MODEL PAPER – 2

Time : 3 Hours + 15 Minutes]   [Total Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. Candidates are required to give their answers in their own words as far as practicable.
2. Figure in the right hand margin indicate full marks.
3. While answering the questions, candidate should adhere to the word limit as far as practicable.
4. 15 Minutes of extra time has been allotted for the candidates to read the questions carefully.
5. This question paper is divided into two sections—**SECTION – A** and **SECTION – B**.
6. In **SECTION – A** there are **70 Objective Type Question**, out of which only 35 objective questions be answered. Darken the circle with blue/black ball pen against the correct option on OMR Sheet provided to you. Do not use Whitener/Liquid/Blade/Nail on OMR paper, otherwise the result will be invalid.
7. In **SECTION – B**, there are **20 Short Answer Type Question** (each carrying 2 marks), out of which any 10 questions are be answered.

   Apart from this, there are **6 Long Answer Type Question** (Each Carrying 5 marks), out of which 3 questions are to be answered.
8. Use of any electronic device is prohibited.

SECTION – A : Objective Type Questions

Directions : *There are 70 Objective Type Questions, out of which only 35 objectives questions to be answered. For each question, mark the correct option on the OMR answer sheet.* $35 \times 1 = 35$

1. Which of the following will have highest boiling point?
   - (A) 1% glucose in water
   - (B) 1% sucrose in water
   - (C) 1% NaCl in water
   - (D) 1% urea in water

2. Which of the following conducts electricity in solution ?
   - (A) Electrolytes
   - (B) Non-electrolytes
   - (C) H_2O molecules
   - (D) Copper wire

3. Pyrolusite is an ore of which of the following ?
   - (A) Magnesium
   - (B) Manganese
   - (C) Zinc
   - (D) Iron

4. Which of the following is a radioactive noble gas ?
   - (A) He
   - (B) Ne
   - (C) Xe
   - (D) Rn

5. Which of the following is called coinage metals ?
   - (A) Fe, Co and Ni
   - (B) Cu and Zn
   - (C) Cu, Ag and Au
   - (D) Au and Pt

6. Chloroform on reduction with zinc and water gives :
   - (A) Acetylene
   - (B) Ethylene
   - (C) Ethane
   - (D) Methane

7. Which of the following will not give iodoform test ?
   - (A) Isopropyl alcohol
   - (B) Ethanol
   - (C) Ethanal
   - (D) Benzyl alcohol

8. Which of the following gives Cannizzaro's reaction ?
   - (A) CH_3CHO
   - (B) HCHO
   - (C) HCOOH
   - (D) CH_3COCH_3

9. The functional group of secondary amine is :
   - (A) —NH—
   - (B) —NH_2
   - (C) NH_3
   - (D) NH_3^+

10. Saccharin is a/an :
    - (A) Aliphatic hydrocarbon
    - (B) Sweetening agent
    - (C) Polynuclear compound
    - (D) Sugar

11. Which of the following disaccharides is present in milk ?
    - (A) Sucrose
    - (B) Lactose
    - (C) Maltose
    - (D) None of these

12. Which of the following is used as a soap ?
    - (A) $C_{17}H_{35}COONa$
    - (B) $(C_{17}H_{35}COO)_2Ca$
    - (C) $C_{17}H_{35}COOH$
    - (D) $C_{15}H_{31}COOH$

13. In hcp structure, the packing fractions is :
    - (A) 0.68
    - (B) 0.74
    - (C) 0.54
    - (D) 0.50

14. What is the co-ordination number of sodium in Na_2O ?
    - (A) 6
    - (B) 4
    - (C) 8
    - (D) 2

15. Which of the following the property of ideal solution ?
    - (A) Obeys Raoult's law
    - (B) Does not obey Raoult's law
    - (C) Both 'A' and 'B'
    - (D) None of these

16. 234.2 gm of sugar syrup contains 34.2 gm of sugar. What is the molal concentration of the solution :
    - (A) 0.1
    - (B) 0.5
    - (C) 5.5
    - (D) 55

17. Which is not affected by temperature ?
    - (A) Normality
    - (B) Molality
    - (C) Molarity
    - (D) Formality

18. Which of the following is not a colligative property of solution ?
    - (A) Depression of freezing point

(B) Elevation of Boiling point

(C) Relative lowering vapour pressure

(D) Optical activity

19. If 96500 coulomb electricity is passed through $CuSO_4$ solution, it will liberate.

(A) 63.5 gm of Cu
(B) 31.76 gm of Cu
(C) 96500 gm of Cu
(D) 100 gm of Cu

20. When one faraday of electric current is passed, the mass deposited, is equal to :

(A) One gram equivalent

(B) One gram mole

(C) electrochemical equivalent

(D) Half gram equivalent

21. In any reaction, catalyst :

(A) retards the rate of reaction

(B) increases the rate of reaction

(C) both increases and decreases the rate of reaction

(D) none of these

22. The unit of rate and rate constant are same for a :

(A) zero order reaction
(B) first order reaction
(C) second order reaction
(D) third order reaction

