

CHEMICAL CALCULATIONS**A. Choose the best answer:**

- The volume occupied by 16g of oxygen at S.T.P.
a) 22.4 L b) 44.8 L
c) 11.2 L d) 5.6 L
- Avogadro's number represents No. of atoms in
a) 12g of C12 b) 320g of S
c) 32g of Oxygen d) 12.7g of iodine.
- Gram molecular volume of ozone at S.T.P is
a) 22.4 L b) 2.24 L
c) 11.2 L d) 67.2 L
- The number of atoms present in 0.5 gram- atoms of Nitrogen is same as the atoms in
a) 12g of C b) 32g of S
c) 8g of the oxygen d) 24g of magnesium.
- No. of gram-atoms of oxygen in 128g of oxygen
a) 4 b) 8
c) 128 d) $8 \times 6.02 \times 10^{23}$
- Total No. of moles present in 111 g of CaCl₂
a) 1 mole b) 2 moles
c) 3 moles d) 4 moles
- Which weighs the most?
a) 1 gram-atom of nitrogen b) 1 mole of water
c) 1 mole of Sodium d) 1 molecule of H₂SO₄
- Which contains same number of carbon atoms as are in 6.0g of carbon (C-12)?
a) 6.0g ethane b) 8.0g methane
c) 21.0g Propane d) 28.0g CO
- Which contains maximum number of atoms?
a) 2.0g hydrogen b) 2.0g oxygen
c) 2.0g nitrogen d) 2.0g methane
- Which is the standard for atomic mass?
a) H b) ¹²6C c) ¹⁴6C d) ¹⁶8O
- Which pair of species have same number of atoms under similar conditions ?
a) 1L each of SO₂ and CO₂
b) 2L each of O₃ and O₂
c) 1L each of NH₃ and Cl₂
d) 1L each of NH₃ and 2L of SO₂
- 2.0 g of oxygen contains No. of atoms same as in
a) 4 g of S b) 7 g of nitrogen
c) 0.5 g of H₂ d) 12.3 g of Na
- No. of gm-molecules of oxygen in 6.02×10^{24} CO molecules is
a) 1 gm-molecule b) 0.5 gm-molecule
c) 5 gm-molecule d) 10 gm-molecule

- Hydrogen phosphate of certain metal has a formula MHPO₄, the formula of metal chloride is
a) MCl b) MCl₃ c) MCl₂ d) MCl₄
- A compound contains 50% of X (atomic mass 10) and 50% Y (at. Mass 20). Which formulate pertain to above date ?
a) XY b) X₂Y c) X₄Y₃ d) (X₂)₃ Y₃
- Which compound has / have percentage of carbon same as that in ethylene (C₂H₄) ?
a) propane b) Cyclohexane c) Ethane d) Benzene
- 5L of 0.1M solution of sodium Carbonate contains
a) 53 g of Na₂CO₃ b) 106 g of Na₂CO₃
c) 10.6 of Na₂CO₃ d) 5×10^2 milli moles of Na₂CO₃
- Which contains same number of carbon atoms as are in 6.0g of carbon (C-12)?
a) 6.0g ethane b) 8.0g methane
c) 21.0g Propane d) 28.0g CO
- Which maximum number of atoms?
a) 2.0g hydrogen b) 2.0g oxygen
c) 2.0g nitrogen d) 2.0g methane
- Which is the standard for atomic mass?
a) H b) 126C c) 146C d) 168O

B. Fill in the blanks

- 1 mole of a triatomic gas contains.....atoms.
- 1 mole of Sulphuric acid contains...Oxygen atoms
- 11.2L of CO₂ at S.T.P containsoxygen atoms.
- Equal volumes of different gases under similar conditions of temperature and pressure contain equal number of.....
- A decimolar solution of NaOH contains....of NaOH per litre of the solution.
- 7 g of CO contains.....O atoms.
- Mass of 1×10^{22} formula units of CuSO₄ 5H₂O is

C. Match the following

- | | |
|---|---|
| 28. CaC ₂ | 106 g |
| 29. Law of multiple proportions | 6.02×10^{23} Ne atoms |
| 30. Hydrargyrum | Molarity of solution |
| 31. 2 gm-equivalents of Na ₂ CO ₃ | 0.01 moles of solute in one L of solution |
| 32. 22.4 L at S.T.P. | Liquid element |
| 33. Number of gm-molecules per litre of solution | Calcium carbide |
| 34. 1 gm-atom of rhombic sulphur | (NH ₄) ₂ SO ₄ .Fe(SO ₄).6H ₂ O |

35. Centimolar solution 1/8 gm-molecules

36. Mohr's Salt John Dalton

D. Answer the following

37. Can two different compounds have same molecular formula? Illustrate with two examples.
38. What are the essentials of a chemical equation?
39. What are the information's conveyed by a chemical equation?
40. Balance the following equations
 - i. $\text{Fe} + \text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$
 - ii. $\text{Fe}_2(\text{SO}_4)_3 + \text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{Fe}(\text{OH})_3 + (\text{NH}_4)_2\text{SO}_4$
 - iii. $\text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{O} + \text{O}_2$
 - iv. $\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{Cr}_2(\text{SO}_4)_3 + \text{H}_2\text{O} + \text{O}_2$

GENERAL INTRODUCTION TO METALLURGY

A. Fill up the blanks

1. Earthy impurities associated with ores
2. Froth flotation process is suitable for concentrating
3. Highly pure metals are obtained byprocess.
4. Gangue + flux \rightarrow
5. Mineral from which metal is profitably extracted
6. Mixture containing copper sulphides and iron is
7. Used as a foaming agent.

B. Write in one or two sentence

8. Distinguish between ore and mineral with suitable example?
9. What are the elements obtained from sea water source?
10. What are different methods of concentration of ores?
11. What is gravity separation?
12. Name the ores which are concentrated by froth flotation process.
13. Define Metallurgy.
14. What are the major steps involved in the metallurgical process?
15. What is calcinations? Give example.
16. What is the principle involved in Bessemer process?
17. What is meant by electrolytic refining? Give example.
18. What is anode mud?
19. What do you understand by i) roasting ii) smelting

C. Explain briefly on the following

20. Write short note on source of element in living system.
21. Explain froth flotation process with neat diagram.

22. How electromagnetic separation process is useful in separation of magnetic impurities from nonmagnetic ores? Draw the diagram.
23. How the impurities of ore are removed by chemical method?
24. What is roasting? Explain types of roasting with example.
25. What is smelting? Explain with example.
26. What is Zone refining? Describe principle involved in purification of metal by this method.
27. How nickel is extracted by Mond's process? Write various reactions involved in the process.
28. Write short note on mineral wealth of India.
29. Give an account of mineral wealth of Tamil Nadu.

ATOMIC STRUCTURE - I

1. Atomic mass of an element is not necessarily a whole number because :
 - a) It contains electrons, protons and neutrons
 - b) It contains allotropic forms
 - c) Atoms are no longer considered indivisible
 - d) It contains isotopes
2. No two electrons in atom will have all 4 quantum numbers equal. The statement is known as
 - a) Exclusion principle
 - b) Uncertainty principle
 - c) Hund's rule
 - d) Aufbau principle
3. When 3d orbital is complete, electron will enter
 - a) 4p orbital
 - b) 4f orbital
 - c) 4s orbital
 - d) 4d orbital
4. The preference of three unpaired electrons in the nitrogen atom can be explained by
 - a) Pauling's exclusion principle
 - b) Aufbau principle
 - c) Uncertainty principle
 - d) Hund's rule
 - e) None of these.
5. The number of orbital in a p-sub-shell is
 - a) 1
 - b) 2
 - c) 3
 - d) 6
 - e) 5
6. The nucleus of an atom contains :
 - a) Electrons & protons
 - b) Neutrons & protons
 - c) Electrons, protons and neutrons
 - d) Neutrons and electrons
 - e) None of these.
7. Which is the lightest among the following?
 - a) An atom of hydrogen
 - b) An electron
 - c) A neutron
 - d) A proton
 - e) An alpha particle.
8. Which has no neutrons in the nucleus?
 - a) Deuterium
 - b) Helium
 - c) Hydrogen
 - d) Tritium
 - e) An alpha particle.

9. When value of azimuthal quantum number is 3, the magnetic quantum number can have values
 a) +1,-1 b) +1,0, 1 e) +3,-3.
 c) +2,+1,0, -1,-2 d) +3,+2, +1,0, -1,-2,-3
10. 2p orbitals have :
 a) $n = 1, l = 2$ b) $n=1, l = 0$
 c) $n = 2, l = 0$ d) $n = 2, l = 1$ e) $n = 1, l = 1$.
11. Atomic number of an element is 17 and its mass number is 37. The number of protons, electrons and neutrons present in the neutral atom are :
 a) 17, 37,20 b) 20,17,37
 c) 17, 17, 20 d) 17, 20,17 e) 37,20, 17.
12. The maximum number of electrons that can be accommodated in the nth level is :
 a) n^2 b) $n+1$ c) $n-1$ d) $2n^2$ e) $2 + n$.
13. The magnetic quantum number decides :
 a) The distance of the orbital from the nucleus
 b) The shape of the orbital
 c) The orientation of the orbital in space
 d) The spin of the electron.

B. Fill up the blanks

14. The decomposition of an electrolyte by passage of electricity is known as
15. When cathode rays are focused on thin metal foil, it gets heated up to
16. Cathode rays produce...on walls of discharge tube
17. Radiations not influenced by a magnet were
18. Neutrons are discovered by

C. Write in one or two sentence

19. What is the charge of electron, proton, neutron ?
20. What is atomic number?
21. What is the maximum number of electrons that an orbital can have?
22. How many orbitals are there in the second orbit? How are they designated?
23. Sketch the shape of s and p-orbital indicating the angular distribution of electrons.
24. What are the charge and mass of an electron?
25. What is an orbital?
26. Give the order of filling of electrons in the following orbitals 3p, 3d,4p, 3d and 6s.
27. What is meant by principal quantum number?
28. How many protons and neutrons present in $^{18}_8\text{O}$?
29. What are the particles generally present in the nuclei of atoms?
30. The atomic mass of an element is 24 and its atomic number is 12. Show how the atom of the element is constituted?

31. How will you experimentally distinguish between a ray of neutron and ray of proton?
32. What is the principal defect of Bohr atom model?
33. Write the complete symbol for nucleus with
 a) atomic number 56 and mass number 138 ;
 b) atomic number 26 and mass number 55 ;
 c) atomic number 4 and mass number 9.
34. An atomic orbital has $n = 3$. What are the possible values of l ?
35. An atomic orbital has $l = 3$. What are the possible values of m ?
36. Give electronic configuration of chromium. ($Z=24$).
37. Which energy level does not have p-orbital?
38. An atom of an element has 19 electrons. What is the total number of p-orbital?
39. How many electrons can have $s + \frac{1}{2}$ in a d-sub-shell?
40. Write the values of l and m for p-orbitals.
41. Which quantum accounts for the orientation of the electron orbital?
42. What is shape of the orbital with
 (i) $n = 2$ and $l = 0$; (ii) $n = 2$ and $l = 1$?
43. Give the values for all quantum numbers for 2p electrons in nitrogen ($Z = 7$).
44. Give the electronic configuration of Mn^{2+} and Cu. Atomic number of Cu = 29 and Mn = 25.
45. Explain why the electronic configuration of Cr and Cu are written as $3d^5, 4s^1$ and $3d^{10} 4s^1$ instead of $3d^4 4s^2$ and $3d^9 4s^2$?

D. Explain briefly on the following

46. Describe Aufbau principle. Explain its significance in the electronic build up of atoms.
47. Using the s, p, d, notation, describe the orbital with the following quantum numbers?
 a) $n = 1, l = 0$ b) $n = 2, l = 0$; c) $n = 3, l = 1$ d) $n = 4, l = 3$.
48. Using the Aufbau principle, write the electronic configuration in ground state of following atoms :
 Boron ($Z = 5$) Neon ($Z = 10$) Aluminium ($Z = 13$).
49. What is Rutherford's α - ray scattering experiment? What are its conclusions?
50. What are the postulates of Bohr theory of atom?
51. Explain the various quantum numbers which completely specify the electron of an atom.

PERIODIC CLASSIFICATION - I**A. Choose the Best Answer**

- The elements with atomic numbers 31 belongs to
a) d-block b) f-block c) p-block d) s-block
- Representative elements belong to :
a) s and d-blocks b) s and p-blocks
c) p and d-blocks d) d and f-blocks
- Most electronegative element of the periodic table
a) Iodine b) Fluorine c) Chlorine d) Oxygen
- Which forms stable gaseous negative ion.
a) F b) Cl c) Br d) I
- The elements having highest ionization energies within their periods are called :
a) Halogens b) Noble gases
c) Alkali metals d) Transition elements
- A property which progressively increases down a group in the periodic table is
a) Ionization enthalpy b) Electro negativity
c) Electron gain enthalpy
d) Strength as reducing agent.
- Elements whose atoms have their s and p-sub-levels complete are the:
a) Normal elements b) Transition elements
c) Halogens d) Inert gases.
- The law of triad is applicable to :
a) Chlorine, bromine and iodine
b) Hydrogen, oxygen and nitrogen
c) Sodium, neon and calcium
d) All of the above
- The law of octaves was stated by :
a) Dobereiner b) Mendeleev
c) Moseley d) Newland
- Which property decreases down a group :
a) Ionization enthalpy b) Atomic radii
c) Valency d) All the above
- Which has the lowest melting point ?
a) CsCl b) RbCl
c) KCl d) NaCl e) LiCl.
- Which of the following hydroxide is most basic ?
a) Mg(OH)₂ b) Ba(OH)₂
c) Ca(OH)₂ d) Be(OH)₂
- Excluding hydrogen and helium, the smallest element in the periodic table is :
a) lithium b) Oxygen
c) Fluorine d) Chlorine
- Which one species has the largest atomic radius:
a) Na b) Mg c) Al d) Si

- Which is the lightest metal ?
a) Calcium b) Lithium
c) Magnesium d) Sodium
 - Which has highest ionization potential?
a) Sodium b) Magnesium
c) Carbon d) Fluorine
 - With respect to chlorine, hydrogen will be
a) Electropositive b) Electronegative
c) Neutral d) None of these.
 - Which element has greatest tendency to lose electrons?
a) Chlorine b) Sulphur
c) Francium d) Beryllium.
 - Halogens belong to the :
a) s-block b) p-block c) d-block
d) f-block e) Zero group of the periodic table.
 - Compared to first ionization enthalpy of an atom, the second is :
a) Greater b) Less
c) Same d) Negligible
 - Which arrangement set of atoms is in order of increasing atomic radius: Na, Rb, K and Mg ;
a) Na, Mg, K, Rb b) Na, K, Mg, Rb
c) Mg, Na, K, Rb d) Na, Mg, Rb, K
 - First attempt to classify elements was made by :
a) Mendeleev b) Newland
c) Lothar Meyer d) Dobereiner
 - Transition elements Characteristic is incomplete in
a) d-orbitals b) f-orbitals
c) p-orbitals d) s-orbitals
 - Which will have lowest first ionization enthalpy ?
a) Na b) Al c) Mg d) Si
 - Which atoms is likely to give off more energy on gaining an electron ?
a) Na b) Mg c) Al d) Cl
 - Transition metals have electronic configuration :
a) ns² nd¹⁻¹⁰ b) ns² npⁿ⁻¹ d¹⁻¹⁰
c) ns² n-1) d¹⁻¹⁰ d) ns² np⁶ n-1) d¹⁻¹⁰
 - In first transition series incoming electron enters:
a) 4d-orbital b) 3d-orbital
c) 5d-orbital d) 6d-orbital
- B. Fill in the Blanks**
- Mendeleev's periodic law states that properties of elements are the periodic functions of
 - The Modern periodic law states that the physical and chemical properties of the elements are periodic functions of their

30. The long form of the periodic table is constructed on the basis of repeating electronic of the atoms when they are arranged in the order of increasing atomic numbers.
31. The first three periods containing 2, 8 and 8 elements respectively are called
32. The valency of representative elements is given by the number of electrons in the outermost orbital and/or equal to Minus the number of outermost electrons.

Write in one or two sentence

33. Arrange F, Cl, Br and I in the order of increasing electronic gain enthalpy.
34. Write electronic configurations for the elements of atomic numbers 6 and 14 and from this find out of which group in the periodic table each elements belongs.
35. Which of the following electronic configurations has the lowest ionization enthalpy ?
a) $1s^2, 2s^2, 2p^6$; b) $1s^2, 2s^2, sp^6$;
c) $1s^2, 2s^2, 2p^6, 3s^2$.
36. State Modern Periodic Law.
37. Why Noble gases have zero electron gain enthalpy?
38. Which of the following pairs of elements would you expect to have lower first ionization enthalpy
a) Cl or F ; b) Cl or S ; c) K or Ar d) Kr or Xe.
39. Why do elements in the same group have generally similar properties?
40. Name any two transition elements and any two inner transition elements.
41. Arrange order of increasing atomic volumes in :
a) Li, Na and K ; b) C, N and O ; (c) Ca, Sr and Ba.
42. Name the different blocks of elements in periodic table. Give the general electronic configuration of each block.
43. To which block does the element with configuration $3d^4 4s^1$ belongs Why nitrogen has higher I.E. value than oxygen?
44. Out of fluorine and chlorine, which has greater electron gain enthalpy?
45. Why are d-block elements called transition elements?
46. What property did Mendeleev use to classify elements in his periodic table?
47. Among the elements Li, K, Ca, S and Kr which one has the lowest first ionization enthalpy? Which has the highest first ionization enthalpy?

D. Explain briefly the following

48. Why does the first ionization enthalpy would have higher electron gain enthalpy?
49. Which of the following pairs of elements would have higher electron gain enthalpy? Explain.
a) N or O ; b) F or Cl .
50. Lanthanides and actinides are placed in separate rows at the bottom of the periodic table. Explain the reason for this arrangement ?
51. What do you mean by representative elements? Name the groups of the periodic table, which contain representative elements.
52. Define transition elements. Name the different transition series.
53. Which element of the following pairs have smaller ionization enthalpy? Justify your answer.
a) Ca or Be ; b) Ca or K ; c) Cl or I.
54. Why is Na atom bigger than the atoms of both lithium and magnesium ?
55. What do you mean by the term electron gain enthalpy? How does electron gain enthalpy change along a period and in a group?
56. Explain how the elements are arranged in the form of the periodic table.
57. What are normal, transition and inner- transition elements?
58. What are the differences between normal and transition elements?
59. Explain why radii of positive ions are always smaller than the radii of corresponding neutral atoms and why negative ions have larger radii than the corresponding neutral atom.
60. Explain the size of group $Cl^- \rightarrow Na^+$
61. What is electron gain enthalpy? On what factors does it depend?
62. Give the general variation of electron gain enthalpies in the periodic table.
63. Define the term ionic radius. Justify that the radius of anion is larger than the parent atom.
64. What do you mean by ionization enthalpy? How does it vary across a period and down a group?
65. What is meant by electronegativity? On what factors does it depend?
66. What are the essential features of the periodic table of Mendeleev?
67. Discuss how his table has been modified subsequently.

GROUP 1 S-BLOCK ELEMENTS**A. Choose the best answer**

1. Atoms of the same element having same atomic number but different mass number are called

- a) isotopes b) isobars
c) isotones d) isomerism
2. Deuterium nucleus consists of
a) 2 protons only b) one neutron
c) 1 proton 1neutron d) 2 protons 1 neutron
3. Deuterium with oxygen gives
a) oxydeuterium b) water
c) heavy water d) all
4. Tritium is prepared by bombarding lithium with
a) deuterons b) mesons
c) slow neutrons d) all
5. At room temperature ordinary hydrogen consists
a) 25% para 75% ortho b) 75% para 25% ortho
c) 99% para 1% ortho d) 1% para 99% ortho
6. D₂O reacts with P₂O₅ and gives
a) DPO₄ b) D₂PO₄
c) D₃PO₃ d) D₃PO₄
7. H₂O₂ is a powerful...agent
a)dehydrating b)oxidising
c)reducing d) desulphurising
8. Used for the preparation of deuterium
a) deuterium oxide b) heavy water
c) both a and b d) deuterium peroxide
9. is used as a propellant in nucleus
a) H₂O₂ b) D₂O
c) ND₃ d) CH₂ = CH₂
10. The oxidation state of alkali metals is
a) +2 b) 0 c) +1 d) +3
11. When heated in bunsen flame, lithium gives colour
a) yellow b) blue
c) lilac d) crimson red
12. On moving down group, density of alkali metals
a) increases b) decreases
c) increases and then decreases
d) decreases and then increases
13. If the element can lose an electron readily, they are said to be
a) electronegative b) electropositive
c) electronative d) electrovalent

B. Fill in the blanks

14. The first element in the periodic table is
15. Common formd of hydrogen.
16. The half-life of tritium is .
17. Deuterium reacts with ammonia to form .
18. The rare isotope of hydrogen is

19. Employed in nuclear reactor to slow down speed of fast moving neutrons.....
20. The magnetic moment of para hydrogen is
21. Deuterium with salt and other compounds forms
22. Hydrogen peroxide was first prepared by
23. Pure H₂O₂ is
24. The Arabic word 'Alquili' means
25. The electronic configuration of potassium is
26. Alkali metals have ... melting ...boiling points.
27. On moving down group of alkali metals, ionization energy is lightest of all solid elements.

C. Write in one or two sentences

28. What are isotopes? Mention isotopes of hydrogen.
29. Write a short note on tritium.
30. How does deuterium react with nitrogen?
31. How does deuterium react with metals?
32. Mention the uses of deuterium.
33. How is tritium prepared?
34. How do you convert para hydrogen to ortho?
35. How does heavy water react with metals?
36. How is hydrogen peroxide prepared in laboratory?
37. How is hydrogen peroxide solution concentrated?
38. Write reducing property of hydrogen peroxide.
39. Mention two important uses of H₂O₂.
40. Why alkali metals have low melting and boiling points?
41. Why alkali metals have strong electropositive character?

D. Explain briefly on the following

42. How is deuterium obtained by diffusion process?
43. Write about the exchange reactions of deuterium.
44. What are ortho and para hydrogen? Explain.
45. Differentiate between ortho and para hydrogen.
46. Explain the preparation of heavy water.
47. Compare water and heavy water.
48. Explain oxidizing property of hydrogen peroxide.
49. Explain how liquid hydrogen is used as a fuel.
50. How is lithium extracted from its ore?

GROUP 2 S-BLOCK ELEMENTS**A. Choose the best Answer**

1. Which is known as 'alkaline earth metal'.
a) Sodium b) Calcium
c) Lithium d) Potassium
2. Alkaline earth metals are
a) monovalent b) trivalent
c) divalent d) zerovalent

- Among alkaline earth metals is having the highest ionization energy.
 - Beryllium
 - magnesium
 - Calcium
 - Barium
- The colour given by barium in flame is
 - Brick red
 - Apple Green
 - Red
 - Blue
- 3rd most abundant dissolved ion in the ocean is
 - Beryllium
 - Barium
 - Calcium
 - Magnesium
- Quick lime is
 - Calcium oxide
 - Calcium hydroxide
 - Calcium nitrate
 - Calcium sulphate
- The formula of bleaching powder is
 - CaCl₂ . H₂O
 - CaOCl₂ . H₂O
 - CaSO₄ . 2H₂O
 - CaSO₄ . ½H₂O
- Plaster of paris is
 - CaSO₄ . 2H₂O
 - CaCl₂
 - CaSO₄
 - CaSO₄ . 2H₂O
- Compound used in making moulds for statues is
 - Epsom salt
 - Calcium sulphide
 - Plaster of paris
 - Gypsum
- The element used in pyrotechnics is
 - Magnesium
 - Barium
 - Calcium
 - Beryllium

B. Fill in the Blanks

- The general electronic configuration of alkaline earth metals is
- The ionic radius....on moving down the group 2.
- In flame, calcium gives.....colour.
- Beryllium resembles with element in 13th group.
- Magnesium comes from the name of mineral
-is present chlorophyll.
- Magnesium is prepared by electrolysis of fused....
- With air, Magnesium formsand.....
- The formula of epsom salt is
- Epsom salt is used as

C. Match the following

- | | |
|----------------|--|
| 21. Magnetite | CaSO ₄ . 2H ₂ O |
| 22. Dolomite | Mg Cl ₂ . KCl . 6H ₂ O |
| 23. Epsom salt | MgCO ₃ |
| 24. Carnallite | MgCO ₃ . CaCO ₃ |
| 25. Gypsum | MgSO ₄ . 7H ₂ O |

D. Write in one or two sentence

- Why the oxides of Group 2 metals have high melting points?

- Why there is increase in the ionisation potential for forming M³⁺ ion for group 2 metals?
- Why the ionization potential of M²⁺ is not very much greater than M⁺?
- Why a precipitate of Mg(OH)₂ is not formed when aqueous ammonia, NH₄OH is added to a solution of MgCl₂?
- List the carbonates and hydroxide of alkaline earth metals in order of their increasing stability and their solution.
- Why do beryllium halides fume in air?
- Why group 2 elements are harder than alkali metals?
- Beryllium halides are covalent whereas magnesium halides are ionic. Why?
- Why are monoxides of alkaline earth metals are very stable?
- The basic strength of the oxides of group 2 elements increases from Be to Ba. Why?

D. Explain briefly on the following

- What are alkaline earth metals? Why are they called so?
- In what respects Be and Mg differ from all the other metals of group 2.
- How can you explain the anomalous behaviour of beryllium.
- How does magnesium occur in nature? How is the metal extracted from its Ore?
- In the light of metallic bonding account for the following properties of group 2 elements.
 - These are harder than alkali metals
 - These are good conductors of heat & electricity
- Why the first ionization energy of alkaline earth metals higher than that of 1st group.
- Mention the uses of plaster of Paris.
- How is plaster of paris prepared?
- How is MgSO₄ prepared?
- Mention the uses of Magnesium?

P-BLOCK ELEMENTS**A. Choose the best answer**

- The elements of group 13 to 18 of the periodic table are known as
 - s - block elements
 - p - block elements
 - d - block elements
 - f - block elements
- General electronic configuration of group 18 elements is
 - ns²
 - ns² np¹
 - ns² np¹⁻⁵
 - ns² np⁶
- The basic oxide among the following

- a) Bi₂O₃ b) SnO₂
 c) HNO₃ d) SO₃
4. The most stable hydride of the following
 a) NH₃ b) PH₃
 c) ASH₃ d) BiH₃
5. The formula of Borax is
 a) NaBO₂ b) Na₂B₄O₇
 c) H₃BO₃ d) None of the above
6. The general electronic configuration of carbon group elements is
 a) ns²np⁶ b) ns²
 c) ns²np¹ d) ns²np²
7. Process used for the manufacture of ammonia is
 a) Contact process b) Ostwald process
 c) Haber's process d) Linde's process
8. Oxides of non-metals are usually
 a) ionic b) coordinate
 c) covalent d) none of the above
9. Metallic oxides are generally
 a) acidic b) basic
 c) amphoteric d) neutral
10. Fixation of nitrogen is a source for Various
 a) oxygen compounds b) phosphorus compound
 c) nitrogen compounds d) sulphur compounds
11. Oxyacid of nitrogen used in azo dyes manufacture
 a) Nitrous acid b) Nitric acid
 c) Hyponitrous acid d) Pernitric acid
12. Hydride of V group element which is used in the manufacture of artificial silk
 a) ammonia b) stibine
 c) phosphine d) bismuthine
13. Anaesthetic used for minor operation dentistry
 a) nitrous oxide b) nitric oxide
 c) NO + oxygen d) nitrogen dioxide
14. An allotrope of carbon discovered by Richard Smalley et al.
 a) graphite b) diamond
 c) fullerene d) carbon black

B. Fill in the blanks

15. The general electronic configuration of Boron group elements is .
16. Boron combines with nitrogen to form .
17. is used to identify the metallic radicals in the qualitative analysis.
18. is known as 'inorganic benzene'.
19. In diamond, every carbon atom is bonded with the other by bond.

20. C₆₀ Buckminster fullerene was nicknamed as .
21. Carbon tetrachloride hydrolysis.
22. Nitrogen was discovered by .
23. Nitric acid means .
24. Oxidising power of nitric acid with dilution.
25. Dioxygen is also called as .
26. Atomic oxygen combines with molecular oxygen to give .
27. The ozoniser commonly used in the preparation of ozone are and
28. Ozone can liberate a oxygen easily.
29. is used in the manufacture of synthetic camphor.

C. Match the following

- | | |
|-----------------------|--|
| 30. Borax | a. Allotrope of carbon |
| 31. Graphite | b. Na ₂ B ₄ O ₇ |
| 32. ZnO | c. Ozone |
| 33. CFCs | d. Neutral oxide |
| 34. NH ₃ | e. Fertilizer |
| | f. Fixation of nitrogen |
| 35. Inert pair effect | a. Nitric acid |
| 36. Oxyacid | b. Cell fuel |
| 37. Liquid nitrogen | c. Stabilisation of lower oxidation state |
| 38. Ostwald process | d. Ozone |
| 39. Molecular oxygen | e. Platinum gauze |
| | f. Refrigerant |
| 40. Copper | a. Blue |
| 41. Iron | b. Grey |
| 42. Manganese | c. Red |
| 43. Cobalt | d. Bottlegreen |
| 44. Chromium | e. Colorless |
| | f. Green |

D. Write in one or two sentence

45. Mention the reasons for the stabilisation of lower oxidation state of p-block element.
46. Show the electron accepting property of boron trifluoride by giving an example.
47. Give an example of monovalent and trivalent element in group III.
48. Why diamond is hard compared with graphite?
49. Why Boron family has tendency to form hydrides?
50. Boron does not form B³⁺ ion. Why?
51. Why NH₃ has high boiling point than PH₃?
52. NH₃ is soluble in water whereas other hydrides of group 15 elements are insoluble in water. Why?

53. Which is considered to be "earth's protective umbrella"?
54. Mention any 3 uses of ozone.
55. What are CFCs? Mention its environmental action.
56. What are compound oxides? Give an example.
57. Mention the metal ions present in haemoglobin and myoglobin and state its function.
58. What happens when ozone reacts with
a) lead sulphide b) potassium manganate

E. Explain briefly on the following

59. Explain inert pair effect with suitable example.
60. Give an account of nature of hydrides of 15th group elements.
61. How is boron extracted from borax?
62. What happens when boron reacts with
a) conc. H₂SO₄ b) conc. HNO₃ c) SiO₂
63. How is borax prepared from colemanite?
64. How borax bead test is helpful in identifying basic radicals in qualitative analysis?
65. Discuss the structural difference between diamond and graphite.
66. Write a short note on fixation of nitrogen.
67. How nitric acid is prepared by Ostwald process.
68. Why silicon carbide is used as an abrasive?
69. How molecular oxygen is important for all oxygenated animals?
70. How ozone reacts with the following
a) PbS b) K₂MnO₄

SOLID STATE - I**A. Choose the best answer**

1. The structure of sodium chloride crystal is:
a) body centred cubic lattice c) octahedral
b) face centred cubic lattice d) square planar
2. Number of atoms in face centred cubic unit cell is:
a) 4 b) 3 c) 2 d) 1
3. The 8:8 type of packing is present in:
a) CsCl b) KCl c) NaCl d) MgF₂
4. In a simple cubic cell, each point on corner is shared by
a) 2 unit cells b) 1 unit cells
c) 8 unit cells d) 4 unit cells
5. An amorphous solid is :
a) NaCl b) CaF₂ c) glass d) CsCl
6. Each unit cell of NaCl consists 4 chlorine ions and
a) 13 Na atoms b) 4 Na atoms
c) 6 Na atoms d) 8 Na atoms

7. In a body centred cubic cell, an atom at the body of centre is shared by:
a) 1 unit cell b) 2 unit cells
c) 3 unit cells d) 4 unit cells
8. In the sodium chloride structure, formula per unit cell is equal to
a) 2 b) 8 c) 3 d) 4
9. In a face centred cubic cell, an atom at the face centre is shared by:
a) 4 unit cell b) 2 unit cells
c) 1 unit cells d) 6 unit cells

B. Fill in the Blanks :

10. In NaCl ionic crystal each Na +
11. ion is surrounded by Cl-ions and each Cl-ion is surrounded by Na+ions.
12. Coordination number of Cs⁺ in CsCl crystal is ...
13. solids do not possess sharp melting points and can be considered as liquids.
14. A body centred unit cell has an atom at the each vertex and at of the unit cell.
15. Three types of cubic unit cells are
16. A crystal may have a number of planes or axes of symmetry but it possesses only one
17. Amorphous solids that exhibit same physical properties in all the directions are called
18. Crystalline solids that exhibit different physical properties in all directions are called
19. The number of atoms in a single unit cell of cubic close packed sphere is
20. In BCC, an atom of the body centre is shared by unit cell.
21. Weiss indices of a plane are 1/2, 1/2, 1/2. Miller indices will be plane is designated as
22. A plane is parallel to x & z axes and makes unit intercepts along y-axis. Weiss indices are Its Miller indices are Plane is designated as

C. Write in one or two sentence :

23. What governs the packing of particles in crystals?
24. What is meant by 'unit cell' in crystallography?
25. How many types of cubic unit cell exists?
26. What are Miller Indices?
27. Mention the number of sodium and chloride ions in each unit cell of NaCl
28. Mention the number of cesium and chloride ions in each unit cell of CsCl

D. Explain briefly on the following :

29. Define and explain the following terms
a) Crystalline solids b) Amorphous solids

- c) Unit cell
30. Give the distinguishing features of crystalline solids and amorphous solids.
31. Explain the terms
a) Isotropy b) Anisotropy.
32. What is the difference between body centred cubic and face centred cubic?
33. Draw a neat diagram for sodium chloride structure and describe it accordingly.
34. Draw a neat diagram for Cesium chloride structure and describe it accordingly.

GASEOUS STATE - I

A. Choose the correct answer :

1. A curve drawn at constant temperature is called an isotherm. This shows relationship between
a) P and $\frac{1}{V}$ b) PV and V
c) P and V d) V and $\frac{1}{P}$
2. Critical temperature of a gas is that temperature
a) Above which it can no longer remain in the gaseous state
b) Above which it can not be liquified by pressure
c) At which it solidifies
d) At which volume of gas becomes zero
3. If a gas expands at constant temperature.
a) Number of molecules of the gas decreases
b) The kinetic energy of the molecules decreases
c) The kinetic energy of the molecules decreases
d) The kinetic energy of the molecules increases
4. Molecules of a gas A travel four times faster than the molecules of gas B at the same temperature. The ratio of molecular weight (MA/MB) will be
a) 1: 16 b) 4 c) 1:4 d) 16

B. Fill in the blanks

5. Correction term for pressure deviation is in the Vanderwaal equation of state.
6. Relation between inversion temperature and Vanderwaal's constants 'a' and 'b' is
7. To liquefy Heliummethod is used.
8. Adiabatic expansion of a real gas results in
9. The rate of diffusion of gas is..... to square root of both and molecular mass.

C. Match the following

10. Ideal gas behaviour a) Critical temperature
11. Adiabatic demagnetization b) Liquid oxygen
12. CO₂ at 31.1oC c) Mole fraction of gas

13. Joule Thomson Experiment d) No. of moles of gas
14. Ratio of partial pressure to total pressure e) Low pressure high temperature
- f) Liquid Helium

D. Write in one or two sentence

15. Write mathematical expression for Boyle's law.
16. Compare the partial pressures of gases A and B when 3 moles of A and 5 moles of B mixed in constant volume, and 25oC and 1 atm pressure.
17. Give the correction factors for the volume and pressure deviation for a Vanderwaal's gas.
18. A sample of an ideal gas escapes into an evacuated container, there is no change in the kinetic energy of the gas. Why?
19. What is the change in temperature when a compressed real gas is allowed to expand adiabatically through a porous plug.
20. Define Boyle's law and Charle's law.
21. What are measurable properties of gases?
22. What is the molar volume of nitrogen at 500K and 600 atm according to ideal gas law?
23. Define Graham's law of diffusion.
24. Give values of R-gas constant calories and Joules.
25. What are units Vanderwaals constants 'a' and 'b' ?
26. Write the significance of Vanderwaal's constants.
27. Write limitations of vanderwaal equation of state.
28. Define Joule-Thomson effect.
29. What is meant by inversion temperature ?

E. Explain briefly on the following

30. Explain the causes for deviation for real gases from ideal behaviour.
31. Deduce the relationship between critical constants and Vanderwaal's constants.
32. Describe Linde's process of liquefaction of gases with neat diagram.
33. Describe Claude's process of liquefaction of gases with neat diagram.
34. What is meant by adiabatic demagnetisation? Explain its use in liquefaction of gases.

CHEMICAL BONDING

A. Choose the correct answer

1. The crystal lattice of electrovalent compounds is composed of
a) Atoms b) Molecules
c) Opposite charged ions d) Both molecules ions
2. The compound which contains both ionic and covalent is

- For a deliquescence to occur, the vapour pressure of water in the air must be..... than that of the saturated solution.
- Depression in freezing point is pronounced if camphor is used as a solvent in place of water for same amount of solute and solvent.
- Every solution behaves as ideal solution
- The osmotic pressures of 0.1M glucose and 0.1M NaCl solutions are
- Solutions that have same osmotic pressure are called solutions.

C. Answer the following in one (or) two sentences

- What are colligative properties?
- Define relative lowering of vapour pressure.
- What do you understand by molal elevation of boiling point? What are abnormal solutes?
- Addition of non-volatile solute always increases the boiling point of the solution. Why?
- Volatile hydrocarbons are not used in the brakes of automobile as lubricant, but non-volatile hydrocarbon are used as lubricants. Why?
- Prove that the depression in freezing point is a colligative property.
- Explain the terms osmosis and osmotic pressure.
- What are isotonic solutions?
- What are the advantages of Berkley-Hartley method?
- Explain how the degree of dissociation of an electrolyte may be determined from the measurement of a colligative property.

D. Explain briefly on the following

- Explain the determination of relative lowering of vapour pressure by Ostwald- Walker method?
- Describe about Beckmann thermometer.
- Explain the determination of depression in freezing point by Beckmann method.
- What is elevation of boiling point? Explain its determination by Cottrell's method.
- Explain the laws of osmotic pressure?
- Explain its determination by Berkley-Hartley method.
- What are abnormal colligative properties? Explain with example and write its determination using Van't Hoff factor.

THERMODYNAMICS - I**A. Choose the correct answer :**

- Which of the following is not a state functions?
 - q
 - q + w
 - ΔH
 - V + PV
- Which of the following is an extensive property?

- volume
 - density
 - refractive index
 - molar volume
- Which of the following is an exothermic reaction?
 - melting of ice
 - combustion reactions
 - hydrolysis
 - boiling of water
 - Which of the following is reversible process?
 - Diffusion
 - melting
 - neutralization
 - combustion
 - In which process, work is maximum?
 - reversible
 - irreversible
 - exothermic
 - cyclic

B. Fill in the blanks

- Translational energy of molecules is a part of energy of the system.
- Specific heat of a liquid system is property.
- Work done in the reversible expansion is
- Combustion is an..... process.
- Heat of neutralisation of a strong acid is than that of a weak acid.

C. Write in one or two sentence:

- Name the equipment using which heat of combustion of compounds are determined?
- Energy can be created and be destroyed. State whether this is true or false.
- Define the law of thermodynamics.
- Give the relation between ΔH and ΔU
- Define an adiabatic process.
- Write the differences between an exothermic and an endothermic process.
- What are intensive and extensive properties?.
- Define first law of thermodynamics.
- Explain thermal and mechanical equilibrium processes.

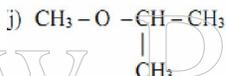
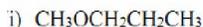
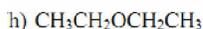
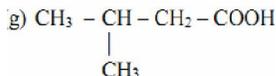
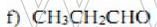
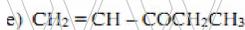
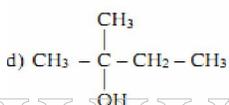
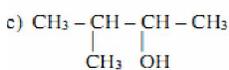
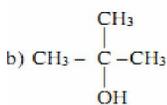
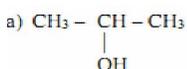
D. Explain briefly on the following

- Describe a bomb calorimeter and explain how heat of formation of an organic compound is determined.
- Compare the enthalpy changes that occur between the neutralisation of a strong acid and a weak acid by sodium hydroxide. Explain differences seen.

CHEMICAL EQUILIBRIUM - I**A. Choose the correct answer :**

- In which equilibrium pressure has no effect
 - $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$
 - $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$
 - $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$
 - $\text{NH}_4\text{Cl}(\text{s}) \rightleftharpoons \text{NH}_3(\text{g}) + \text{HCl}(\text{g})$
- For equilibrium K_p and K_c values are related as

- Addition reaction.
- Elimination reaction.
- Polymerisation reaction.
- Condensation reaction.
- Hydrolysis.
- Reduction and oxidation reactions.
- Electrophilic and Nucleophilic reagents.
- Carbonium ions and carbanions.
- Free radicals.
- Inductive effect.
- Resonance effect.

B. Write IUPAC name of the following**PURIFICATION OF ORGANIC COMPOUNDS****A. Choose the best answer**

- Organic compounds are soluble in
 - Non-polar Solvents
 - Polar solvents
 - Water
 - HCl
- Decolourisation of coloured compounds can be effected by using
 - Animal charcoal
 - Carbon
 - Coke
 - Infra-red rays
- Compounds having boiling points widely apart 40 K and above can be purified by
 - Crystallisation
 - Simple distillation
 - Fractional distillation
 - Sublimation
- Nitrobenzene and benzene can be separated by the method of
 - Steam distillation
 - Crystallisation
 - Fractional crystallisation
 - Chromatography
- Purification of two miscible liquids possessing very close boiling points can be separated using
 - Fractional distillation
 - Sublimation
 - Simple distillation
 - Steam distillation

- Purification of mixture of compounds can be done by steam distillation only if the impurities are
 - Non-volatile
 - Volatile
 - Insoluble in Water
 - both a & c
- When the stationary phase is solid, then the compounds can be separated on the basis of
 - Adsorption
 - Partition
 - Both partition&adsorption
 - Either
- Column Chromatography is based on principle of
 - Adsorption
 - Partition
 - Absorption
 - Distribution
- In Ascending paper Chromatography, the solvent moves
 - Upwards
 - Downwards
 - Horizontally
 - None
- The existence of wide range of organic compounds is due to their, property of
 - Extensive catenation
 - Lower boiling points
 - Polymerisation
 - Isomerism

B. Fill in the blanks

- The Compounds separated and purified by crystallisation can be dried over
- Camphor can be purified by process of
- In simple distillation the compounds should not decompose at
- Water insoluble compounds can be purified by
- In T.L.C the stationary phase is a
- Chromatographic technique was first introduced by
- In paper chromatography, the mobile phase travels by..... action through the paper.
- Adsorbent used in column Chromatography method is.....
- In Chromatographic technique, separation of compounds are brought about by movement of the compounds.
- Paper Chromatography..... is Chromatography

C. Write in one or two sentence

- What are the different stages followed during Crystallisation?
- Define steam distillation.
- What are different types of distillation?
- Give the advantages of distillation under reduced pressure.
- What are the types of paper chromatography?

D. Explain briefly on the following

- Explain the method of purifying a solid organic compound.

27. Write short notes on
- Fractional crystallisation
 - Solvent extraction
28. Explain the purification of compounds by using thin layer chromatography.
29. What are the various principles used in chromatographic separation?
30. Write down the general characteristics of organic compounds.

HYDROCARBONS

A. Choose the correct answer

- Alkanes can be represented by the formula
 - C_nH_{2n+2}
 - C_nH_{2n}
 - C_nH_{2n-2}
 - C_nH_{2n-3}
- Alkenes are represented by the formula
 - C_nH_{2n+2}
 - C_nH_{2n}
 - C_nH_{2n-2}
 - C_nH_{2n-3}
- Alkynes are represented by the formula
 - C_nH_{2n+2}
 - C_nH_{2n}
 - C_nH_{2n-2}
 - C_nH_{2n-3}
- Substitution reaction that takes place when methane is treated with Cl_2 in presence of light
 - ionic
 - electrophilic
 - nucleophilic
 - radial
- When n-hexane is passed over hot alumina supported chromium, vanadium or molybdenum oxide the compound formed is
 - cyclopentane
 - cyclohexane
 - toluene
 - benzene
- When the identical groups are on the same or opposite sides of the bonds in alkenes the isomerism is called as
 - chain isomerism
 - geometrical isomerism
 - position isomerism
 - optical isomerism
- Diels-Alder reaction is the reaction between
 - diene and dienophile
 - electrophile and nucleophile
 - oxidant and reductant
 - none.
- Unsaturated compounds with two double bonds are called as
 - diene
 - alkadiene
 - olefins
 - paraffins.
- The hybridization of carbons in ethylene is
 - sp^2
 - sp
 - sp^3
 - dsp^2
- Alcohols can be dehydrated to olefins using
 - H_2SO_4
 - $SOCl_2$
 - Pd
 - Zn/Hg
- When alkyl halides are treated with alcoholic KOH, the products are
 - olefins
 - alkanes
 - alcohols
 - aldehydes

- Witting reaction is used to prep are
 - alkene
 - alkyne
 - alkane
 - none
- Electrolysis of potassium succinate gives
 - ethylene
 - ethane
 - acetylene
 - none

B. Fill up the blanks

- In alkanes, the carbon atoms are connected by bonds.
- Treatment of 1,2-dibromopropane with zinc and ethanol gives.....
- Cis But-2-ene is an isomer.
- Addition of HCl to an olefin follows rule.
- An alkene reacts with ozone to form.....
- CaC_2 on hydrolysis gives.....
- Ethylenedibromide on treatment with KOH gives
- Electrolysis of sodium maleate gives.....

C. Explain briefly on the following

- Mention any five chemical properties of alkanes.
- Discuss the general methods of preparing alkanes.
- What is hydroboration?
- What is ozonolysis?
- What is witting reaction?
- What is polymerisation?
- How is ethylene hydrated?
- What is the action of ozone on acetylene.
- What happens when acetylene is passed through red-hot tube?

AROMATIC HYDROCARBONS

A. Choose the best answer :

- Aromatic compounds are
 - benzenoid compounds
 - non-benzenoid compounds
 - aliphatic compounds
 - alicyclic compounds
- Benzene was first isolated by
 - Huckel
 - Faraday
 - Hofmann
 - Barthelot
- Benzene undergoes
 - addition reactions
 - oxidation reactions
 - polymerisation reaction
 - electrophilic substitution reactions
- Modern theory of aromaticity was introduced by
 - Faraday
 - Huckel
 - Hofmann
 - Berthelot
- Any compound can be aromatic if they have localised π electrons.
 - $4n + 2$
 - $4n + 1$
 - $4n$
 - $4n - 2$

6. The function of FeCl₃ in chlorination of benzene is to produce
 a) Cl b) Cl⁺ c) Cl⁻ d) C
7. The ortho and para directing groups are
 a) activating group b) deactivating group
 c) both d) none
8. The purpose of adding conc. H₂SO₄ in nitration of benzene is to produce
 a) NO₂ b) NO₂⁻ c) NO₂⁺ d) NO₃⁻
9. An example of polycyclic aromatic hydrocarbon
 a) pyridine b) pyrrole
 c) naphthalene d) cyclohexane
10. The compound which is used as a solvent for the extraction of fats and oils
 a) naphthalene b) benzene
 c) cyclohexane d) butane

B. Fill in the blanks

11. Many synthetic drugs used are.....in part.
12.forms source of many organic compounds.
13. Modern theory of aromaticity was introduced by.
14. Ortho and para directing groups are called as.... groups.
15. Meta directing groups are called as..... groups.
16. Alkyl substituted benzenes are prepared by.....
17. Naphtha obtained by fractional distillation of is passed over platinum.
18. Aromatic compounds readily undergo substitution reactions.
19. reacts vigorously with aromatic hydrocarbons even in the absence of catalyst.
20. In the presence of.....benzene reacts with hydrogen to give cyclohexane.

C. Explain briefly on the following

21. How is benzene is prepared commercially?
22. Explain the term aromaticity.
23. Write a note an activating groups in benzene.
24. Write briefly on resonance in benzene.
25. How would you convert the following?
 a) sodium benzoate to benzene
 b) phenol to benzene
 c) benzene to toluene

ORGANIC HALOGEN COMPOUNDS**A. Choose the correct answer**

1. IUPAC name of $\text{CH}_3 \cdot \underset{\text{Br}}{\text{CH}} - \underset{\text{Cl}}{\text{CH}_2} - \overset{\text{CH}_3}{\text{CH}} - \text{CH}_3$

- a. 2-Bromo-3-chloro-4-methylpentane
 b. 2-Methyl-3-chloro-4-bromopentane
 c. 2-Bromo-3-chloro-3-isopropyl propane
 d. 2,4-Dimethyl-4-Bromo-3-chloro butane.
2. For reacting with HCl, the alcohol which does not require ZnCl₂ is
 a. CH₃ CH₂ OH b. CH₃ - CH₂ CH₂ OH
 c. $\begin{array}{c} \text{CH}_3 - \text{CH} \text{OH} \\ | \\ \text{CH}_3 \end{array}$ d. C (CH₃)₃ C-OH.
3. For converting alcohols into alkyl halides, the best reagent is
 a. PCl₃ b. PCl₅
 c. SOCl₂ d. None of the above
4. The olefin, which is not important for Markovni Koff's addition of HCl, is
 a. Propene b. But-1-ene
 c. 2-Methyl-propene d. Ethylene
5. The SN₁ reaction of alkyl halides is not affected by the nature of the
 a. alkyl group b. the halogen
 c. medium d. nucleophile

B. Fill in the blanks

6. Markonikoff's rule is followed for the addition of HCl to.....
7. In Swarts reaction metallic fluorides are added to..
8. Hoffman's rule is applicable to elimination
9. Chloropicrin is prepared by adding nitric acid to..

C. Write in one or two sentence

10. What are Lewis acids?
11. What is an electrophilic addition?
12. What is Hunsdiecker reaction?
13. What is Finkelstein reaction?
14. What is Swarts reaction?

D. Explain briefly on the following

15. Discuss SN₁ mechanism
16. Discuss SN₂ mechanism
17. Discuss E₁ elimination
18. Discuss E₂ elimination
19. What are the uses of alkyl halides?
20. What are the general reactions of aryl halides.
21. What are aralkyl halides ? How are they prepared?
22. What are Grignard reagents? Discuss its synthetic uses.
23. Discuss the general methods of preparation of alkyl halides.

ONE OR TWO WORDS

1. What are the elements from sea water source?

Na, Mg, Cl_2 and Br_2

2. Name the ores which are concentrated by froth floatation process.

- o Zinc blende (ZnS)
- o Copper pyrites ($CuFeS_2$)

3. What is the charge of electron, proton, neutron

Subatomic particles	Charge
Electron	Negative
Proton	Positive
Neutron	Chargeless

4. What is atomic number?

Number of protons in an atom (Z)

No. of protons = No. of electrons

5. What is the maximum number of electrons that an orbital can have?

2 electrons [$2(2l+1)$]

6. What are the charge and mass of an electron?

Charge : 1.6022×10^{-19} coulomb

Mass : 9.10939×10^{-31} kg

7. Give the order of filling of electrons in the following orbitals 3p, 3d, 4p, 3d and 6s.

3p, 4s, 3d, 4p, 5s, 4d [Aufbau principle]

8. Write the complete symbol for Nucleus with

a) atomic number 56 mass number 138 ;



b) atomic number 26 and mass number 55 ;



c) atomic number 4 and mass number 9.



9. An atomic orbital has $n = 3$. What are the possible values of l ?

$l = 0, 1, 2$

10. An atomic orbital has $l = 3$. What are possible values of m ?

$m = -3, -2, -1, 0, +1, +2, +3$

11. Give the electronic configuration of chromium. ($Z=24$).

$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^1$

12. Which energy level does not have p-orbital?

First energy level ($n = 1$)

13. An atom of an element has 19 electrons. What is the total number of p-orbital?

${}_{19}K: 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$

14. How many protons and neutrons are in ${}_{8}O^{18}$?

No. of Protons = 8

No. of electrons = 8

No. of neutrons = $18 - 8 = 10$

15. What are the particles generally present in the nuclei of atoms?

Proton and neutron [Collectively nucleons]

16. Atomic mass of an element is 24 and its atomic number is 12. Show how atom of the element is constituted?

$$Z = 12$$

No. of protons = No. of electrons = 12

$$A = 24$$

No. of neutrons = $24 - 12 = 12$

i.e 12 protons, 12 neutrons, 12 electrons

17. Write the values of l and m for p -orbitals.

$$l = 1$$

$$m = -1, 0, +1$$

18. Which quantum accounts for the orientation of the electron orbital?

Magnetic quantum number (m)

19. What is shape of the orbital with

i) $n = 2$ and $l = 0$ Spherically symmetrical

ii) $n = 2$ and $l = 1$? Dumb-bell shaped

20. Give the values for all quantum numbers for 2p electrons in nitrogen ($Z = 7$).

$n = 2, l = 1, m = -1, 0, +1, S = \frac{1}{2}$ or $-\frac{1}{2}$

21. Give the electronic configuration of Mn^{2+} and Cu. Atomic number of Cu = 29 and Mn = 25.

$Mn^{2+} : 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^3$

Cu : $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}$,

22. Arrange F, Cl, Br and I in the order of increasing electronic gain enthalpy

$I < Br < F < Cl$

23. Write electronic configurations for the elements of atomic numbers 6 and 14. Find out group in periodic table each element belongs.

Z	Element	E. Configuration	Group
6	Carbon	$1s^2 2s^2 2p^2$	14
14	Silicon	$1s^2 2s^2 2p^2 3s^2 3p^2$	14

24. Which electronic configurations has the lowest ionization enthalpy?

a) $1s^2, 2s^2, 2p^5$ b) $1s^2, 2s^2, 2p^6$ c) $1s^2, 2s^2, 2p^6, 3s^2$

- $1s^2, 2s^2, 2p^6$
25. Which pairs of elements would have lower first ionization enthalpy?
a) Cl or F; b) Cl or S; c) K or Ar; d) Kr or Xe.
a) Cl or F
26. Which pairs have smaller ionization enthalpy?
(a) Ca or Be ; (b) Ca or K ; (c) Cl or I.
(c) Cl or I.
27. Name any two transition elements and any two inner transition elements.
○ Transition elements : Ag, Au.
○ Inner transition elements: La, Ac
28. Arrange order of increasing atomic volumes in
a) Li, Na and K b) C, N and O c) Ca, Sr, Ba.
a) Li, Na, K; b) O, N, C; c) Ca, Sr, Ba
29. To which block does the element with configuration $3d^1 4s^2$ belongs
d- block
30. Out of fluorine and chlorine, which has greater electron gain enthalpy?
Chlorine.
31. Give an example of monovalent and trivalent element in group III.
monovalent element : Thallium (Tl)⁺¹
trivalent element : Aluminium(Al)⁺³
32. What property did Mendeleev use to classify elements in his periodic table?
Increasing order of atomic weights of elements
33. Among Li, K, Ca, S and Kr which one has the lowest first ionization enthalpy? Which has the highest first ionization enthalpy?
lowest first ionization enthalpy = K
highest first ionization enthalpy = Kr
34. Why alkali metals have low melting and boiling points?
Due to weak bonding in crystal lattice
35. What governs packing of particles in crystals?
Intermolecular force of attraction between crystal molecules
36. Give values of R-gas constant in calories and Joules.
R = 8.314 Joule K⁻¹ mol⁻¹
R = 1.987 cal deg⁻¹ mol⁻¹
37. What are the units of Vanderwaals constants 'a' and 'b' ?
Unit of *a* = atm. dm⁶ mol⁻² [or] litre² atm. mol⁻²
Unit of *b* = dm³ mol⁻¹ (or) litre mol⁻¹
38. Arrange NaCl, MgCl₂ and AlCl₃ in the increasing order of covalent character.
 $AlCl_3 > MgCl_2 > NaCl$.
39. Among Na⁺, Ca⁺², Mg⁺², Al⁺³ which has high polarising power ?
 $Al^{3+} > Mg^{2+} > Na^+ > Ca$
Al⁺³ has high polarising power
40. What is the structure of BeCl₂ ?
Linear
41. Why the oxides of Group 2 metals have high melting points?
No. of bonding electrons are twice 1s elements
42. Why there is increase in ionisation potential for forming M³⁺ ion for group 2 metals?
Two 2 s electrons in outer most orbit
43. Why the ionization potential of M²⁺ is not very much greater than M⁺?
High lattice energy
44. Why do beryllium halides fume in air?
Due to hydrolysis
45. List carbonates and hydroxide of alkaline earth metals in order of their increasing stability and their solution.
 $BeCO_3 < MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$
 $Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$
46. Why group 2 elements are harder than alkali metals?
1. Smaller atomic size
2. Strong metallic bond
47. Why are monoxides of alkaline earth metals are very stable?
1. Strong force of attraction
2. High lattice energy
48. Name the equipment using which heat of combustion of compounds are determined?
Bomb calorimeter.
49. Give the relation between ΔU and ΔH .
 $\Delta H = \Delta U + P \Delta V$ or
 $\Delta H = \Delta U + \Delta n_g RT$ [For gaseous reaction]

VERY SHORT ANSWERS

1. What are methods of concentration of ores?

- Gravity separation process /hydraulic washing
- Froth flotation process
- Electromagnetic separation process
- Chemical method

2. What are major steps in metallurgical process

- Roasting- oxidation
- Oxidising Roasting
- Calcination
- Smelting – Reduction

3. What is anode mud?

- In electrolytic refining
- Insoluble impurities dissolve in electrolyte
- or fall at bottom & collect as anode mud

4. How many orbitals are there in the second orbit? How are they designated?

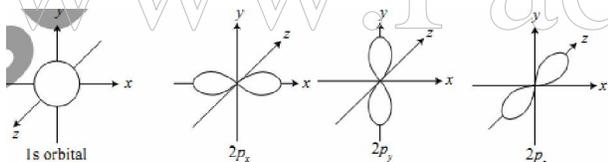
For 2nd orbit, Principal quantum number $n = 2$

Possible values of (l) = 0, 1.

No. of orbitals in 2nd orbit = 4

They are designated as :2s, 2p_x, 2p_y, 2p_z

5. Sketch the shape of s and p-orbital indicating the angular distribution of electrons.



6. What is an orbital?

- In strong magnetic field a sub-shell is resolved into different orientations in space.
- These orientations are called orbitals
- They have slight differences in energy

7. What is meant by principal quantum number?

- Electrons are arranged in electron shells or orbits
- Each shell is characterized by principal quantum number (n)
- 'n' values : 1,2,3,4. for K, L, M, and N shells

8. What is the principal defect of Bohr model?

No explanation for

1. spectrum of multi electron atoms
2. Zeeman effect
3. Stark effect

9. How many electrons have $s + \frac{1}{2}$ in a d-sub-shell?

1. There are 5 orbitals. Each with 2 electrons
2. Among these 10 electrons 5 can have $S = \frac{1}{2}$
Another 5 can have $S = -\frac{1}{2}$

10. State Modern Periodic Law.

Physical and chemical properties of the elements are periodic function of their atomic numbers

11. Why nitrogen has higher I.E. than oxygen?

Oxygen (1s² 2s² 2p⁴) loses an electron more easily to acquire stable half filled configuration

12. Name different blocks of elements in periodic table. Give general electronic configuration

s-block	ns^{1-2}
p-block	$ns^2 np^{1-6}$
d-block	$(n-1) d^{1-10} ns^{1-2}$
f-block	$(n-2) f^{1-14} (n-1) d^{0-10} ns^2$

13. Why are d-block elements called transition elements?

- d-block elements form a bridge between chemically active metals of s-block elements and less active metals of groups 13 and 14
- thus take the name "transition elements"

14. What do you mean by representative elements? Name the groups of the periodic table, which contain representative elements.

- p-Block Elements comprise groups 13 to 18
- together with s-block elements groups 1 and 2 are called Representative Elements

15. Name the different transition series.

- 3d series Scandium to Zinc IV period
 4d series Yttrium to Cadmium V period
 5d series Lanthanum to Mercury VI period
 6d series Actinium to incomplete VII period

16. Define ionic radius.

- Distance between the centers of nucleus and outermost shell of electrons in an atom or ion
- Among isoelectronic ions, the one with large positive nuclear charge will have small radius

17. Why Boron has tendency to form hydrides?

- Small size and high electronegativity.
- Difference in electronegativity between boron and hydrogen is less.

18. Boron does not form B⁺³ ion. Why?

1. Smaller atomic size
2. Highest ionisation potential

PHYSICAL CHEMISTRY

1. What is meant by 'unit cell'?

- Fundamental elementary pattern of crystalline solid
- Smallest structure of which the crystalline solid is built by its repetition in 3 dimensions

2. How many types of cubic unit cell exists?

- Three types of cubic unit cell exists.
 - i) Simple cubic
 - ii) Body-centred cubic and
 - iii) Face-centred cubic.

3. What are Miller Indices?

- Reciprocals of Weiss indices
- multiplying throughout by smallest number
- in order to make all reciprocals as integers
- obtain Miller indices of a plane.

4. What are the different types of bonds?

- ionic or electrovalent bond
- covalent bond
- coordinate - covalent bond

5. Write mathematical expression for Boyle's law.

For given mass of gas at constant temperature, pressure P is inversely proportional to volume V

$$P \propto \frac{1}{V} \quad (\text{at constant temperature})$$

$$PV = \text{constant.}$$

$$P_1V_1 = P_2V_2 = \text{const} \tan t \quad [\text{For Two gases}]$$

6. Give the correction factors for the volume and pressure deviation for a Vanderwaal's gas.

corrected volume of real gas is = (V-b)

$$\text{corrected pressure} = \left[P + \frac{a}{V^2} \right]$$

7. What are colligative properties?

- properties of dilute solutions
- which depend only on No. of solute particles
- not on their chemical nature.

8. Define relative lowering of vapour pressure.

- Ratio between lowering of vapour pressure ($p^\circ - p$) to vapour pressure of pure solvent (p°)

$$\text{relative lowering of vapour pressure} = \frac{p^\circ - p}{p^\circ}$$

9. What do you understand by molal elevation of boiling point?

- Elevation in boiling point produced by one molal solution of a non-volatile, non-electrolyte solute in a given solvent

10. What are abnormal solutes?

Those undergo dissociation or association in a given solvent.

11. What are isotonic solutions?

Two solutions of different substances having same osmotic pressure at same temperature

12. Energy can be created and be destroyed. State whether this is true or false.

- False.
- According to first law of thermodynamics, *energy neither be created nor destroyed.*

13. Define first law of thermodynamics.

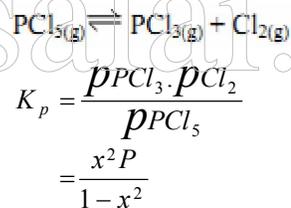
- Energy neither be created nor destroyed.
- A form of energy is converted into other form

14. Define law of mass action

Rate of a chemical reaction is proportional to active masses of reactants

$$\text{Rate} \propto \text{active mass}$$

15. Write the Kp expression for



16. Define half life period.

Time required to reduce concentration of reactant to half its initial value. ($T_{1/2}$)

17. What is molecularity?

Number of atoms or molecules taking part in an elementary step leading to a chemical reaction

18. List factors on which order of reaction depend.

- pressure,
- temperature
- concentration

19. Write rate law of $pA + qB \rightarrow lC + mD$ reaction.

$$\text{Rate} \propto [A]^p [B]^q$$

$$\text{Rate} = k[A]^p [B]^q$$

where k = rate constant

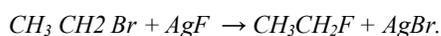
20. Define the rate of a reaction.

change in concentration of any reactant or product in the reaction per unit time

ORGANIC CHEMISTRY

- What are the stages during Crystallisation?
 - preparation of solution in suitable solvent
 - filtration of hot solution
 - crystallisation by cooling hot filtrate
 - isolation and drying of purified substance.
- Define steam distillation.
 - Separation and purification of organic compounds
 - Which are immiscible in water
 - Not decomposable at steam temperature
- What are different types of distillation?
 - Simple Distillation
 - Fractional Distillation
 - Steam Distillation
 - Distillation under reduced pressure
- Give advantages of distillation under reduced pressure.
 - Compounds decompose on boiling points can be purified
 - At a reduced pressure, liquid would boil at temperature below its normal boiling point.
 - Fuel-economical
 - Liquid boils at temperature well below normal boiling point.
- What are the types of paper chromatography?
 - column chromatography (CC)
 - thin-layer chromatography (TLC)
 - paper chromatography (PC)
 - gas-liquid chromatography (GLC)
 - ion-exchange chromatography
- What are Lewis acids?
 - Mixture of con. HCl and anhydrous ZnCl₂
 - They accept pair of electrons
 - e.g BF₃, AlCl₃
- What is an electrophilic addition?
 - Electrophile is added to C = C or C ≡ C of a polarised double or triple bond
 - This reaction is called electrophilic addition.
- What is Swarts reaction?

Alkyl fluorides are obtained by treating alkyl chloride or bromide with metallic fluoride, such as AgF or SbF₃.



SHORT ANSWERS

- What are the informations conveyed by a chemical equation ?
 - Reactants and products taking part in chemical reaction.
 - Conditions for a reaction such as temperature, pressure, catalyst etc.
 - Nature of products.
 - Amount of reactants required and amount of products formed in terms of grams, number of moles, number of atoms etc.

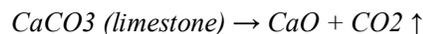
2. Distinguish: ore and mineral

Ore	Mineral
Mineral from which metal can be profitably extracted	Natural material in which metal and their compounds occur in earth
All ores are minerals.	All minerals are not ores.
Ex. Bauxite is an ore of aluminium.	Clay is a mineral of Al

3. Define Metallurgy.

Branch of chemistry which deals with,

- Extraction of metals from ores
 - Refining of crude metal
 - Producing alloys
 - Study of their constitution, structure, property
 - Relationship of physical and mechanical treatment of metals to alloys.
- What is calcinations? Give example.
 - Conversion of ore into metal oxide (oxidation) is called calcination.
 - It is the process in which ore is subjected to action of heat at high temperature in the absence of air below its melting point.



5. What is the principle in Bessemer process ?

- Cold air blowed through refractory lined vessel known as converter
- containing molten pig iron at 2 atmospheric pressure, oxidizing impurities
- simultaneously converting pig iron to steel.

6. What is meant by electrolytic refining? Give eg

- Gives high purity metals such as Cu, Ag, Pb, Au, Ni, Sn, Zn etc.
- Anode - Blocks of impure metal

Cathode - thin sheets of pure metal

Electrolyte - Metal salt solution

3. On passing electric current through solution

- Pure metal dissolves from anode; deposits on cathode
- Insoluble impurities dissolve in electrolyte or fall at bottom & collect as anode mud

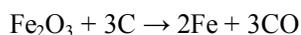
7. What do you understand by Roasting

- One of the oxidation method where ore is converted into metal oxide.
- Ore alone or with suitable material, subjected to heat in excess air below melting point.
- Carried out in a reverberatory furnace or in a blast furnace.
- During roasting
 - Volatile impurities get oxidized and escape out as volatile gases
 - Sulphide ore decompose to oxide evolving SO_2
$$2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$$

8. What do you understand by smelting

- Process of separation of metal or sulphide mixture from ore in fused state
- Ore is melted with flux with a reducing agent
- Involves, calcination, roasting and reduction.

Extraction of iron



9. Explain why the electronic configuration of Cr and Cu are written as $3d^5, 4s^1$ and $3d^{10} 4s^1$?

- Chromium and copper have 5 and 10 electrons in 3d orbitals rather than 4 and 9 electrons as expected.
- To acquire more stability, one of the 4s electron goes into 3d orbitals so that 3d orbitals get half-filled or completely filled in chromium and copper

10. Why Noble gases have zero electron gain enthalpy?

- Outer s-and p-orbitals are completely filled.
- No more electrons can be accommodated in these orbitals.
- They show no tendency to accept electrons.
- Their electron gain enthalpies are zero

11. Why do elements in the same group have generally similar properties?

- Elements in the same vertical column or group have similar electronic configurations,
- Have same number of electrons in the outer orbitals, and similar properties.
e.g Group 1 (the alkali metals) is an example.

12. Why does the first ionization enthalpy would have higher electron gain enthalpy?

- Amount of energy required to remove the loosely bound electron from the isolated gaseous atom is **First ionisation enthalpy**
- Higher ionisation enthalpy means nuclear charge is high and size of the atom is small.
- When nuclear charge is high, electron gain enthalpy will also be higher.

13. Which pairs of elements would have higher electron gain enthalpy? a) N or O (b) F or Cl.

- F or Cl will have greater electron gain
- F by gaining a electron attains stable inert gas configuration.
- Chlorine has greater electron affinity because of its bigger size and attracting electron.
- In N or O electron gain enthalpy is less because O has to gain $2e^-$ to acquire noble gas configuration.

14. Lanthanides and actinides are placed in separate rows at the bottom of periodic table. Explain the reason for this arrangement ?

- 4f- and 5f- transition series of elements are placed separately in the periodic table
- to maintain its structure and to preserve principle of classification by keeping elements with similar properties in a single column

15. What are inner- transition elements?

- Two rows of elements at the bottom of periodic table are *Lanthanoids* $_{58}\text{Ce}$ - $_{71}\text{Lu}$ and *Actinoids* $_{90}\text{Th}$ - $_{103}\text{Lr}$
- They are characterized by outer electronic configuration $(n-2) f^{1-14} (n-1) d^{0-10} ns^2$
- Last electron added to each element is an f-electron.
- Hence they are called inner transition elements

16. What are isotopes? Mention hydrogen isotopes.

Atoms of same element having same atomic number but different mass number are isotopes.

Isotopes for hydrogen

1. Protium or hydrogen,
2. Deuterium or heavy hydrogen,
3. Tritium.

17. Write a short note on tritium.

- It occurs in upper atmosphere
- where it is continuously formed by nuclear reactions induced by cosmic rays.
- It is radioactive with a half-life of ~12.3 years
- It's nucleus consists of 1 proton and 2 neutrons

18. How does deuterium react with metals?

It combines with nitrogen in presence of a catalyst to form heavy ammonia or deuterio ammonia.



19. How does deuterium react with metals?

Deuterium reacts with alkali metals at high temperatures (633 K) to form deuterides.

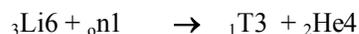


20. Mention the uses of deuterium

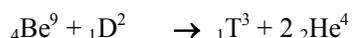
- *As tracers*
Mechanism of chemical reactions study
- *High speed deuterons*
used in artificial radioactivity.
- *Heavy water (D₂O)*
Employed as moderator in nuclear reactor to slow down fast moving neutrons.

21. How is tritium prepared?

i) By bombarding lithium with slow neutrons



ii) By bombarding beryllium with deuterons

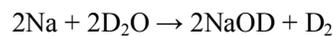


22. How do you convert para hydrogen to ortho hydrogen?

- By treatment with platinum or iron catalysts
- By passing an electric discharge.
- By heating to 800°C or more.
- By mixing with paramagnetic molecules like O₂, NO, NO₂
- By mixing with nascent hydrogen or atomic hydrogen.

23. How does heavy water react with metals?

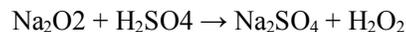
D₂O reacts slowly with alkali and alkaline earth metals liberating heavy hydrogen.



Sodium deuterioxide

24. How is hydrogen peroxide prepared in laboratory?

By action of dilute sulphuric acid on sodium peroxide calculated quantity of Na₂O₂ is added in small proportions to 20% ice cold solution of sulphuric acid.



30% solution of H₂O₂ is obtained by this process.

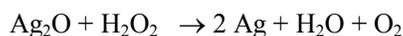
25. How is hydrogen peroxide solution concentrated?

- By careful evaporation of solution obtained above on water bath preferably under reduced pressure using fractionating column.
- By distillation under reduced pressure at temperatures below 330K, concentration up to 90% solution is used till crystallisation formed

26. Write about reducing property of hydrogen peroxide.

With powerful oxidizing agents, H₂O₂ acts as a reducing agent.

Moist silver oxide, acidified KMnO₄, ozone, chlorine and alkaline solutions of ferricyanides are reduced.



27. Mention two important uses of H₂O₂.

- It destroys bacteria
Hence used as an antiseptic and germicide for washing wounds teeth and ears.
- It destroys colour of some organic compounds
Hence used in bleaching delicate things like hair, wool, silk, ivory and feathers.
- It is used as an oxidizing agent.
- It is used as a propellant in rockets.

28. Why NH₃ has high boiling point than PH₃?

- In any group stability of hydride decreases from top to bottom
- Its strength as acid increases in this order.
- Order of stability of these hydrides is
- NH₃ > PH₃ > AsH₃ > SbH₃ > BiH₃

29. Why diamond is hard compared with graphite

Diamond	Graphite
carbon atoms are linked with 4 neighbouring carbon atoms held at the corners of regular tetrahedron by covalent bonds	carbon atoms are arranged in regular hexagons in flat parallel layers
every atom is bonded with other by covalent links forming giant molecule.	No strong bonding between different layers, So, easily separable from each other

30. NH₃ is soluble in water where as other hydrides of group 15 elements are insoluble in water. Why?

- Hydrides of non-metals are more stable.
- In any group stability of hydride decreases from top to bottom
- Its strength as an acid increases in this order.

31. Which is considered to be "Earth's protective umbrella"?

- Ozone in the upper atmosphere is important in shielding us from intense ultraviolet radiation coming from the sun.
- Ozone shield is a shell about 30 km altitude
- It contains enough ozone to absorb short wavelength UV radiation (less than 300 nm).
- Hence ozone is considered to be 'earth's protective umbrella'.

32. Mention any 3 uses of ozone.

- 1) It is used as *germicide and disinfectant*.
- 2) It is used for *bleaching* oils, ivory, flour, starch.
- 3) Used in the *manufacture of artificial silk* and synthetic camphor.

33. What are CFCs? Mention its environmental action.

- Chlorofluorocarbons react with O₃ and causes a hole in the ozone layer.
- Lifetime of CFCs are so long that extent of ozone depletion will be tremendous.
- Holes caused in the ozone layer over Antarctic and Arctic ocean are due to the use of CFCs in aerosols and refrigerators propellants

34. What are compound oxides? Give an example.

- Some oxides behave as if they are compounds of the two oxides.

Ex. Ferrous-ferric oxide (Fe₃O₄).

- This is considered to be the mixture of FeO and Fe₂O₃.
- They react with acids and forms a mixture of ferrous and ferric salts.

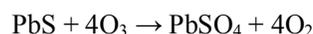
**35. Mention the metal ions present in haemoglobin and myoglobin and state its function.**

Haemoglobin is an iron containing coordination compound in red blood cells responsible for the transport of oxygen from the lungs to various parts of the body.

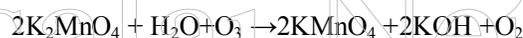
Myoglobin is a similar substance in muscle tissue, acting as a reservoir for the storage of oxygen and as a transport of oxygen within muscle cells.

36. What happens when ozone reacts with**a) lead sulphide b) potassium manganate**

a) Lead sulphide is oxidised to lead sulphate



b) K₂MnO₄ oxidised to potassium permanganate

**PHYSICAL CHEMISTRY****1. Mention the number of sodium and chloride ions in each unit cell of NaCl**

$$\begin{aligned} \text{No. of Na}^+ \text{ ions} &= 12 (\text{At edge centers}) \times \frac{1}{4} \\ &+ 1 (\text{At body center}) \times 1 \\ &= \frac{N_{ec}}{4} + \frac{N_b}{1} + \frac{N_f}{2} + \frac{N_c}{8} \\ &= 12 \times \frac{1}{4} + 1 \times 1 = 4 \end{aligned}$$

$$\begin{aligned} \text{No. of Cl}^- \text{ ions} &= 8 (\text{At corners}) \times \frac{1}{8} \\ &+ 6 (\text{At face centre}) \times \frac{1}{2} \\ &= 8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4 \end{aligned}$$

2. Mention the number of cesium and chloride ions in each unit cell of CsCl

$$\begin{aligned} \text{No. of Cl}^- \text{ ions} &= 8 (\text{At corners}) \times \frac{1}{8} \\ &= 8 \times \frac{1}{8} \\ &= 1 \end{aligned}$$

$$\begin{aligned} \text{No. of Cs}^+ \text{ ion} &= 1 (\text{At the body center}) \times 1 \\ &= 1 \times 1 = 1 \end{aligned}$$

3. A sample of an ideal gas escapes into an evacuated container, there is no change in the kinetic energy of the gas. Why?

- For an ideal gas forces of attraction between gaseous molecule are nil at all temperature and pressure.
- Hence there is no change in kinetic energy when they expand

4. What is the change in temperature when a compressed real gas is allowed to expand adiabatically through a porous plug.

When a compressed real gas is allowed to expand adiabatically through a porous plug into a region of low pressure,

- There is appreciable cooling.
- When gas is allowed to escape into a region of low pressure, molecules move apart rapidly against intermolecular attractive forces
- In this case, work is done by gas molecules at the expense of internal energy of the gas.
- This reduction in temperature is referred as *Joule-Thomson effect*.

5. Define Boyle's law and Charle's law.

- For a given mass of gas, at constant pressure, its volume (V) varies directly as its absolute temperature (T).

$$\frac{V \propto T}{\frac{V}{T} = \text{Constant}}$$

- For a given quantity of a gas, at constant volume pressure (P) varies directly as its absolute temperature (T)

$$\frac{P \propto T}{\frac{P}{T} = \text{Constant}}$$

6. What are measurable properties of gases?

- A gaseous state can be described in terms of four parameters
- They are known as measurable properties
 - volume V
 - Pressure P
 - Temperature T
 - Number of moles n

7. Define Graham's law of diffusion.

Under same conditions of temperature and pressure, the rates of diffusion of different gases are inversely proportional to the square roots of their molecular masses

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$$

8. Write significance of Vanderwaal's constants.

- *Cohesion pressure (or) internal pressure.* measure of attractive forces of molecules,

$$\frac{a}{V^2}$$

- *Inversion temperature of a gas* Expressed in terms of 'a' and 'b'

$$T_i = \frac{2a}{Rb}$$

- *Calculation of critical constants of a gas.* Enabled by Vanderwaal's constants 'a' and 'b'

9. Write limitations of vanderwaal equation

- It could not explain *quantitative deviation* and *qualitative aspects* of P and V deviations.
- 'a' and 'b' vary with P and T, such variations are not considered in the derivation of Vanderwaal's equation.
- Critical constants calculated from *Vander waal's equation* deviate from original values determined by other *experiments*.

10. Define Joule-Thomson effect.

Phenomenon of producing lowering of temperature when a gas is made to expand adiabatically from a region of high pressure into a region of low pressure

11. What is meant by inversion temperature ?

Characteristic temperature below which a gas expands adiabatically into a region of low pressure through a porous plug with a fall in temperature is called as inversion temperature (Ti)

$$T_i = \frac{2a}{Rb}$$

12. Give reason : CCl₄ is insoluble in H₂O while NaCl is soluble.

- CCl₄ is a non polar Covalent molecules
- Soluble in nonpolar solvents (benzene, ether)
- insoluble in polar solvents like water.

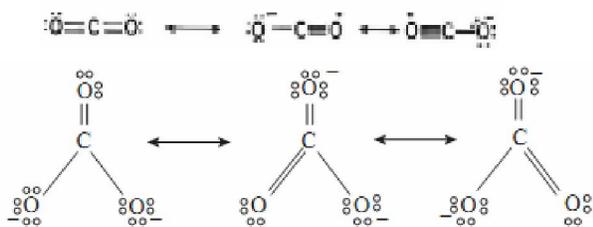
13. Find σ and π bonds in the following

may combine or mix completely to form equal number of equivalent energy new orbitals with properties of their own.

This is called as hybridisation of orbitals.

21. Define resonance. Give the various resonance structures of CO₂ and CO₃²⁻ ion.

- Whenever single Lewis structure cannot describe a molecular structure accurately,
- a number of structures with similar energy, positions of nuclei, bonding and non bonding pairs of electrons are considered to represent the structure.
- Such structure is called as canonical structure
- The phenomenon is resonance



22. Addition of non-volatile solute always increases the boiling point of the solution. Why?

- Vapour pressure of solution decreases
- Tendency of solvent to vapor decreases
- Vapour pressure of solution is higher than solvent
- So boiling point of the solution increases

23. Volatile hydrocarbons are not used in brakes of automobile as lubricant, but non-volatile hydrocarbon are used as lubricants. Why?

- Volatile hydrocarbons are vaporised due to heat evolved from break system
- Their lubrication property reduced
- Break system fails
- