

**Time allowed: 3 Hours**

**Max. Marks: 70**

General Instructions:

- (a) All questions are compulsory
- (b) Section A: Q.no. 1 to 5 are very short questions and carry 1 mark each.
- (c) Section B: Q. no. 6 to 12 are short answer questions and carry 2 marks each.
- (d) Section C: Q. no. 13 to 24 are also short answer questions and carry 3 marks each.
- (e) Section D: Q. no. 25 to 27 are long answer questions and carry 5 marks each.
- (f) There is no overall choice. However an internal choice has been provided in two questions of one mark, two questions of two marks, four questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- (g) Use of log tables if necessary, use of calculators is not allowed.

### Section-A (1 mark each)

Q1. What is the Normality of 1.5 M  $\text{H}_2\text{SO}_4$ ?

Ans. Normality =  $1.5 \times 2 = 3 \text{ N}$

**OR**

Why Al cannot be obtained by electrolysis of fused  $\text{AlCl}_3$ ?

Ans. It is a covalent compound and sublimes at 453 K.

Q2. A reaction is found to be zero order. Will its molecularity be also zero.

Ans. No, Molecularity of a reaction cannot be zero.

Q3. Which out of Molarity or Molality varies with temperature?

Ans. Molarity varies with temperature.

**OR**

Define Adsorption.

Ans. The phenomenon of higher concentration of molecular species (gases or liquids) on the surface of solids than in the bulk is called adsorption.

Q4. Which method is used to concentrate the sulphide ores?

Ans. Froth Floatation method is used to concentrate the sulphide ores.

Q5. Name the elements of the 13<sup>th</sup> group and give general electronic configuration of their valence shells.

Ans. Boron (B), Aluminium (Al), Gallium (Ga), Indium (In), Thallium (Tl). They have  $ns^2np^1$  electronic configuration in their valence shells.

### Section-B (2 marks each)

Q6. In a close packing of N spheres, how many (i) tetrahedral and (ii) octahedral sites are present?

Ans. (i) Tetrahedral =  $2N$

(ii) Octahedral =  $N$

**OR**

What is the role of salt-bridge in an electrochemical cell?

Ans. Role of salt bridge:

- (i) Complete the electrical circuit internally
- (ii) Maintains electrical neutrality

Q7. Mention any four factors affecting rate of a reaction.

- Ans. (i) Nature of the reacting species
- (ii) Concentration of the reacting species
- (iii) Temperature of the system
- (iv) Surface area of the reactants

**OR**

Describe the two uses of each of the following:

(a) Copper sulphate (b) Silver nitrate

Ans. (a) Uses of Copper sulphate

- (i) For copper plating
- (ii) As germicide and fungicide

(b) Uses of Silver nitrate

- (i) In lab to detect presence of halides
- (ii) In silvering of mirrors

Q8. Give two uses of emulsions.

Ans. (i) In medicine: the various pharmaceuticals and cosmetics available in liquid form such as cod liver oil.

(iii) Cleansing action of soap: it is based on oil-in-water type emulsion.

Q9. Write the IUPAC names of the following coordination compounds.

(a)  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  (b)  $[\text{Ni}(\text{CO})_4]$

Ans. (a)  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  Hexaamminecobalt (III) chloride

(b)  $[\text{Ni}(\text{CO})_4]$  Tetracarbonylnickel (0)

Q10. What are antioxidants? Name two antioxidants.

Ans. The antioxidants are chemical substances which prevent oxidation of food and prevent it from getting spoiled. Names of antioxidants used for food are Butylated p-hydroxyanisole (BHA) and Butylated p-hydroxytoluene (BHT)

Q11. What is nucleoside? Write two functions of RNA.

Ans. A nucleoside contains only two basic components of nucleic acids, one is pentose sugar and the other is nitrogenous base.

Functions of RNA:

1. RNA manages the synthesis of protein
2. RNA can synthesize RNA by replication and DNA by reverse transcription

Q12. Give reagents for birch reduction.

Ans. Birch reduction reagents: Liq.  $\text{NH}_3$  + Na/Li/K and alcohol (e.g. ethanol)

### Section-C (3 marks each)

Q13. What are the characteristics of a non-ideal solution?

Ans. (a) It does not obey Raoult's Law,  $P_s \neq P^0 \times X$

(b)  $\Delta H_{\text{Mix}} \neq 0$ ;  $\Delta H_{\text{Mix}} > 0$  or  $\Delta H_{\text{Mix}} < 0$

(c)  $\Delta V_{\text{Mix}} \neq 0$ , there is a volume change on mixing

Q14. Define Corrosion. How can corrosion be prevented?

Ans. The process of deterioration of a metal due to its reaction with water air and moisture around it is known as Corrosion.