23. $t_{\frac{1}{2}}$ for first order reaction is :

(A) $\dfrac{0.6}{k}$
(B) $\dfrac{0.693}{k}$
(C) $\dfrac{0.683}{k}$
(D) $\dfrac{0.10}{k}$

24. Volume of one mole of any gas at NTP is :

(A) 11.2 litre
(B) 22.4 litre
(C) 10.2 litre
(D) 22.8 litre

25. How many layers are involved in chemical adsoption ?

(A) One
(B) Two
(C) Many
(D) Zero

26. Which gas is absorbed strongly by charcoal ?

(A) CO
(B) NH_3
(C) NCl_3
(D) H_2

27. Which of the following statement is true ?

(A) All ores are minerals

(B) All minerals are ore

(C) All alkalis are not bases

(D) All of these

28. Concentration of sulphide ore is done by :

(A) froth flotation process
(B) electrolysis
(C) roasting
(D) None of these

29. A process of heating ore of a metal in excess of air below its melting point is called :

(A) Roasting
(B) Smelting
(C) Calcination
(D) All

30. Dolamite mineral contains

(A) Mg
(B) Al
(C) Ca
(D) K

31. Other than oxygen in Group 16 of the periodic table, the element found is :

(A) Sulphur
(B) Sodium
(C) Iron
(D) Nitrogen

32. The symbol of tin is :

(A) Sn
(B) Tn
(C) Ti
(D) Fe

33. Boron shows diagonal relation with :

(A) Al
(B) C
(C) Si
(D) Sn

34. Which one of the following is the strongest lewis acid ?

(A) BF_3
(B) BCl_3
(C) BBr_3
(D) BI_3

35. The number of p-o-p bonds in cyclic metaphosphoric acid is :

(A) two
(B) zero
(C) three
(D) four

36. Which metal becomes passive in concentrated HNO_3 ?

(A) Cu
(B) Zn
(C) Al
(D) Pb

37. White and yellow phosphorous are :

(A) Allotropes
(B) Isomers
(C) Isobars
(D) Isotones

38. PCl_5 is a :

(A) Oxidising agent
(B) Reducing agent
(C) Oxidizing and reducing agent both
(D) None

39. Photographic film plate has an essential ingredient of :

(A) silver nitrate
(B) silver bromide
(C) sodium chloride
(D) oleic acid

40. The shape of a XeF_2 is.

(A) Linear
(B) Triangular
(C) Angular
(D) Planar

41. Shape of d-orbital is :

(A) spherical
(B) dumb-bell
(C) double dumb-bell
(D) none of these

42. Most abundant element in earth's crust is :

(A) Si
(B) Al
(C) Zn
(D) Fe

43. The metal always found in free state is :

(A) Gold
(B) Silver
(C) Copper
(D) Sodium

44. The highest magnetic moment shown by the transition metal ion with the outermost electronic configuration is :

(A) $3d^5$
(B) $3d^2$
(C) $3d^7$
(D) $3d^9$

45. Which of the following has the most stable +2 oxidation state ?

(A) Sn
(B) Ag
(C) Fe
(D) Pb

46. The oxidation number of Ni in [Ni(CO)$_4$] is
    (A) 0　　　　　　　　　　(B) 2
    (C) 3　　　　　　　　　　(D) 4

47. What is the coordination number of nickle in [Ni(CO$_4$)] is :
    (A) 1　　　　　　　　　　(B) 4
    (C) 2　　　　　　　　　　(D) 3

48. The oxidation number of Cr in the complex [Cr(H$_2$O)$_4$ Cl$_2$]$^+$ is :
    (A) + 1　　　　　　　　　(B) + 3
    (C) + 5　　　　　　　　　(D) + 6

49. [Co(NH$_3$)$_6$]Cl$_3$ is which type of complex compound :
    (A) Cationic complex　　　(B) Anionic complex
    (C) Neutral complex　　　(D) None of these

50. In which of the following allotropes of carbon, percentage of carbon is maximum ?
    (A) Wood charcoal　　　　(B) Coconut charcoal
    (C) Graphite　　　　　　(D) None of these

51. Valency of carbon is :
    (A) 1　　　　　　　　　　(B) 2
    (C) 3　　　　　　　　　　(D) 4

52. The compound having general formula C$_n$H$_{2n+2}$ is :
    (A) Alkene　　　　　　　(B) Alkyne
    (C) Alkane　　　　　　　(D) None of these

53. A Grignard reagent is prepared by the action of magnesium in dry ether on ?
    (A) C$_2$H$_5$OH　　　　　(B) C$_2$H$_6$
    (C) C$_2$H$_5$Cl　　　　　(D) C$_2$H$_5$CN

54. Which of the following alcohols gives 2-butene on dehydration by conc H$_2$SO$_4$?
    (A) 2-Methyl propene-2-ol　(B) 2-Methyl 1-propanol
    (C) Butan-2-ol　　　　　(D) Butan 1-ol

55. Which is ethoxy ethane?
    (A) C$_2$H$_5$OCH$_3$　　　(B) CH$_3$OCH$_3$
    (C) C$_2$H$_5$OC$_2$H$_5$　　(D) None of these

56. The reaction given below :
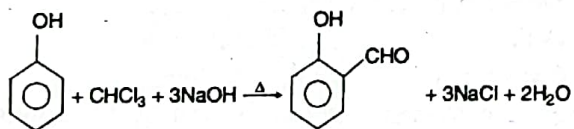
    (A) Kolbe's reaction
    (B) Friedal Craft's reaction
    (C) Sandmeyer's reaction
    (D) Reimer Tiemann's reaction

57. HCOOH is a :
    (A) Monobasic acid　　　(B) Di basic acid
    (C) tri basic acid　　　　(D) mineral acid

58. Which of the following undergoes Aldol condensation ?
    (A) CH$_3$COOH　　　　　(B) CH$_3$CHO
    (C) C$_6$H$_5$CHO　　　　(D) CH$_3$–COOCH$_3$

59. Which of the following compounds will undergo Cannizzaro reaction ?
    (A) CH$_3$CHO　　　　　　(B) CH$_3$COCH$_3$
    (C) C$_6$H$_5$CHO　　　　(D) C$_6$H$_5$CH$_2$CHO

60. In which of the following reactions a new carbon-carbon bond is not formed ?
    (A) Wurtz reaction　　　(B) Aldol condensation
    (C) Cannizaro's reaction　(D) Friedal-Crafts reaction

61. Paraldehyde is a trimer of :
    (A) Methanal　　　　　　(B) Ethanal
    (C) Butanol　　　　　　(D) None

62. —CONH$_2$ group is known as :
    (A) Amide group　　　　(B) Amino group
    (C) Imino group　　　　(D) Carbyl amine

63. The hybridisation of N in NH$_3$ is :
    (A) sp^3　　　　　　　(B) sp^2
    (C) sp　　　　　　　　(D) d^{2}sp^3
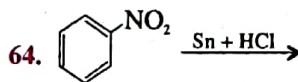
64.
    (A) C$_6$H$_5$OH　　　　　(B) C$_6$H$_5$NH$_2$
    (C) C$_6$H$_5$CH$_3$　　　(D) C$_6$H$_6$

65. In a chemical reaction : CH$_3$COOH $\xrightarrow[\Lambda]{+NH_3}$ A $\xrightarrow{P_2O_5}$ B
    the product B is :
    (A) Acetonitrile　　　　(B) Ethyl cyanide
    (C) Methylamine　　　　(D) Acetamide

66. Polythene is a :
    (A) Thermoplastic　　　(B) Thermosetting plastic
    (C) Fiber　　　　　　　(D) All of these

67. Buna– N and Buna – S are :
    (A) Natural rubber　　　(B) Synthetic rubber
    (C) Latex　　　　　　　(D) Polythene

68. In nucleic acids, the sequence is :
    (A) base - phosphate - sugar
    (B) base - sugar - phosphate
    (C) sugar - base - phosphate
    (D) phosphate - base - sugar

69. Which of the following is mono-saccharide ?
    (A) Sucrose　　　　　　(B) Maltose
    (C) Lactose　　　　　　(D) Frutose

70. Cinnabar is :
    (A) HgS　　　　　　　　(B) PbS
    (C) ZnS　　　　　　　　(D) H$_2$S

SECTION – B : Non-Objective Type Questions

SHORT ANSWER TYPE QUESTIONS

Directions : Questions Nos. 1 to 20 are of short answer type. Each question carries 2 marks. Answer any ten question on your copy.   10 × 2 = 20

1. How are metals refined by Bessemerisation ?
2. What are enzymes ?
3. Explain the terms polymer and monomers.
4. What are anionic detergents ? How are they prepared ? Write their two main uses.
5. Chloroacetic acid is stronger than acetic acid, Why ?
6. (a) What are main ores of iron
   (b) What is Pig iron and Cast iron
   (c) Give the uses of cast iron.
7. H_2O is liquid but H_2S is gas, Why ?
8. Define Point defect.
9. What do you know Chemical Adsorption ?
10. What happens when Ethyl acetate is hydroslysed in presence of acid ?
11. Why do solids have a definite volume ?
12. What do you mean by vapour pressure ? What happens to the vapour pressure, when (i) Volatile solute is dissolved in solution, (ii) non-volatile solute is dissolved in solution ?
13. What are Faraday's laws of electrolysis ? Explain.
14. How does the activation energy of a reaction affect the rate of reaction ?
15. Differentiate between Absorption and Adsorption.
16. Describe a method for refining nickel.
17. Why does the reactivity of nitrogen differ from phosphorous ?
18. Bond angle in PH_4^+ is higher than that in PH_3. Why ?
19. Any transition series contains only ten elements. Why ?
20. (a) What are natural and synthetic polymers ?
    (b) Define and classify vitamins.

LONG ANSWER TYPE QUESTIONS

Directions : Questions Nos. 21 to 26 are Long Answer Type Questions. Answer any 3 questions out of them.   3 × 5 = 15

21. Write the following name reactions :
    (i) Claisen Condensation
    (ii) Clemmensen Reduction
22. Name two important ores of iron. Write the method of extraction of iron and the chemical reaction involved in it.
23. What happens when :
    (i) Sodium acetate is heated with soda-lime.
    (ii) Calcium carbide is treated with water.
24. What are carbohydrates ? How are they classified ?
25. Calculate the molal mass of salute by relative lowering of vapour pressure.
26. Define specific conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.

## ANSWER WITH EXPLANATION

SECTION – A

OMR ANSWER-SHEET

1. Ⓐ Ⓑ Ⓒ Ⓓ   36. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ   37. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ   38. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ   39. Ⓐ Ⓑ Ⓒ Ⓓ
5. Ⓐ Ⓑ Ⓒ Ⓓ   40. Ⓐ Ⓑ Ⓒ Ⓓ
6. Ⓐ Ⓑ Ⓒ Ⓓ   41. Ⓐ Ⓑ Ⓒ Ⓓ
7. Ⓐ Ⓑ Ⓒ Ⓓ   42. Ⓐ Ⓑ Ⓒ Ⓓ
8. Ⓐ Ⓑ Ⓒ Ⓓ   43. Ⓐ Ⓑ Ⓒ Ⓓ
9. Ⓐ Ⓑ Ⓒ Ⓓ   44. Ⓐ Ⓑ Ⓒ Ⓓ
10. Ⓐ Ⓑ Ⓒ Ⓓ   45. Ⓐ Ⓑ Ⓒ Ⓓ
11. Ⓐ Ⓑ Ⓒ Ⓓ   46. Ⓐ Ⓑ Ⓒ Ⓓ
12. Ⓐ Ⓑ Ⓒ Ⓓ   47. Ⓐ Ⓑ Ⓒ Ⓓ
13. Ⓐ Ⓑ Ⓒ Ⓓ   48. Ⓐ Ⓑ Ⓒ Ⓓ
14. Ⓐ Ⓑ Ⓒ Ⓓ   49. Ⓐ Ⓑ Ⓒ Ⓓ
15. Ⓐ Ⓑ Ⓒ Ⓓ   50. Ⓐ Ⓑ Ⓒ Ⓓ
16. Ⓐ Ⓑ Ⓒ Ⓓ   51. Ⓐ Ⓑ Ⓒ Ⓓ
17. Ⓐ Ⓑ Ⓒ Ⓓ   52. Ⓐ Ⓑ Ⓒ Ⓓ
18. Ⓐ Ⓑ Ⓒ Ⓓ   53. Ⓐ Ⓑ Ⓒ Ⓓ
19. Ⓐ Ⓑ Ⓒ Ⓓ   54. Ⓐ Ⓑ Ⓒ Ⓓ
20. Ⓐ Ⓑ Ⓒ Ⓓ   55. Ⓐ Ⓑ Ⓒ Ⓓ
21. Ⓐ Ⓑ Ⓒ Ⓓ   56. Ⓐ Ⓑ Ⓒ Ⓓ
22. Ⓐ Ⓑ Ⓒ Ⓓ   57. Ⓐ Ⓑ Ⓒ Ⓓ
23. Ⓐ Ⓑ Ⓒ Ⓓ   58. Ⓐ Ⓑ Ⓒ Ⓓ
24. Ⓐ Ⓑ Ⓒ Ⓓ   59. Ⓐ Ⓑ Ⓒ Ⓓ
25. Ⓐ Ⓑ Ⓒ Ⓓ   60. Ⓐ Ⓑ Ⓒ Ⓓ
26. Ⓐ Ⓑ Ⓒ Ⓓ   61. Ⓐ Ⓑ Ⓒ Ⓓ
27. Ⓐ Ⓑ Ⓒ Ⓓ   62. Ⓐ Ⓑ Ⓒ Ⓓ
28. Ⓐ Ⓑ Ⓒ Ⓓ   63. Ⓐ Ⓑ Ⓒ Ⓓ
29. Ⓐ Ⓑ Ⓒ Ⓓ   64. Ⓐ Ⓑ Ⓒ Ⓓ
30. Ⓐ Ⓑ Ⓒ Ⓓ   65. Ⓐ Ⓑ Ⓒ Ⓓ
31. Ⓐ Ⓑ Ⓒ Ⓓ   66. Ⓐ Ⓑ Ⓒ Ⓓ
32. Ⓐ Ⓑ Ⓒ Ⓓ   67. Ⓐ Ⓑ Ⓒ Ⓓ
33. Ⓐ Ⓑ Ⓒ Ⓓ   68. Ⓐ Ⓑ Ⓒ Ⓓ
34. Ⓐ Ⓑ Ⓒ Ⓓ   69. Ⓐ Ⓑ Ⓒ Ⓓ
35. Ⓐ Ⓑ Ⓒ Ⓓ   70. Ⓐ Ⓑ Ⓒ Ⓓ

