_3(s)$, $\Delta_r H^0 = -1670$ kJ

(Ans=-822.4kJ)

2) How much heat is evolved when 12 g of CO reacts with NO_2 ?

The reaction is

$4\ CO(g) + 2\ NO_2(g) \longrightarrow 4\ CO_2(g) + N_2(g)$, $\Delta_r H^0 = -1200$ kJ

(Ans=128.57 kJ of heat is evolved)

Write an application of Hess's law.

Does the following reaction represent a thermochemical equation?

$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(g)}$ $\Delta_r H^0 = -900\ kJmol^{-1}$

3) Classify the following into intensive and extensive properties.

Pressure, volume, mass, temperature.

Define state function and write two examples of it.

Chapter-05

Electrochemistry Marks-5 with option 7

Multiple choice questions (1 Mark)

i) Kohlrausch law is applicable for the solution _____ (Pg no.94)
a) At infinite dilution b) a concentrated solution c) concentrated as well as dilute solution d) aqueous solution

ii) During electrolysis of molten NaCl, which of the following statement is correct : (Pg no.99)
a) a pale green Cl_2 gas is released at anode b)molten silvery white sodium is deposited at cathode
c) decomposition of NaCl into Na metal and Cl_2 gas **d) All the above**

iii) SI unit of conductivity is _____ (Pg no.92)
a) $\Omega^{-1}m^{-1}$ b) Ωcm^{-1} c) Ωm^{-1} d) $\Omega^{-1}m^2mol^{-1}$

iv) In case of weak electrolyte the graph Λ vs $\sqrt{c}$ is _____ (Pg no.94)
a) Linear **b) Not linear** c) Straight line passing from origin d) Curved

v) In construction of Standard Hydrogen Electrode, platinum acts as _____ (Pg no.108)
a) inert electrode b) positive ion producing electrode
c) negative ion producing electrode d) Null electrode

vi) For hydrogen gas electrode E_{H2} is calculated through to Nernst equation, where E^0_{H2} is always (Pg no.109)
a) 1.1V **b) 0V** c) -1.1V d)0.0592V

vii) When molten ionic compound is electrolyzed a metal is formed at ___ (Pg no.99)
a) Negative electrode b)Positive electrode c)Salt bridge d)Electrolyte

viii) The molar conductivity and conductivity of $AgNO_3$ solution is 121.4 $\Omega^{-1}cm^2mol^{-1}$ and 2.428×10^{-3} $\Omega^{-1}cm^{-1}$ at 25^0C. What is molar concentration of $AgNO_3$ solution: (Pg no.93)
a) 0.2M **b) 0.02M** c) 2.0M d) 2.2M

ix) A cell constituted by two electrodes A($E^0_{A+/A}$ = 0.35V) and B($E^0_{B+/B}$ = +0.42V) has value of E^0_{cell} equal to _____ (Pg no.105)
a) 0.77V **b) 0.07V** c) -0.77V d) -0.07V

x) Calculate E_{cell} for galvanic cell with electrodes Co/Co^{3+} // Mn^{2+}/Mn, E^0_{Mn} = -1.18V, E^0_{Co}=1.82 V. (Pg no.118)
a) -3.0V b) + 3.0V c) 1.36V d) 0.268V

Very short answer questions (1 Mark)

i) Give SI unit of resistivity. (Pg no.92)
ii) What is cell voltage? (Pg no.105)
iii) Write a mathematical expression for Standard Cell Potential. (Pg no.105)
iv) Name the process by which water produces hydrogen gas at cathode during electrolysis of aqueous NaCl. (Pg no.99)
v) Give the chemical composition present in the salt bridge. (Pg no.102)
vi) Write the potential produced through the NICAD storage cell. (Pg no.112)
vii) Write an equation that shows the relationship between molar conductivity and degree of dissociation of weak electrolyte. (Pg no.95)

Short answer questions (Type- I) (2 Marks)

1) Draw a neat and labelled diagram for electrolysis of fused NaCl.
2) What are the functions of a salt bridge in a galvanic cell?
3) Derive relation between rate of reaction(k) and cell potential(E^0_{cell})

4) Write applications of Kohlrausch's Law.
5) What is cell constant? Write its SI unit.
6) Mention difficulties in settings Standard Hydrogen Electrode.
7) What is the mass of copper metal produced at cathode during the passage of 2.03A current through the $CuSO_4$ solution for 1 hour. Molar mass of Cu = 63.5 g mol^{-1} (Ans: 2.4 g)
8) Mercury battery provides more constant voltage than any other dry cell ; Explain.
9) Represent the galvanic cell from following overall cell reaction -
$3Ni_{(s)} + 2Al^{3+}(1\ M) \rightarrow 3Ni^{2+}(1\ M) + 2Al_{(s)}$
10) How many moles of electrons are required for reduction of 2 moles of Zn^{2+} to Zn ? (Ans: 4 moles)
11) Calculate standard cell potential of following galvanic cell:
$Zn/Zn^{2+}(1\ M)$ // $Pb^{2+}(1\ M)/Pb$. If E^0_{Pb} = 0.126V and E^0_{Zn} = -0.763V (Ans: 0.889V)

Short answer questions (Type- II) (3 Marks)

1) State Kohlrausch law of independent migration of ions. Derive the relationship between Gibbs energy of cell reaction and cell potential.
2) Give the main difference between electrolytic conductivity and molar conductivity with respect to concentration. Also write one application of electrochemical series.
3) Write three important steps required to determine molar conductivity.
4) Draw a neat and well labelled diagram of Standard Hydrogen Electrode. Also write its one application.
5) Define reference electode.write two applications of electrochemical series.
6) Calculate the voltage of the cell Sn(s) / Sn^{2+}(0.02 M) // Ag^+(0.01 M) / Ag(s) at 25^0C.
Given: E^0_{Sn} = -0.136V, E^0_{Ag} = 0.800V (Ans: 0.8679V)
7) Draw a well labelled diagram of a conductivity cell. Also write net cell reactions involved in electrolysis of aqueous NaCl.
8) Write a mathematical formula for mole ratio. How long will it take to produce 2.415g of Ag metal from its salt solution by passing a current of 3A? Molar mass of Ag= 107.9 $gmol^{-1}$ (Ans: 720 s or 12 min.)

Long answer questions (4 Marks)

1) Why is Nickel Cadmium referred to as a secondary cell? Write working of NICAD storage cell. Also write its applications.
2) Write relation between electrolytic conductivity and molar conductivity.
Calculate molar conductivity at zero concentration for $CaCl_2$ and NaCl.
Given: molar ionic conductivities of Ca^{2+}, Cl^-, Na^+ ions are respectively, 104, 76.4, 50.1 $\Omega^{-1}cm^{-2}mol^{-1}$
(Ans:256.8$\Omega^{-1}cm^2mol^{-1}$ and 126.5$\Omega^{-1}cm^2mol^{-1}$)
3) Calculate E^0_{cell} of the following galvanic cell:
Mg(s) / Mg^{2+}(1 M) // Ag^+(1 M) / Ag(s) if E^0_{Mg} = -2.37V and E^0_{Ag} = 0.8V. Write cell reactions involved in the above cell. Also mention if cell reaction is spontaneous or not. (Ans: 3.17 V)
4) Explain construction, working in terms of cell reactions and the results of electrolysis of fused NaCl.