Methods to prevent corrosion are:

1. Barrier protection
2. Sacrificial protection
3. Electrical protection
4. Protection using anti rust solution

Q15. Give 3 difference between Molecularity and Order.

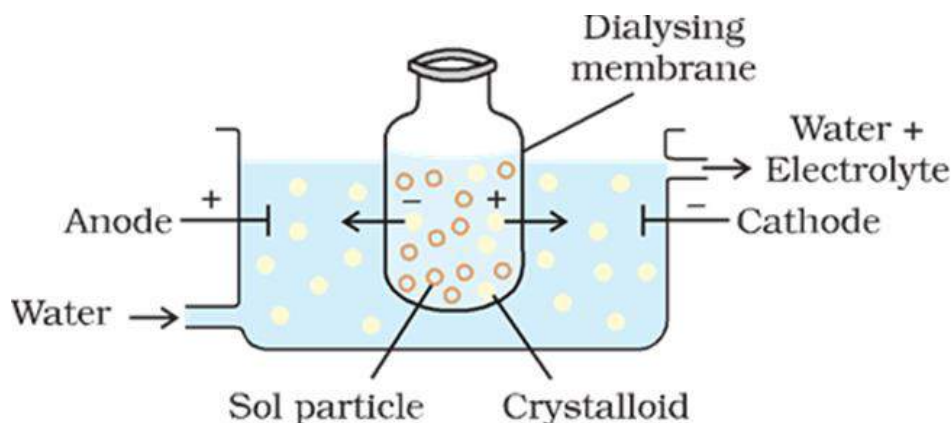
Ans.

S. No.	Molecularity	Order
1.	It is the theoretical concept	It is an experimental concept
2.	It can have integral values only	It can have fractional values as well
3.	It cannot be zero	It can be zero

Q16. Give the methods for the purification of Colloidal Solutions.

Ans. Methods for the purification of Colloidal Solutions are:

- (a) **Dialysis:** it is based on the principle that colloidal particles cannot pass through a parchment membrane whereas the ions of electrolyte can pass through it.
- (b) **Electro dialysis:** In order to increase the speed of purification, an electric field is applied.



- (c) **Ultra-filtration:** In this method impurities are removed from colloidal solution by using graded filter paper called ultra-filter papers.

OR

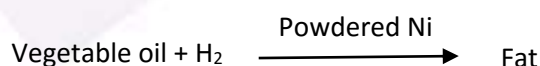
Write brief notes on the following:

- (i) Homogeneous catalysis
- (ii) Heterogeneous catalysis
- (iii) Enzyme catalysis

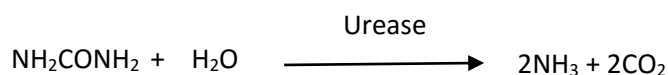
Ans. (i) **Homogeneous catalysis:** When the catalyst are present in same phase as that of the reactants and products is called Homogeneous catalysis.



- (iii) **Heterogeneous catalysis:** When the catalyst are present in different phase as that of the reactants and products is called Heterogeneous catalysis.



- (iv) **Enzyme catalysis:** A number of reactions occur in living beings using catalyst. For example, energy rich biomolecules are broken down to release energy by using catalyst. Catalysts increasing the rate of the reaction by lowering down the activation energy.



Q17. Give three points of resemblance between Boron and Silicon

- (b) The hydrides of Boron and Silicon are quite stable.
- (c) both elemental Boron and Silicon are semi-conductors.

Ans. (a) They both exhibit the typical properties of non-metals.

Q18. Write three points of Werner's theory.

Ans. (a) Element exhibits 2 types of valency which are primary and secondary valency. Primary valency is ionisable and is known as oxidation state and secondary valency is non-ionizable and is known as coordination number.

(b) Each element satisfies both the primary and secondary valency.

(c) Coordination number is fixed for every element and is oriented towards fixed positions in space and hence predicts the stereochemistry of the coordination compound.

Q19. What are biodegradable polymers? Give the names of two commercial bio-degradable polymers.

Ans. The polymers which degrade themselves during a particular duration of time are known as biodegradable polymers.

Names of two commercial bio-degradable polymers are:

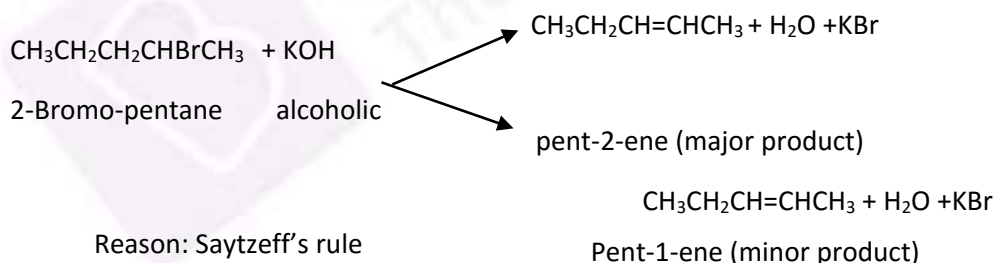
(i) Poly (Glycolic Acid) -PGA

(ii) Poly (Lactic Acid)-PLA

OR

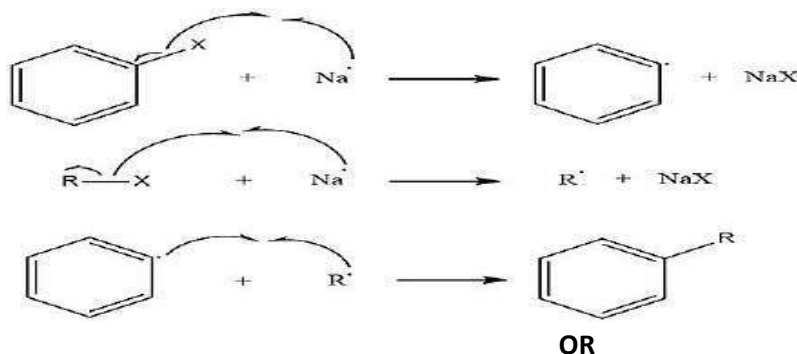
Write the IUPAC name of the major product obtained when 2-bromopentane is heated with alcoholic KOH. Give equation and also name the reaction.

Ans. (a) Pent-2-ene



Q20. Explain Wurtz Fittig reaction.

Ans. Wurtz Fittig reaction: it is the reaction between alkyl halide and aryl halide by using sodium metal in dry ether and the product of the reaction is alkyl benzene.



Give reason for each of the following.

- (i) Why is aniline a weaker base than ammonia?
- (ii) Why is ethanamine soluble in water whereas aniline is insoluble?

(iii) Why direct nitration of aniline is not possible?

Ans. (i) In case of Aniline the lone pair of electron present on nitrogen atom is delocalized over benzene ring due to resonance. As a result lone pair of electron is not available for protonation. Whereas in case of ammonia, lone pair of electrons are readily available for protonation.

(ii) Ethanamine is soluble in water as it forms hydrogen bonding with water molecules, whereas in aniline which is an aromatic amine, due to presence of large hydrocarbon part, it cannot form hydrogen bonding.

(iii) Nitric acid is a very strong oxidizing agent oxidizes most of aniline to form tar like oxidation products.

Q21. Give three factors affecting adsorption.

- Ans. (i) Nature of gas  
(ii) Effect of nature of the adsorbent  
(iii) Surface area of solid

Q22. Mention three properties of yellow phosphorous

- Ans. (i) Very poisonous.  
(ii) Boiling point is 553 K and melting point is 317 K.  
(iii) It is kept under water because it is flammable spontaneously.

**OR**

Write electronic configuration of  $\text{Ce}^{3+}$  ion and determine magnetic moment for this ion.

Ans.  $\text{Ce}^{3+} = [\text{Xe}] 4f$

$\text{Ce}^{3+}$  is paramagnetic

$$\begin{aligned}\text{Magnetic moment} &= \sqrt{n(n+2)} \quad n = \text{number of unpaired electrons} \\ &= \sqrt{3} = 1.73 \text{ B.M.}\end{aligned}$$

Q23. What is nuclear reactor? Discuss the role of heavy water as moderator.

Ans. An apparatus in which the nuclear chain reaction is performed in a controlled manner is known as nuclear reactor.

Role of heavy water ( $\text{D}_2\text{O}$ ): It is used as a moderator to slow down the speed of fast moving neutrons, formed via fission, hence the efficacy increases.

Q24. Give the monomer units of Teflon, Bakelite and Nylon 66.

Ans. Teflon- tetrafluoroethylene; Bakelite-phenol and formaldehyde; Nylon 6-Caprolactam

### Section-D (5 marks each)

Q25. Define Coordination number. What is the coordination number of atoms in (i) in cubic close packed structure (ii) in a body centred cubic structure.

Ans. In the crystal structure atoms are like spheres, they touch with the neighbouring spheres or the atoms. The number of atoms or spheres surrounding the atom in the centre is known as Coordination number.

Coordination number of atoms (i) in cubic close packed (ccp) structure is 12, out of which 6 atoms are touching in its own plane and 3 below and 3 above it.

Coordination number of atoms (ii) in a body centred cubic (bcc) structure is 8, as atom at the body centre of unit cell is surrounded by 8 atoms at each corners of the cube.

OR

The boiling point of benzene is 353.23 K when 1.80 g of a non-volatile, non-electrolytic solute was dissolved in 90 g of benzene the boiling point was raised to 354.11 K. Calculate the molar mass of the solute. ( $K_b$  for benzene = 2.53 K.Kg mol<sup>-1</sup>).

(b) What is Van't Hoff's factor?

Ans. (a)  $\Delta T_b = (K_b \times W_2 \times 1000)/(M_2 \times W_1)$

$$\Delta T_b = (354.11 \text{ K} - 353.23 \text{ K}) = 0.88 \text{ K}$$

$$M_2 = (2.53 \times 1.8 \times 1000)/(0.88 \times 90) = 58 \text{ g/mol}$$

(b) Van't Hoff's factor 'i' was given by Van't Hoff's which gives the extent of association or dissociation of solutes in solution.

$$i = \text{Normal molecular mass} / \text{Observed molecular mass}$$

Q26.  $\Delta H$  and  $\Delta S$  for the reaction  $\text{Ag}_2\text{O}_{(s)} \longrightarrow 2\text{Ag}_{(s)} + \frac{1}{2} \text{O}_{2(g)}$  are 30.56 KJmol<sup>-1</sup> and 6.6 JK<sup>-1</sup> mol<sup>-1</sup> respectively. Calculate the temperature at which the free energy change for the reaction will be zero. What will be the direction of the reaction at this temperature and temperature below it and why?

Ans.  $\Delta G = \Delta H - T\Delta S$

$$\Delta G = 0$$

$$0 = \Delta H - T\Delta S$$

$$\Delta H = T\Delta S$$

$$T = \Delta H / \Delta S$$

$$\Delta H = 30.56 \text{ KJ mol}^{-1}$$

$$= 30560 \text{ J mol}^{-1}$$

$$\Delta S = 6.6 \text{ JK}^{-1}$$

$$T = 30560/6.6$$

$$= 4630 \text{ K}$$

(i) At temperature  $T = 4630 \text{ K}$  the reaction will be at equilibrium, since  $\Delta G = 0$

(ii) Below this temperature,  $\Delta G$  will be positive because both  $\Delta H$  and  $\Delta S$  are positive and  $\Delta H > T\Delta S$ . Hence, reaction will not be spontaneous below this temperature.

OR

Define first order reaction. Calculate the half-life of a first order reaction from their rate constants given below:

- (a)  $200 \text{ s}^{-1}$     (b)  $2 \text{ min}^{-1}$     (c)  $4 \text{ year}^{-1}$

Ans. First order reaction:

- (a) rate constant =  $200 \text{ sec}^{-1}$

$$\begin{aligned} \text{For a first order reaction } t_{1/2} &= 0.693/K \\ &= 0.693/200 \\ &= 3.47 \times 10^{-3} \text{ seconds} \end{aligned}$$

- (b) rate constant =  $2 \text{ min}^{-1}$

$$\begin{aligned} t_{1/2} &= 0.693/K \\ &= 0.693/2 \\ &= 0.35 \text{ min} \end{aligned}$$

- (c) rate constant =  $4 \text{ year}^{-1}$

$$\begin{aligned} t_{1/2} &= 0.693/K \\ &= 0.693/4 \\ &= 0.173 \text{ year} \end{aligned}$$

Q27. What is a spontaneous reaction? Write differences between rate of reaction and rate constant of reaction.

Ans. Reaction which takes place by itself is known as spontaneous reaction.

Difference between rate of reaction and rate constant of reaction

Rate of reaction	Rate constant of reaction
Speed at which the reactants are converted into products at any instant of time	Constant of proportionality in the rate law expression
Depends upon the concentration of the reactant at that instant of time	It is the rate of reaction at specific point of time when concentration of the reactant is one or unity
Its value decreases as the reaction progresses	It does not depend upon the progress of reaction as it is a constant value
Unit for all the reactions is same $\text{ML}^{-1}\text{S}^{-1}$	Units vary for different reactions

OR

Define dispersed phase and the dispersion medium. Discuss classification of colloids with example.

Ans. Dispersed phase: Component present in less quantity as the solute present in the solution.

Dispersion medium: Component present in more quantity as the solvent present in the solution.

Classification of Colloids:

Dispersed phase	Dispersion medium	Type of colloid	Examples
Solid	Solid	Solid sol	Coloured glasses, gem stones
Solid	Liquid	Sol	Cell fluids, paints
Solid	Gas	Aerosol	Dust, smoke
Liquid	Solid	Gel	Butter, cheese, jellies
Liquid	Liquid	Emulsion	Milk, hair cream
Liquid	Gas	Aerosol	Mist, fog, insecticide spray, cloud
Gas	Solid	Solid sol	Foam rubber, pumice stone
Gas	Liquid	Foam	Whipped cream, froth