ANSWER

|				
1. (C)	2. (A)	3. (B)	4. (D)	5. (C)
6. (D)	7. (D)	8. (B)	9. (A)	10. (B)
11. (B)	12. (A)	13. (B)	14. (B)	15. (A)
16. (B)	17. (B)	18. (D)	19. (B)	20. (A)
21. (C)	22. (A)	23. (B)	24. (B)	25. (A)
26. (A)	27. (A)	28. (A)	29. (A)	30. (A)
31. (A)	32. (A)	33. (C)	34. (D)	35. (C)
36. (C)	37. (A)	38. (A)	39. (B)	40. (A)
41. (C)	42. (A)	43. (A)	44. (A)	45. (D)
46. (A)	47. (B)	48. (B)	49. (A)	50. (C)
51. (D)	52. (C)	53. (C)	54. (C)	55. (C)
56. (D)	57. (A)	58. (B)	59. (C)	60. (C)
61. (B)	62. (A)	63. (A)	64. (B)	65. (B)
66. (A)	67. (B)	68. (B)	69. (D)	70. (A)

SECTION – B

1. Bessemerisation is a metallurgical process in which the air is blown to copper metal which is kept in Bessemer converted. Molten copper (99% pure) is formed.

2. All biological reactions are catalysed by special catalysts called enzymes. Thus enzymes are biological catalyst. An enzyme facilitates a biochemical reaction by providing alternate lower activation energy pathways there by increasing the rate of the reaction. Chemically all enzymes are globular proteins. However same enzymes are also associated with same non-protein component called the co-factor for their activity. The enzymes differ from other type of catalyst in being highly specific and selective.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Maltose}} 2C_6H_{12}O_6$$

Maltose   glucose
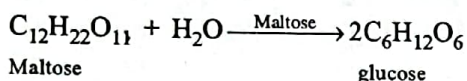
Enzymes, like catalyst are needed only in small quantities.

3. (i) **Polymer** is a high molecular mass macromolecule consisting of repeating structural units derived from monomers, e.g., polyethene, polyvinyl chloride, Nylon 6, 6 etc.

   (ii) **Monomer** is a simple molecule capable of undergoing polymerization and leading to the formation of the corresponding polymer, e.g., ethene, vinyl chloride etc.

4. The detergents which have negative charge on the surface active group in their molecules are called anionic detergents. Sodium lauryl sulphate is a typical anionic detergent.
   Preparation : Sodium lauryl sulphate is prepared by reacting aliphatic longchain alcohol (C_{10}–C_{14}) with conc. H_2SO_4 and neutralising the product with NaOH.
   Uses :
   (i) mostly used for household work
   (ii) used in tooth pastes

5. Chloroacetic acid is stronger than acetic acid, because chlorine atom is an electron withdrawing group, which increases acidity of carboxilic acid. This effect makes more stable conjugate base.

6. (a) **Main ores of iron :**

      (i) Haematite—Fe_2O_3 (ii) Magnetite—Fe_3O_4

   (b) The iron obtained from Blast furnace contains about 4% carbon and many impurities in smaller amount is known as **Pig iron.** Pig iron contains 92–94% iron. **Cast iron** is obtained by passing a blast of hot air through the molten mixture containing pig iron, scrap iron and coke. Molten cast iron can be cast into any shape.

   (c) **Uses of cast iron**—Cast iron is used for casting various shaped articles, such as radiators, stools, pipes and agricultural implements.

7. In vapour state (~100 K) Sulphur partly exists as S_2 molecules like O_2 has two unpaired electrons in the antibonding π molecular orbital and exhibits paramagnetism.

8. **Point defect**—The defects caused by a departure from the periodic arrangement of particles in the vicinity of an atom or group of atoms, are called *point defects.*

9. **Chemical adsorption**—When the adsorbate is held to the surface of an adsorbent by forces nearly as strong as a chemical bond, the adsorption is called *chemical adsorption.*

10. Ethyl acetate on hydrolysis in presence of dilute acid give acetic acid and ethyl alcohol.

$$CH_3COOC_2H_5 + H_2O \xrightarrow{[H^+]} CH_3COOH + C_2H_5OH$$
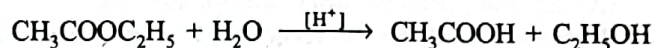
11. The constituents particles in solids are bound to their mean positions by strong forces of attraction. The inter-particle distances remain unchanged even at increased or reduced pressure. Therefore, solids have a definite volume.

12. **Vapour pressure**—It is defined as the pressure exerted by a vapour in thermodynamic equilibrium with its condensed phased (solid or liquid) at a given temperature in a closed system.
    (i) Volatile solute increases vapour pressure of solvent.
    (ii) Nonvolatile solute lowers vapour pressure of solvent.

13. **Faraday's Ist law of electrolysis**—This law states that the mass of a substance produced at an electrode is directly proportional to the quantity of electricity passed.

    $m \propto Q$ where
    $m \propto I \times t$ $Q \rightarrow$ quantity of electricity
 $m = z \times I \times t$ $I \rightarrow$ current in amperes
                   $t \rightarrow$ time
                   $Z \rightarrow$ Electrochemical equivalent

14. The energy of activation of a reaction determines its rate. The reactions having lower energy of activation are fast, while the reactions having very high activation energy are extremely slow.

15. **Difference between Adsorption and Absorption :**

Adsorption	Absorption
1. In this phenomenon, the concentration on the surface of adsorbent is different from that in the bulk.	1. In this phenomenon, the concentration is same through out the material.
2. It occurs only at the surface of adsorbent.	2. It occurs throughout the body of the material.

16. Nickel is refined by MOND process. When impure nickel is heated in a current of CO at 330–350 K it forms volatile nickel carbonyl leaving behind the impurities. The nickel carbonyl [Ni(CO)$_4$] thus obtained is then heated to a higher temperature (450–470 K) when it undergoes thermal decomposition giving pure metal.

$$Ni + 4CO \xrightarrow{330-350\,K} Ni\,(CO)_4$$
Nickel tetra carbonyl

$$Ni(CO)_4 \xrightarrow{450-470\,K} Ni + 4CO \uparrow$$
Pure
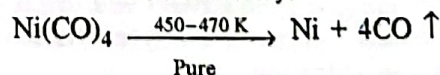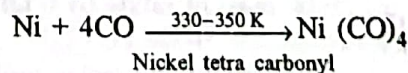
17. The reactivity of Nitrogen differs from P due to its:
   (i) small size
   (ii) high ionisation enthalpy and electronegativity
   (iii) non-availability of d-orbitals with N.
   (iv) Nitrogen has unique ability to form $p\pi - p\pi$ multiple bonds with itself and with other elements having small size and higher electronegativity.

18. P in both PH_3, PH_4^+ is sp^3 hybridized. In PH_4^+ all the four orbitals are bonded, whereas in PH_3, there is a lone pair of electrons on P. It is responsible for lone pair-bond repulsion in PH_3 reducing the bond angle to less than the normal 109°28'.

19. There are five d-orbitals in an energy level and each orbital can accommodate two electrons. As we move from one element to the next, an electron is added to a d-orbital and for complete filling of the 5 d-orbitals, 10 electrons are needed. Hence any transition series contains 10 elements.

20. (a) The polymers which occur in nature i.e., in plants, animals etc. are called **natural polymers.**

   Examples : Natural rubber, Cellulose, Proteins, Starch etc. are **natural polymers.**

   The polymers which are made in factories / laboratories by using simple substances are called synthetic or man-made polymers.

   Example : Polythene, Polyvinyl chloride (PVC), Teflon, Nylon Terylene, etc.
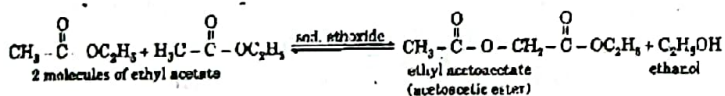
   (b) **Vitamins :** Vitamins are a group of organic compounds which are required in very small amounts for the healthy growth and proper functioning of the living organisms. Vitamins cannot be prepared within the body by any organisms. So the vitamins have to be supplied in the diet.

   Vitamins are classified on the basis of their solubility in water or oil. These are called—
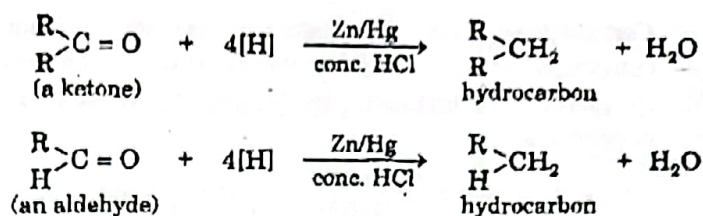
   Water-soluble vitamins–Vitamin C and vitamins of B-group are water-soluble vitamins.

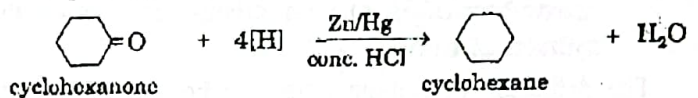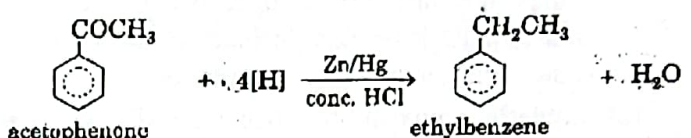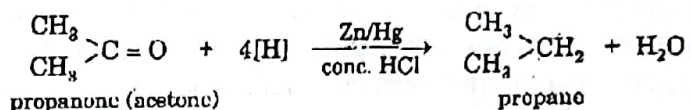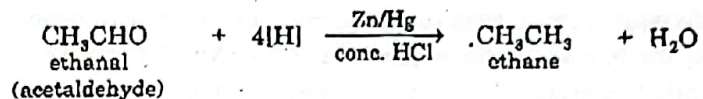   Oil or Fat-soluble vitamins–Vitamins A, D, E and K are fat or oil soluble vitamins.

21. (i) **Claisen Condensation**—The self-condensation of esters containing α-hydrogen atom in the presence of an alkoxide (sodium metal or sodamide) to give a β-ketoester is called **Claisen condensation.** Claisen condensation is also referred to as *Claisen ester condensation.* The best example of claisen condensation is the preparation of ethyl acetoacetate from ethyl acetate in the presence of sodium ethoxide.

$$CH_3-\overset{O}{\underset{}{C}}-OC_2H_5 + H_3C-\overset{O}{\underset{}{C}}-OC_2H_5 \xrightarrow{\text{sod. ethoxide}} CH_3-\overset{O}{\underset{}{C}}-O-CH_2-\overset{O}{\underset{}{C}}-OC_2H_5 + C_2H_5OH$$

2 molecules of ethyl acetate — ethyl acetoacetate (acetoacetic ester) — ethanol

   (ii) **Clemmensen Reduction**—The reduction of $>C=O$ group to methylene group ($>CH_2$) with amalgamated zinc and concentrated hydrochloric acid is known as **Clemmensen reduction.**
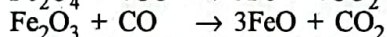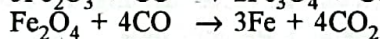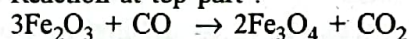
$$\underset{\text{(a ketone)}}{\overset{R}{\underset{R}{>}}C=O} + 4[H] \xrightarrow[\text{conc. HCl}]{Zn/Hg} \underset{\text{hydrocarbon}}{\overset{R}{\underset{R}{>}}CH_2} + H_2O$$

$$\underset{\text{(an aldehyde)}}{\overset{R}{\underset{H}{>}}C=O} + 4[H] \xrightarrow[\text{conc. HCl}]{Zn/Hg} \underset{\text{hydrocarbon}}{\overset{R}{\underset{H}{>}}CH_2} + H_2O$$

For example,

$$\underset{\underset{\text{(acetaldehyde)}}{\text{ethanal}}}{CH_3CHO} + 4[H] \xrightarrow[\text{conc. HCl}]{Zn/Hg} \underset{\text{ethane}}{CH_3CH_3} + H_2O$$

$$\underset{\text{propanone (acetone)}}{\overset{CH_3}{\underset{CH_3}{>}}C=O} + 4[H] \xrightarrow[\text{conc. HCl}]{Zn/Hg} \underset{\text{propane}}{\overset{CH_3}{\underset{CH_3}{>}}CH_2} + H_2O$$

acetophenone $+ 4[H] \xrightarrow[\text{conc. HCl}]{Zn/Hg}$ ethylbenzene $+ H_2O$

cyclohexanone $=O + 4[H] \xrightarrow[\text{conc. HCl}]{Zn/Hg}$ cyclohexane $+ H_2O$

22. **Extraction of Fe by carbon reduction method :** Main ores of iron are hematite (Fe_2O_3) and magnetite (Fe_3O_4). Extraction of iron is mainly carried from its haematite and magnetite ores.
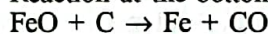
   Extraction : At first, iron ore is calcined which removes water vapour, decomposes carbonates and sulphides are oxidised. Calcined ore is now mixed with limestone and coke and is led into the blast furnace; coke burns to produce carbon monoxide. The temperature of the bottom part of the furnace is 1800 K and that at the top is 500 K. Carbon monoxide acts as reducing agent at the top and carbon itself acts as reducing agent at the bottom of the furnace.

   **Reaction in the furnace :**
   (i) Reaction at top part :
   $$3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$$
   $$Fe_3O_4 + 4CO \rightarrow 3Fe + 4CO_2$$
   $$Fe_2O_3 + CO \rightarrow 3FeO + CO_2$$
   (ii) Reaction at the bottom (The hottest part)—
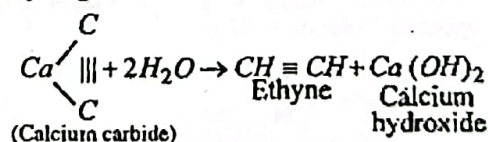 $$FeO + C \rightarrow Fe + CO$$

   In this way, the molten iron reaches the base of the furnace. Lime stone decomposes at 1000 K forming calcium oxide which combines with silica forming molten calcium silicate or slag. Iron thus, obtained is called pig iron and contains 4% C and other impurities (S, P, SI, Mn).

23. (i) When sodium acetate is heated with soda-line, Methane gas is librated.
   $$\underset{\text{(Sodium acetate)}}{CH_3-COONa} \xrightarrow[\Delta]{NaOH+CaO} \underset{\text{(methane)}}{CH_4}$$
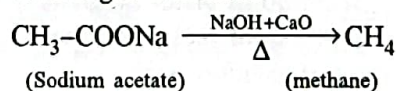
   (ii) When calcium carbide reacts with water, it liberates ethyne gas
   $$\underset{\text{(Calcium carbide)}}{Ca\overset{C}{\underset{C}{\lVert\lVert}}} + 2H_2O \rightarrow \underset{\text{Ethyne}}{CH \equiv CH} + \underset{\substack{\text{Calcium} \\ \text{hydroxide}}}{Ca(OH)_2}$$

24. Carbohydrates are the naturally occuring organic compounds and are a major source of energy to our body. In plants carbohydrates are formed as a result for photosynthesis.

$$xCO_2 + yH_2O \xrightarrow[\text{Sun light}]{\text{Chlorophill}} C_x(H_2O)_y + xO_2$$
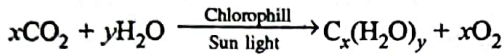
In animal systems the carbonydrates undergo decomposition to form carbon-dioxide and water accompanied by the release of energy needed for the body. Composition of carbohydrates—The chemical formula of the carbohydrates suggests that these are the hydrates of carbon. For example, glucose may be represented as $C_6(H_2O)_6$ while sucrose as $C_{12}(H_2O)_{11}$. But this definition has certain limitation.

(i) Compounds like formaldehyde (CH_2O) and acetic acid ($C_2H_4O_2$) are they hydrates of carbon do not show characteristics of carbohydrates.

(ii) Similarly, compound like rhammose ($C_6H_{12}O_6$) and deoxyribose ($C_5H_{10}O_4$) are carbohydrates but not the hydrates of carbon.

The definition of carbohydrates has been modified and they may be defined as—The optically active polyhydroxy aldehydes or polyhydroxy ketones are substances which generally give these on hydrolysis.

Classification of carbohydrates are done in three ways :

(a) Based on molecular size—On the basis of the molecular size, carbohydrates have been classified into three types. These are—

(i) Manosaccharides e.g. Glucose, Fructoxe

(ii) Oligosaccharides e.g. Sucrose, Maltose

(iii) Polysaccharides e.g. Starch, Cellulose

(b) Based on taste—Carbohydrates with sweet taste are called sugar while those without a sweet taste are called non-sugars. It may be noted that all mono and oligosaccharides are sugars while polysaccharides are non-sugar.

(c) Reducing and non-reducing sugar—Carbohydrate which reudce Tollen's reagent and Fehling solution are called reducing sugar while those which don't reduce, these are called non reducing sugar. For example—glucose and fructose.

25. According to Raoult's law

$$\frac{P_O - P_S}{P_O} = \frac{n}{N+n} \qquad ...(1)$$

Where, n = no of moles of salute

N = no of moles of solvent

Let, Total amount of solute = w g

Total amount of solvent = W g

Molal mass of solute = m g

Molal mass of Solvent = M g

$$\therefore \qquad n = \frac{w}{m}$$

$$N = \frac{W}{M}$$

From equation (1)

$$\frac{P_O - P_S}{P_O} = \frac{n}{N+n}$$

$$\Rightarrow \quad \frac{P_O - P_S}{P_O} = \frac{\dfrac{W}{m}}{\dfrac{W}{M} + \dfrac{w}{m}}$$

$\because$ Solution is be dilute then $\dfrac{w}{m}$ is be neglible w.r.t. $\dfrac{W}{M}$

$$\Rightarrow \quad \frac{P_O - P_S}{P_O} = \frac{\dfrac{w}{m}}{\dfrac{W}{M}}$$

$$\Rightarrow \quad \frac{P_O - P_S}{P_O} = \frac{w \times M}{m \times W}$$

$$\Rightarrow \quad m\left(\frac{P_O - P_S}{P_O}\right) = \frac{w \times M}{W}$$

$$\Rightarrow \quad m = \frac{w \times M}{W \times \left(\dfrac{P_O - P_S}{P_O}\right)}$$

m is the molal mass of solute.

26. Conductivity or specific conductance (κ, α : Kappa : Greek word) is the reciprocal of resistivity.

It is the conductance of a material which is 1 metre in length and having an area of cross-section of $1m^2$.

Its unit is Siemen (S) m^{-1}.

$1S\ cm^{-1} = 100\ S\ m^{-1}$

1 Siemen or $1S = 1\ ohm^{-1}$ or mho or Ω^{-1}.

If we take an electrolytical solution in a 1 cm^3 of a vessel having electrodes 1 cm apart, its conductance is also called specific conductance or conductivity.

Unit of κ is also $ohm^{-1}\ cm^{-1}$.

Molar Conductivity—It is the conducting power of all ions producing by dissolving one mole of an electrolyte in solution. It is denoted by Λ_m (lambda). Molar conductivity is related to specific conductance/conductivity (x) as

$$\Lambda_m = \kappa / M.$$

where M is the molar concentration. If M is in the units of Molarity i.e., moles per litre (mol L^{-1}), Λ_m may be expressed as

$$\Lambda_m = \frac{\kappa \times 1000}{M}$$

Unit of Molar conductivity

Molar conductivity = S m^2 mol^{-1}

$\square\ \square\ \square$