Chapter-6
Chemical Kinetics Marks-4 with option- 6

Multiple choice questions (1 Mark)

i) A First order reaction is 50% complete in 69.3 minutes. Time required for 90% completion for the same reaction is _____ (Pg no.135)

a) 230.3 mins b) 100 mins c) 230 mins d) 125 mins

ii) Time required for 100% completion of a zero order reaction is ____ (Pg no.127/129)

a) a/k b) a/2k c) a.k d) 2k/a

iii) Rate constant of a reaction is 3.6 x 10^{-3} s^{-1}. The order of reaction is _____ (Pg no.127)

a) First b) Second c) Third d) Zero

iv) The rate law relates to the rate of a chemical reaction in terms of _____ (Pg no.122)

a) Concentration of catalyst b) Temperature c) Potential energy **d) mol/L of reactants**

v) For first order reaction the rate constant for decomposition of N_2O_5 is 6x10^{-4} s^{-1}. The half-life period for decomposition in seconds is _____ (Pg no.127)

a) 11.55 b) 115.5 c) 1155 **d) 1.155**

vi) Order of reaction for which unit of rate constant is mol $dm^{-3}s^{-1}$ is ___ (Pg no.129)

a)1 b) 3 **c) 0** d)2

vii) The rate of catalysed reaction is large than the uncatalysed reaction as ___ (Pg no.134)

a) E_a is larger **b) E_a is lower** c) E_a is same

d) Threshold energy is absent

viii) Which of the following is a unimolecular reaction? (Pg no.125)

a) $2HI \rightarrow H_2 + I_2$

b) $N_2O_5 \rightarrow N_2O_4 + ½\ O_2$

c) $H_2 + Cl_2 \rightarrow 2HCl$

d) $PCl_3 + Cl_2 \rightarrow PCl_5$

ix) Effect of catalyst in a chemical reaction is to change the ___ (Pg no.134)

a) Activation energy b) Equilibrium concentration c) Final products d) Heat of a reaction

Very short answer questions (1 Mark)

i) Give one example of pseudo first order reaction. (Pg no.130)

ii) Write order of the following reaction: (Pg no.130)

$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$

iii) Identify molecularity of following reaction: (Pg no.125)

$C_2H_5I(g) \rightarrow C_2H_4(g) + HI(g)$

iv) Rate constant for the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ is 4.98 x 10^{-4} s^{-1}. Find the order of reaction?(Pg no.135)
(Ans: First order)

v) Write a mathematical expression for integrated rate law for zero order reaction. (Pg no.129)

vi) Name the slowest step that determines the rate in a complex reaction. (Pg no.125)

vii) Give one example of zero order reaction. (Pg no.130)

ix) For the reaction $2NO(g) + 2H_2(g) \rightarrow N_2(g) + 2H_2O(g)$. The rate law is rate = $k[NO]^2[H_2]$.
What is the overall order of reaction. (Pg no.124)

Short answer questions (Type- I) (2 Marks)

1) What is half life of first order reaction if time required to decrease concentration of reactants from 0.8M to 0.2M is 12 hrs. (Ans: 6hrs)
2) Distinguish between order of reaction and molecularity.
3) For the reaction $2NOBr \rightarrow 2NO_2 + Br_2$, the rate law is rate = $k[NOBr]^2$. If the rate of a reaction is 6.5×10^{-6} $molL^{-1}s^{-1}$, when the concentration of NOBr is 2×10^{-3} $molL^{-1}$.What would be the rate constant of the reaction? (Ans: 1.625 $molL^{-1}s^{-1}$)
4) Write four key points about order of reaction.
5) Explain pseudo first order reaction with a suitable example.
6) Define order of reaction with suitable examples.
7) Explain with the help of a potential energy diagram that the catalyst increases the rate of the reaction.

Short answer questions (Type- II) (3 Marks)

1) Derive an integrated rate law expression for first order reaction: $A \rightarrow B + C$
2) Define molecularity. The rate constant of the first order reaction is $1.386 min^{-1}$. Calculate the time required for 80% reactant to decompose?(Ans:1.162min.or 69.7 s)
3) A reaction occurs in the following steps:
   a) $NO_2(g) + F_2 \rightarrow NO_2F(g) + F(g)$ (slow)
   b) $F(g) + NO_2(g) \rightarrow NO_2F$ (Fast)
      i) Write the equation of overall reaction ii) Write the rate law
      iii) Identify reaction intermediate
4) Define half life of a reaction. Write units of rate constants for:
   a) First order reaction b) Zero order reaction
5) Write an expression for instantaneous rate of reaction: $2N_2O(g) \rightarrow 4NO_2(g) + O_2(g)$.
   What is the order of reaction?
6) Why is molecularity applicable for only elementary reactions whereas order of reaction is applicable for elementary and complex reactions? Explain with suitable examples.
7) For a zero order reaction molecularity can never be equal to zero. Explain.
8) For the reaction $2A + B \rightarrow C$, rate of disappearance of A 0.076 $mols^{-1}$.
   a) What is the rate of formation of C?
   b) What is the rate of consumption of B?
   c) What is the rate of the overall reaction? (Ans: a) 0.076$mols^{-1}$ b) 0.038$mols^{-1}$ c)0.038$mols^{-1}$)

Long answer questions (4 Marks)

1) In a first order reaction $A \rightarrow B$, 60% of a given sample of a compound decomposes in 45 mins. What is half life of reaction? Also write the rate law equation for above first order reaction. (Ans: $t_{1/2}$ = 34 mins)
2) Derive an expression for the relation between half life and rate constant for first order reaction. The half life period for first order reaction is 1.7 hrs. How long will it take for 20% of the reactant to disappear?
   (Ans: t = 0.5476 hrs or 32.9min)
3) Give one example of the reaction where order and molecularity are the same. Mention any two factors that influence the rate of chemical reaction. If for the reaction

$A \rightarrow$ products, a straight line graph passing through origin is obtained between the rate of reaction against concentration of A, what would be the order of reaction? Why?

Chapter- 07

Elements of Group 16, 17, 18 Marks 6 with option 8

Multiple Choice Questions (1 Mark)

i) In chlorous acid, oxidation state of chlorine is _____
(a) +2 (b) +4 **(c) +5** (d) +7 (P:148)

ii) Acidic strength of halogen acids increases in the order of _____
(a) HF>HCL>HBr>HI (b) HCL>HF>HBr>HI
(c) HBr>HCL>HF>HI (**d) HI>HBr>HCL>HF** (P:144)

iii) Sulfur dioxide reacts with sodium hydroxide solution to form ____
(a) Sodium Sulfite (b) Sodium Sulfate
(c) Sodium hydrogen sulfite (d) Sodium hydrogen sulfate (P:152)

iv) The gas is evolved,when sulfuric acid reacts with copper metal _____
(a) Sulfur dioxide (b) Sulfur trioxide
(c) Nitrogen dioxide (d) Nitrogen trioxide
(P:153)

v) When hot and concentrate alkali NaOH reacts with chlorine to form _____
(a) Only Chlorate (b) Only Hypochlorate
(c) Chloride and Chlorate (d) Chloride and Hypochlorate (P:155)

vi) When SO_2 is passed through an aqueous solution of I_2 solution becomes _____
(a) ruby red **(b) colourless** (c) violet (d) yellowish green (P:152)

vii) O_2 molecule is _____
(a) ferromagnetic **(b) diamagnetic**
(c) paramagnetic (d) ferrimagnetic

viii) The number of covalent bonds are present in sulfuric acid ?
(a) 4 **(b) 6** (c) 8 (d) 2 (P:147)

ix) In Interhalogen compounds, which halogen is never the central atom?
(a) I **(b) F** (c) Br (d) Cl (P:157)

Very Short Answer Questions (1 Mark)

(i) What is O-S-O bond angle in SO_2 ? (P:152)

(ii) Complete the following reaction
$SO_{2(g)} + Cl_{2(g)} - \xrightarrow{\text{charcoal}} ?$ (P:152)

(iii) Name the solution which is formed by passing sulfur dioxide in water. (P:152)

(iv) Write chemical formula of galena (P:138)

(v) Why does oxygen cannot exhibit higher oxidation state? (P:142)

(vi) The number of lone pairs of electron are present in ClF_5 (P:160)

(vii) Write the order of ionic character of halide with monovalent metal (M) (P:146)

Short Answer Questions (Type- I) (2 Marks)

(Q1) Draw structure and name the shape of bromine trifluoride .
(Q2) Write four uses of chlorine.
(Q3) Write a balanced chemical reaction of sulfuric acid with (a) carbon (b) sulfur.
(Q4) Draw resonance hybrid structure of SO_2 in two canonical forms.
(Q5) What is the action of chlorine on (a) cold and dilute sulfuric acid (b) hot and concentrated sulfuric acid .
(Q6) Elements of group 16 have lower ionization enthalpy values compared to those of group 15 elements. Explain why?

Short Answer Questions (Type-II) (3 Marks)

(Q1) What is oxidation state of sulfur in following
(a) Sulfurous acid (b) Sulfuric acid (c) Peroxy monosulfuricacid .
(Q2) Explain why fluorine shows only +1 oxidation state while other halogens show higher positive oxidation state? Write chemical reaction of action of Cl_2 on excess NH_3
(Q3) Distinguish between rhombic sulfur and monoclinic sulfur with respect to following points: Colour,shape,melting point,density,solubility in CS_2,structure.
(Q4) Explain the trend in the following atomic properties of group 16 elements:
(a) atomic radii (b) electronegativity (c) electron gain enthalpy
(Q5) What are chalcogens ? Discuss industrial method of preparation of sulfur dioxide from zinc sulfide and iron pyrites .
(Q6) Write three physical properties and three uses of sulfuric acid .

Long Answer Questions (4 Marks)

(Q1) Write chemical reactions in the manufacture of sulfuric acid by contact process.
(Q2) What happens when chlorine reacts with?
(a) Al (b) Na (c) S_8 (d) P_4
(Q3) Draw structure of chloric acid and chlorous acid . Discuss four points anomalous behavior of fluorine.

Chapter- 08

Transition and Inner transition elements Marks- 6 with option 8

Multiple Choice Questions (1 Mark)

i) The following ion has the maximum number of unpaired electrons
(a) Sc^{3+} (b) Ti^{3+}
(c) Fe^{3+} (d) Co^{2+} (P:168)

ii) In 3d series, if nuclear charge increases, the shielding effects will ____
(a) increases (b) decreases
(c) first increase then decrease (d) first decrease then increase (P:170)

iii) Transition elements have more tendency to form interstitial compounds because of ____
(a) defect in their crystal lattice (b) they have reducing property
(c) they have low ionization enthalpy (d) they have same atomic size (P:174)

iv) The following electronic configuration of elements shows highest oxidation state
(a) $3d^5 4S^2$ (b) $3d^5 4S^1$
(c) $3d^{10} 4S^2$ (d) $3d^{10} 4S^1$ (P:167)

v) Zinc does NOT show variable valency because _____
(a) complete 4S subshell **(b) complete d subshell**
(c) incomplete d subshell (d) incomplete S subshell (P:168)

vi) The catalyst used for decomposition of $KClO_3$
(a) ZnO **(b) MnO_2**
(c) CuO (d) K_2O (P:174)

vii) The atomic number of tranuranium elements starts from-----
(a) 89-103 (b) 90-103
(c) 91-103 **(d) 93-103** (P:190)

viii) The following pair of elements has half-filled d-orbitals
(a) chromium and cobalt (b) manganese and nickel
(c) chromium and manganese (d) cobalt and nickel (P:167)

Very Short Answer Questions (1 Mark)

i) Write formula to calculate magnetic moment. (P:171)
(ii) Write the general electronic configuration of 3d series. (P:166)
(iii Name the radioactive element in Lanthanoids (P:188)
(iv)What is lanthanoid contraction? (P:182)
(v) Write chemical formula of ore of zinc. (P:177)
(vi) Name the alloy which is formed from copper and tin. (P:175)
(vii) Which alloy is used in the Fischer-Tropsch process in the synthesis of gasoline (P:174)
(viii) The catalyst used in the hydrogenation of ethene to ethane (P:174)

Short Answer Questions (Type- I) (2 Marks)

(Q1) Salt of S_c^{3+} and Ti^{4+} are colourless. Explain why ?
(Q2) Give the electronic configuration of Europium (Z=63) and Gadolinium (Z=64)
(Q3) Distinguish between lanthanoids and actinoids .
(Q4) Manganese in the +2 oxidation state is more stable than +3 oxidation state where as iron is stable at +3 oxidation state than +2 oxidation state. Explain why?
(Q5) Explain terms cast iron and wrought iron with their uses?
(Q6) What are the causes of lanthanide contraction?

Short Answer Questions (Type-II) (3 Marks)

(Q1) Give similarities and differences in the elements of 3d,4d and 5d series.
(Q2) Discuss the position of d-block elements, lanthanoids and actinoids in the periodic table.
(Q3) Calculate magnetic moment of thorium (Z=90) . Is this element diamagnetic or paramagnetic?
(Q4) What are interstitial compounds? write any four properties of it .
(Q5) What are ferrous and non-ferrous alloy? Write any two uses of alloy.
(Q6) What are rare earth elements? Write any two properties and uses of actinides.

Long Answer Questions (4 Marks)

(Q1) Ground state electronic configurations of gadolinium and lowrentium are different than expected. Explain why?
(Q2) Explain the trends in : (a) Atomic radii (b) Oxidation state of 3d elements. Which factors relate to the colour of transition metal?
(Q3) Define transuranium and d-block elements.Write two applications of lanthanoids and actinoids.

Chapter-09

Coordination Compounds Marks- 5 with option 7

Multiple Choice Questions (1 Mark)

i. Amongst the following, the ambidentate ligand is…… pg 193
   a) Ethylene diamine b) Oxalate ion
   c) Chloride ion **d) Cyanide ion**

ii. The charge on metal ion in $[Fe(CN)_6]^{4-}$ is …….. pg 193
   a) 2 b) 3
   c) 4 d)5

iii. The effective atomic number of cobalt in $[Co(NH_3)_6]^{3+}$ is……. pg 197
   a) 33 b) 34
   c) 35 **d) 36**

iv. The IUPAC name of $Na_3[AlF_6]$ is…… .pg 196
   a) Hexa fluorosodiumaluminate
   b) Sodium hexafluoroaluminate(III)
   c) Sodium hexafluoroaluminate(II)
   d) Sodium hexafluoroaluminium (III)

v. Hybridization of cobalt in $[Co(NH_3)_6]^{3+}$ complex ion is……. pg 202
   b) sp^3d^2 b) sp^2d^3
   c) $\mathbf{d^2 sp^3}$ d) $d^3 sp^2$

vi. The geometry of $[CoF_6]^{3-}$ complex ion is……. .pg 303
   a) Trigonal bipyramidal b) Tetrahedral
   c) Octahedral d) square planar

vii. The pair $[Co(NH_3)_5(SO_4)]Br$ and $[Co(NH_3)_5Br]\,SO_4$ exhibits…….. isomerism pg 200
   a) Coordination **b) Ionisation**
   c) Linkage d) Optical

Very Short Answer Questions (1 Mark)

i. Draw structure of Ethylenediaminetetraacetate ion. pg 192

ii. Write coordination number of Fe^{+3} in $[Fe(C_2O_4)_3]^{3-}$ complex ion. pg 193

iii. Write chemical composition of carnalite. pg 194

iv. Write oxidation number of iron in $[Fe(CO)_5]$ pg 196

v. Calculate effective atomic number of iron in $[Fe(CN)_6]^{4-}$ complex ion pg 197

vi. Write the type of isomerism exhibited by $[Co(NH_3)_5(NO_2)]^{2+}$ and $[Co(NH_3)_5ONO]^{2+}$ pair of complex ion. pg 199

vii. Write the IUPAC name of $[Fe(CN)_6]^{4-}$ ion. pg 196

Short Answer Questions (Type- I) (2 Marks)

1) Explain homoleptic and heteroleptic complexes.
2) Write four postulates of Werner's theory
3) Write one example each of bidentate and ambidentate ligand.
4) Distinguish between double salt and coordination complex.
5) Define the following terms: (i) Co-ordination isomer (ii) Hydrated isomers
6) Write two applications of coordination compound.

Short Answer Questions (Type-II) (3 Marks)

1) Write classification of ligands with one example of each type.
2) Define following terms (i) Co-ordination isomer (ii) Hydrated isomers.
   Draw structure of cis isomer of $[Co(NH_3)_4Cl_2]^+$
3) Write formula to calculate EAN with significance of terms involved in it. Calculate EAN of $[Fe(CN)_6]^{3-}$.

4. Write the IUPAC name of $[Ni(CN)_4]^{2-}$.
   Draw the geometrical isomers of following complexes $[Pt(NH_3)(H_2O)Cl_2]$ and $[Co(NH_3)_4Cl_2]^+$
5. Define ligand. Explain the magnetic properties of $[Ni(CN)_4]^{2-}$.
6. Define (i) Anionic sphere complex (ii) coordination number. Draw optical isomers
   Of $[Co(en)_3]^{3+}$

Long Answer Questions (4 Marks)

1) Write oxidation state and coordination number of $[Co(NH_3)_4Cl_2]^+$ ion. Calculate EAN of iron in $[Fe(CN)_6]^{4-}$.Write the IUPAC name of$[Zn(NH_3)_4]^{2+}$.
2) Explain, why $[Co(NH_3)_6]^{3+}$ ion is low spin? Calculate number of unpaired electrons and write the geometry of $[Co(NH_3)_6]^{3+}$.
3) Answer the following with respect to $[CoF_6]^{3-}$ion
   (i) Type of hybridization
   (ii) Number of unpaired electrons
   (iii) Geometry of complex ion
   (iv) Magnetic property.

Chapter- 10
Halogen Derivatives Marks 5 with option 7

Multiple choice questions (1 Mark)

i) The type of monohalogen derivative in which a halogen atom is bonded to sp^3 hybridized carbon atom next to carbon-carbon double bond is ..... (pg. 211)

a) alkyl halide **b) allylic halide**
c) vinylic halide d) benzylic halide

ii) Aromatic electrophilic substitution with iodine can be carried out using..... (pg. 214)

a) HNO_3 b) HCl
c) HI d) H_3PO_4

iii) For the isomeric dihalobenzenes , melting point of ..... (pg. 215)

a) ortho isomer is higher b) meta isomer is higher
c) para isomer is higher d) all isomers is nearly same

iv) Optical activity of a molecule is associated with .... (pg.217)

a) plane polarized light **b) 3-D structure of a molecule**
c) achiral molecule d) superimposable mirror images

v) Propane nitrile can be prepared by heating ..... (pg. 220)

a) ethyl bromide with alcoholic KCN b) propyl bromide with alcoholic KCN
c) ethyl bromide with alcoholic AgCN d) propyl bromide with alcoholic AgCN

vi) The following will react faster by S_N1 mechanism (pg. 222)

a) 1-chloropropane b) 2-chloropropane
c) 2-chloro-2-methylpropane d) chloroethane

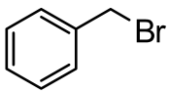
vii) Major product of the following reaction is ..... (pg. 226)

$CH_3\text{-}CH_2\text{-}Mg\text{-}Br + NH_3 \longrightarrow$?

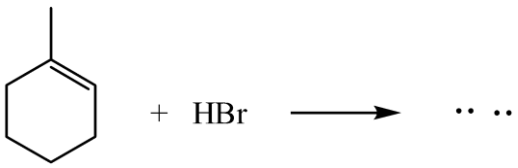
a) $CH_3\text{-}CH_2\text{-}Mg\text{-}NH_2$ **b) $CH_3\text{-}CH_3$**
c) $Mg\text{-}Br\text{-}NH_2$ d) $CH_3\text{-}CH_2\text{-}Br$

Very Short Answer Questions (1 Mark)

i) Write IUPAC name of the following . (pg. 211)



ii) Write the major product of the following reaction . (pg. 213)



iii) Write the correct decreasing order of boiling point for bromomethane , chloroform , dibromomethane and bromoform . (pg. 216)

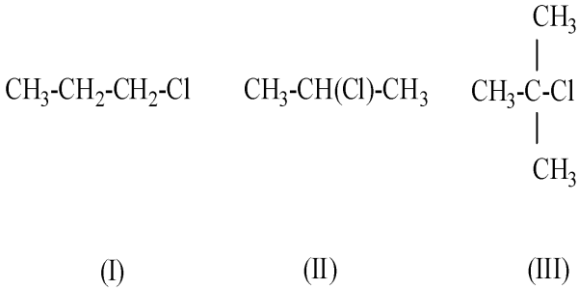
iv) Write IUPAC name of the product 'B' in the following reaction sequence. (pg. 214)

$$C_2H_5OH \xrightarrow[\Delta]{NaBr/H_2SO_4} A \xrightarrow[acetone]{NaI} B$$

v) Nucleophilic substitution reaction of 2,4-dinitrochlorobenzene is faster than p-nitrochlorobenzene . Give reason . (pg. 227)

vi) Name the reagent used to convert alkyl halide to ester. (pg. 220)

vii) Write the correct order of increasing ease of dehydrohalogenation. (pg. 225)



(I) (II) (III)

Short Answer Questions (Type- I) (2 Marks)

i) Explain .Aryl halides are less reactive than alkyl halides towards nucleophilic substitution reactions.

ii) Explain reactions of haloarenes with sodium metal.

iii) Give reason. Though alkyl halides are moderately polar, they are insoluble in water.

iv) Explain optical activity of 2-chlorobutane

v) Distinguish between S_N1 and S_N2 mechanism .

vi) Explain primary benzylic halide shows higher reactivity by S_N1 mechanism than other primary alkyl halide.

Short Answer Questions (Type-II) (3 Marks)

i) Explain the factors affecting S_N1 and S_N2 mechanism.

ii) Explain aqueous alkaline hydrolysis of tert. butyl bromide.

iii) How are following conversions carried out?

a) propene to 1-iodopropane b) propene to 2-nitropropane c) benzene to biphenyl

iv) What is Grignard reagent? How is it prepared? Why are they prepared under anhydrous condition?

v) Write chemical equations indicating the action of following on bromobenzene .

a) CH_3COCl / anhy. $AlCl_3$ b) fuming H_2SO_4 c) conc. HNO_3 / conc. H_2SO_4

vi) An organic compound A with molecular formula $C_4H_{10}O$ on treatment with phosphorus pentachloride gives alkyl chloride. Alkyl chloride on treatment with Mg in presence of dry ether gives a highly reactive compound B. Compound B reacts with water to give hydrocarbon C. Alkyl chloride on treatment with Na in dry ether as a solvent gives alkane, 2,2,3,3-tetramethylbutane. Identify 'A' , 'B' , 'C' .

Long Answer Questions (4 Marks)

i) Write the equations for preparation of ethyl chloride using

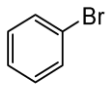
a) Hydrogen halide b) ethene c) Thionyl chloride

Which of these methods is preferred and why ?

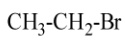
ii) What is dehydrohalogenation ? State the rule for formation of preferred product of dehydrohalogenation. Predict all the alkenes that would be formed by dehydrohalogenation of following alkyl halide.

a) 2-chloro-2-methylbutane b) 3-bromo-2,2,3-trimethylpentane

iii) Observe the following compounds and answer the questions given below.



(I)



(II)

a) Identify the type of halides. b) Explain the nature of C – Br bond in both of these halides .

c) Which of these compounds will undergo aqueous alkaline hydrolysis readily?

Write the reaction in support of your answer.

Chapter- 11

Alcohols,Phenols and Ethers Marks 4 with option 6

Multiple choice questions (1 Mark)

i) In a carbinol system of nomenclature tert.butyl alcohol is named as.... (pg. 235)

a) trimethyl carbinol b) dimethyl ethyl carbinol c) methyl carbinol d) ethyl carbinol

ii) Which of the following pair of reagent is used for conversion of carboxylic acid to alcohol (pg 239)

a) $LiAlH_4$ / H_3O^+ b) H_2 / Ni – heat

c) B_2H_6 / H_2O_2, OH^- d) H_2 / Pd

iii) Reaction between Grignard reagent and aldehyde other than formaldehyde leads to formation of (pg 239)

a) primary alcohol **b) secondary alcohol**

c) tertiary alcohol d) optically active alcohol

iv) Oxidation of ethyl alcohol using $K_2Cr_2O_7$/dil H_2SO_4 leads to formation of... (pg. 246)

a) acetaldehyde **b) acetic acid**

c) ethane d) acetone

v) When vapours of tert.butyl alcohol are passed over hot copper, it gives .... (pg. 246)

a) butanal b) butanoic acid

c) butanone **d) isobutylene**

vi) Reaction between hot conc. HI and anisole gives .... (pg. 251)

a) phenol and methyl iodide b) iodobenzene and methyl alcohol

c) iodobenzene and methyl iodide d) phenol and methyl alcohol

vii) The reagents used to convert phenol to 2,4,6-tribromophenol is ... (pg. 247)

a) Br_2 / CS_2 b) Br_2 / CCl_4

c) Br_2 / H_2O d) KBr aq.

Very Short Answer Questions (1 Mark)

i) Why do phenols give deep coloration with neutral ferric chloride? (pg. 242)

ii)Arrange the following in decreasing order of acid strength. (pg. 243)

CH_3OH , CH_3-CH_2-OH , CH_3-CH(OH)-CH_3 , $(CH_3)_3$ – C- OH

iii) Write IUPAC name of crotonyl alcohol. (pg. 236)

iv) Draw the structure of the major product of hydroboration-oxidation of propene. (pg. 238)

v) Write the reaction to get aspirin from salicylic acid. (pg. 245)

vi)Write the name of major product when anisole reacts HI at 398 K (pg. 251)

vii)What is the action of atmospheric oxygen on ethers? (pg. 250)

viii)With the help of chemical equations show what happens when cumene hydroperoxide is treated with dil. acid. (pg. 240)

ix) Draw intramolecular hydrogen bonding structure in o-nitrophenol . (pg.242)

Short Answer Questions (Type- I) (2 Marks)

i) What is the action of following reagents on pent-3-enal

a) H_2 / Ni

b) $LiAlH_4$ / H_3O^+

ii) Write the reactions involved in preparation of phenol from benzene sulfonic acid.

iii) Write Kolbe's reaction.

iv) Name the reagents used to convert phenol into

a) picric acid

b) p-benzoquinone

v) Identify 'A' and 'B' in the following reaction sequence.

$$CH_3COOH + C_2H_5OH \xrightarrow[-H_2O]{H^+} A \xrightarrow[\Delta]{H_2/Ni} B$$

vi) Write chemical equation of acetyl chloride with
a) ethanol b) phenol

Short Answer Questions (Type-II) (3 Marks)

i) What is the action of following on phenol at low temperature.
a) dil. HNO_3 b) conc. H_2SO_4 c) Br_2/CS_2

ii) An unknown alcohol is treated with Lucas reagent. Explain how you will determine whether the alcohol is primary , secondary or tertiary . Indicate by chemical equation the reaction between isopropyl alcohol and Lucas reagent.

iii) How will you bring about the following conversions?
a) isopropyl alcohol to acetone
b) 2-methyl propan-2-ol to 2-methylpropene
c) acetone to 2-methylpropan-2-ol

iv) Compound 'A' with molecular formula C_6H_5Cl is fused with NaOH at high temperature under pressure to give compound 'B'. Compound 'B' on treatment with dil.HCl gives compound C having characteristic carbolic odour. Write the chemical equations in support of this . Name the process and give uses of compound C.

v) Write the preparation of ethanol from methyl magnesium iodide. Write the reaction between ethanol and acetic anhydride.

vi) Write the reactions for preparation of carbolic acid from aniline. What is the action of conc. H_2SO_4 on carbolic acid at 373 K.

Long Answer Questions (4 Marks)

i) Write chemical reactions to convert phenol into salicyaldehyde.Write the name of the reaction.What happen when if CCl_4 is used instead of $CHCl_3$ in the above reaction.

ii) An organic compound gives hydrogen on reaction with sodium metal. It forms an aldehyde with molecular formula C_2H_4O on oxidation with pyridinium chlorochromate. Give the chemical equations in support of these observations.
Explain the fact that in alkyl aryl ethers, alkoxy group is ring activating and ortho/para directing towards electrophilic aromatic substitution.

iii) How will you prepare diethyl ether by dehydration of alcohols? What are the limitations to prepare ether by this method ? What is the action of following on diethyl ether?
a) dil. H_2SO_4 b) PCl_5

Chapter -12

Aldehydes, Ketones and carboxylic acids. Marks - 06 with option 08

Multiple choice questions (1Mark)

i) Which of the following is the product of reaction of ethane nitrile with Grignard reagent followed by acid hydrolysis?

a) **a ketone** b) an aldehyde
c) an acid d) an acid chloride

ii)------- reaction is used to synthesize straight alkyl substituted benzenes.

a) Etard b) Rosenmund reduction
c) Stephen reaction **d) Wolf Kishner reduction**

iii) Ketones can NOT be converted into carboxylic acid using____.

a) Alkaline KMnO4 b) CrO_3
c) **dil HNO_3** d) hot and conc HNO_3

iv) Correct order of acid strength for
i)acetic acid ii) fluoroacetic acid iii) 4-Nitrobenzoic acid iv) 4-Methyl benzoic acid is…….

a) i> ii> iii > iv b) **ii > iii > iv > i,**
c) iii > iv > i > ii d) iv > i > ii > iii

v) Addition of sodium bisulphite to ethanol is --------- type of reaction.

a)electrophilic addition b) electrophilic substitution
c) **nucleophilic addition** d) nucleophilic substitution

vi) The following reactants CAN NOT be converted into carboxylic acid?

a Dry ice **b) Cyclohexane**
c) Toluene d) Cyclohexene

vii) The following compounds will give positive Fehling's test.

a.Propandane b) Pentan-3-one
c) Butanone d) **Butan-2-ol**

Very short answer type of questions (1 mark)

i) Write IUPAC name of Phthaldehyde?
ii) What is substituted imine called?
iii) Write the name of the product when ketones react with 1,2-diol in presence of dry HCl .
iv) Write another name of disproportionation reaction?
v) Write the number of products when a mixture of ethanal and propanal is reacted with dilute alkali?
vi) Write structure of the product formed when carboxylic acid is heated with dehydrating agent like P_2O_5
vii) Write the reducing agent which CAN NOT reduce – COOH group.

Short answer questions (Type-I) (2 Marks)

i. i) Write Classification of aliphatic ketones with suitable example
ii. ii) What is the action of Grignard reagent on benzonitrile?
iii. iii) Carboxylic acids have higher boiling points than those of ethers .Give reason.
iv. iv) Explain Cannizzaro reaction with suitable example.
v. v) What is the action of following on proponal? a.Hydroxyl amine b.Hydrazine
vi.vi) Write the preparation reactions for acid amide from the following.
a. Carboxylic acid b. Acid chloride

Short answer questions (Type-II) (3 marks)

i) What is the action of following reagents on ethanoic acid?
a) $SOCl_2$ / heat b) sodalime / heat c) P_2O_5 / heat

ii) Explain aldol condensation reaction in details.

iii)Write reactions for the following conversions.
a.Benzene to Benzaldehyde
b.Propanone to Propane
c.4-Nitrobenzoic acid to Nitrobenzene

iv) Explain haloform reaction with suitable example.
Write reaction to distinguish acetaldehyde from acetone

v) Write IUPAC name of mesityl oxide. What is the action of following reagents on acetaldehyde
a. hydroxyl amine b. acidified potassium dichromate

vi) Write chemical reactions to convert –COOH group of acetic acid into following
a. CH_4 b. C_2H_5OH c. CH_3COCl

Long answer questions. (4 marks)

i) Draw structure of salicylaldehyde.
Write reaction for preparation of acetophenone from benzoyl chloride.
Explain the acidic nature of carboxylic acids.

ii) Write reactions for the action of following reagents on p-chlorobenzaldehyde .
a) Ethane-1,2-diol in presence of dry HCl.
b) Tollen's reagent.
c) Phenyl hydrazine.
Write reagent for conversion of alkyl nitrile into aldehyde.

iii) What are aliphatic aldehydes? Complete the following sequence of reactions and write structures for A, B, C .

Dry ice $\xrightarrow[\text{ii. Hydrolysis}]{\text{i. Dry ether}}$ A $\xrightarrow{PCl_5}$ B $\xrightarrow[\text{Pd-BaSO4}]{H_2\text{ (gas)}}$ C

Chapter -13
Amines Marks 3 with option 4

Multiple Choice Questions (1 Mark)

i) The following amines is the product of Gabriel phthalimide synthesis (p-286)
a) secondary aliphatic amine **b) primary aliphatic amine**
c) aromatic primary amine d) tertiary aliphatic amine

ii) Mendius reaction is used to convert …… (p285)
a) amide into amine b) alkyl halide into amine
c) nitroalkane into amine **d) alkyl cyanide into amine**

iii) The strongest base amongst the following is (p-288)
a) Methanamine **b) N-Methylmethanamine**
c) N-Methylaniline d) N,N-Dimethylmethanamine

iv) The reaction in which diazonium salt is used (p-293)
a) Sandmeyer reaction b) Mendius reaction
c) Holfmann rearrangement reaction d) Carbylamine reaction

v) The type of isopropylamine is a ……. .(p-284)
a) primary amine b) secondary amine
c) tertiary amine d) quaternary ammonium salt

vi) Aniline on reaction with bromine water produces …… .(p-294)
a) 1,4-Dibromobenzene b) 1,2,4-Tribromobenzene
c) 2,4-Dibromoaniline **d) 2,4,6-Tribromoaniline**

vii) Tertiary amines have lowest boiling points because ……. (p-286)
a) they possess polar N-C bonds
b) they possess intermolecular dipole-dipole attraction forces
c) they possess intermolecular H-bonding
d) they do not possess intermolecular H-bonding

Very short answer type of questions (1 mark)

i) Name the process of breaking C-X bond by ammonia in preparation of amines. (p-283)
ii) Arrange the following compounds in increasing order of their boiling points.
Ethyl alcohol, Ethyl amine, Ethanoic acid, Ethane (p-287)
iii) Write the name of the reaction in which aromatic primary amines produce offensive smell.(p-292)
iv) Write the number of moles of ethanoyl chloride required for complete acylation of N,N-Dimethylaniline. (p-292)
v) Write the name of the gas evolved when a primary amine is reacted with nitrous acid.(p-292)
vi) Write the structure of Hinsberg's reagent. (p-294)
vii) Write the order of reactivity of alkyl halides with ammonia. (p-283)

Short answer questions (Type-I) (2 Marks)

i) Explain basic nature of amines?

ii) Write the reactions to bring about the following conversions.
   a. Aniline to Sulfanilic acid
   b. Methyl chloride to Ethanamine

iii) Explain carbylamine reaction.

iv) Write IUPAC names of p-toluidine and trimethyl amine

v) What is the action of nitrous acid on the following compounds?
   a) Isopropyl amine b) Aniline

vi) Write the reactions to bring about the following conversions.
   a) Nitroalkane to Alkylamine
   b) Alkyl cyanide to Alkylamine

Short answer questions (Type-II) (3 marks)

i) Distinguish between methanamine ,dimethanamine and trimethanamine using Hinsberg's reagent.

ii) Write IUPAC name of $H_2N\text{-}(CH_2)_6\text{-}NH_2$.
   Write reactions to bring about the following conversions.
   a) Acetamide to Ethylamine
   b) Acetamide to methylamine

iii) Explain Hoffmann's exhaustive alkylation with suitable reactions.

iv) Explain nitration of aniline.
   Write reactions for the preparation of p-nitroaniline.

v) Draw resonance structures of aryl diazonium salts.
   Write the use of aryl diazonium salts.

vi) How are amines classified depending on the functional group?
   Give one example of each class of amines.

Long answer questions (4 marks)

i) Write reactions for preparation of ethanamine using Gabriel phthalimide synthesis. Why cannot aniline be prepared by Gabriel phthalimide synthesis?

ii) Explain basicity of amine with suitable example. Write the factors influencing basicity of amines.

iii) Explain the following reactions with suitable examples.
   a) Gatterman reaction
   b) Sandmeyer reaction.
   c) Hofmann elimination reaction.

Chapter- 14

Biomolecules Marks-3 with option 4

Multiple Choice Questions (1-Mark)

i) Glucose on oxidation with dilute nitric acid gives------ (Page-301)
a) saccharic acid b) oxalic acid c) gluconic acid d) malonic acid

ii) The glycosidic linkage in maltose is formed between------ (Page-304)
a) C-1 of α-D glucose and C-2 of α-D glucose **b) C-1 of α-D glucose and C-4 of α-D glucose**
c) C-1 of α-D glucose and C-2 of α-D fructose d) C-1 of α-D glucose and C-4 of α-D fructose

iii) The optically inactive α- amino acid among the following is----- (Page-308)
a) alanine b) insulin c) leucine **d) glycine**

iv) The sugar component of nucleotide unit in RNA is----- (Page-316)
a) α- deoxy-D-ribose **b) D-ribose** c) L-ribose d) 2-deoxy-L-ribose

v) The chemical nature of peptide bond in proteins is ------ (Page-310)
a) primary amide **b) secondary amide** c) tertiary amide d) an ionic bond

vi) In which of the following structure of DNA carries genetic information of the organism (Page-317)
a) the primary structure of DNA b) the double helix structure of DNA
c) complementary base pairing d) sugar-phosphate backbone

vii) In the process of denaturation, there is NO change in the structure following protein (Page-314)
a) primary b) secondary c) tertiary d) quaternary

Very Short Answer Questions (1-Mark)

i) Write the name of polysaccharide used for commercial preparation of glucose. (Page-300)

ii) Draw the structure of α-D glucopyranose. (Page-304)

iii) Write the structure of Zwitterion of alanine. (Page-309)

iv) Write the name of the unit to which glucose unit is linked to form sucrose. (Page-305)

v) Write the name of the base present in DNA but not found in RNA. (Page-316)

vi) Write the number of chiral carbon atoms present in fructose. (Page-304)

vii) Sugar present in DNA is (Page-316)

viii) Complete the following reaction.

$H_2N\text{-}CH_2\text{-}COOH + H_2N\text{-}CHCH_2\text{-}COOH \xrightarrow{-H_2O} ?$

Short Answer Questions (Type-I) (2-Marks)

i) Explain preparation of glucose form sucrose

ii) Write chemical reaction for following conversions
a) glucose into glucoxime b) glucose into gluconic acid

iii) Define peptide bond. Write types of proteins depending upon molecular shape.

iv) Define following terms. a) nucleotide b) nucleoside

v) Explain denaturation of proteins

vi) Define enzyme. Write industrial application of enzyme catalysis.

vii) Draw structure of following. a) 2-Deoxy-D-ribose b) Cytosine

viii) Explain globular and fibrous proteins with example.

ix) Classify the following carbohydrates into monosaccharide,disaccharide,oligosaccharide and polysaccharide
glucose, cellulose, maltose,stachyose

Short Answer Questions (Type-II) (3-Marks)

i) Explain the classification of carbohydrates with examples.
ii) What is the action of following reagents on glucose ?
a) acetic anhydride b) hydroxylamine c) hydrogen iodide.

iii) Define carbohydrates. Draw the Haworth projection structures of the following.
a) α-D-(-) fructofuranose b) maltose
iv) Explain D and L configuration in sugars. Write a chemical reaction to convert glucose into glucose cyanohydrin.
v) Define α- amino acids. Draw the structures of a) Zwitterion of alanine b) Haworth formula of sucrose.
vi) Explain primary structure of proteins. Write a commercial method for preparation of glucose.

Long Answer Questions (4-Marks)

i) Define carbohydrates. Give the classification of carbohydrates with example.
ii) What is monosaccharide? How is glucose prepared on a commercial scale? Draw the structure of pyran.

Chapter- 15

Introduction to polymer chemistry Marks-3 with option 4

Multiple Choice Questions (1-Mark)

i) Semisynthetic polymer among the following is ------ (Page-323)
a) linen b) silk c) nylon **d) cellulose nitrate**

ii) Addition polymer among the following is ---------- (Page-324)
a) terylene **b) polythene** c) nylon 6,6 d) nylon 6.

iii) Homopolymer among the following is ------ (Page-326)
a) Buna-S **b) Nylon 6,6** c) PHBV d) Dacron

iv) Which of the following is a biodegradable polymer? (Page-335)
a) nylon6 b) nylon 6, 6 **c) nylon2-nylon6** d) viscose rayon

v) Chemical combination of Ziegler-Natta catalyst is----- (Page-329)
a) trimethyl aluminium titanium tetrachloride
b) triethyl aluminium titanium tetrachloride
c) triethyl aluminium titanium trichloride
d) triethyl aluminium titanium dichloride

vi) Dacron is a copolymer of ethylene glycol and-------- (Page-331)
a) adipic acid b) hexamethylenediamine c) phthalic acid **d) terephthalic acid**

vii) Nylon 6, 6 is a condensation polymer of hexamethylenediamine and------- (Page-330)
a) picric acid **b) adipic acid** c) terephthalic acid d) ϵ caprolactam

Very Short Answer Questions (1-Mark)

i) Write the number of carbon atoms present in the monomer used for preparation of nylon 6 polymer. (Page-331)

ii) Write the name of the catalyst used for preparation of high density polythene polymer. (Page-329)

iii) Monomer used for preparation of polyacrylonitrile is (Page-330)

iv) Monomers ethylene glycol and terephthalic acid undergo condensation polymerization to give polymer calls. (Page-331)

v) Monomer of natural rubber is. (Page-327)

vi) Write the name of biodegradable polymer formed by two amino acids namely glycine and ϵ-amino caproic acid. (Page-335)

vii) Functional group present in terylene polymer is. (Page-331)

viii) Write the name of the polymer obtained by polymerization of 2-chloro-1, 3-butadiene. (Page-333)

Short Answer Questions (Type-I) (2-Marks)

i) Define elastomer. Write the name of raw material used for preparation of nylon6, 6 polymer.
ii) Write chemical reactions for the preparation of following polymers a) teflon b) polyacrylonitrile
iii) Define vulcanization .write the structure of monomer used in natural rubber.
iv) Explain the term copolymers with examples.
v) Write preparation of low density polythene.Mention two uses of LDP.
vi) Write chemical reactions for preparation of the following. a) Buna-S b) Neoprene.
vii) Explain thermoplastic and thermosetting polymers.
viii) Explain homopolymers with examples.
ix) Write the name of one example of each polymer in which following repeating units.
$(-CF_2-CF_2-)$, $-[-NH-(CH_2)_5-CO-]$, $(-CH_2-CH)-CN$, $(-CH_2-CH_2-)$

Short Answer Questions (Type-II) (3-Marks)

i) Explain classification of polymers on the basis of structures.
ii) Explain copolymers. Write the name and formulae of the monomers used for preparation of dacron.
iii) Write chemical reactions for the preparation of high density polythene.Write its two uses and two properties.
iv) Write the preparation of nylon 6, 6.Mention two properties and two uses of nylon 6,6 polymer.
v) Explain classification of polymers on the basis of origin.
vi) Define fibres. Explain vulcanization of rubber.
vii) Explain free radical mechanism in detail for the preparation of addition polymers.

Long Answer Questions (4-Marks)

i) Define rubber. Write the chemical reactions for the preparation of following polymers.
a) teflon b) polyisoprene c) polyacrylonitrile d) SBR
ii) Explain the reactions involved in the preparation of viscose rayon.

Chapter-16

Green Chemistry And Nanochemistry Marks 3 with option 4

Multiple choice questions (1 Mark)

i) Bottom ash of thermal power stations can be used as raw material for cement and brick industry. This example illustrate which of the following principle of green chemistry

a) Atom economy. b) Designing safer chemicals.
c) Design for energy efficiency. **d) Prevention of waste or by products**. P340

ii) Less hazardous chemical synthesis point of view instead of harmful DDT Now a days ---------- is used as insecticides

a) Benzene **b) BHC**
c) Chlorobenzene d) Ethanol P341

iii) The concept that aims to maximize efficiency and minimize hazardous effect on human health and environment was coined by Paul T.Anastas

a) Green revolution b) Blue revolution
c) Nano chemistry **d) Green Chemistry** P340

iv) Nanorods are the example of ---------

a) One dimensional nanostructure **b) Two Dimensional nanostructure**
c) Three dimensional nanostructure d) Zero dimensional nanostructure P346

v) Which nanoparticles act as highly effective bacterial disinfectant, removing E.Coli from water?

a) Gold nanoparticles **b) Silver nanoparticles**
c) TiO_2 nanoparticles d) ZnO nanoparticles P350

vi) Catalyst used for hydrogenation of oil is-------

a)V_2O_5 b) Fe
c) Raney Ni d) MnO_2 P342

vii) In green technology developed by Drath and Frost, adipic acid is enzymatically synthesized from

a) Sucrose b) lactose
c) maltose **d) glucose** P341

Very short answer Questions (1 Mark)

i) The total number of principles of green chemistry are P340
ii) Name the catalyst used to manufacture of H_2SO_4 by contact process P342
iii) Name the plant which is an example of self-cleaning P350
iv) Write the name of nanomaterial which is used in water purification. P350
v) Name the γ-isomer of Benzene hexachloride P341
vi) Which principle of green chemistry has its perspective towards to carrying out reactions at room temperature and pressure P 341
vii) Write any example of nanoparticles which is used in photo catalysis. P 347

Short Answer Questions (Type-I) (2-Marks)

1) Define atom economy. Write the formula to calculate % atom economy
2) Define i) Green chemistry
   ii) Nanochemistry
3) Write one example of safer solvent and hazardous solvent
4) How does nanochemistry play an important role in water purification?
5) Complete and write the following table

Reaction	Name of catalyst
i) manufacture of HDPE polymer	----------
ii) ----------	V_2O_5

6) Write formula to calculate percentage atom economy

Short Answer Questions (Type-II) (3-Marks)

1) Explain prevention of waste or by products which is one of the principles of green chemistry.
2) Write any three advantages of nanoparticles and nanotechnology.
3) Write one example of nanomaterial used in following
   i) water purification
   ii) tyre of car
   iii) ancient glass painting
4) Explain the role of green chemistry.
5) Explain any three characteristic features of nanoparticles.
6) State Disadvantages of nanoparticles and nanotechnology.

Long Answer Questions (4-Marks)

1) i) Explain the term sustainable development
   ii) How is nanotechnology useful for the energy sector.
2) i) Write a short note on catalytic activity of nanoparticles.
   ii) Complete and write the following table

S/N	Nanomaterial dimension	Nanomaterial type
a)	One dimension <100 nm	----------
b)	Two dimension <100 nm	----------

3) i) Illustrate use of safer solvent by giving suitable examples.
   ii) Define a) Nanomaterial
   b) Nanotechnology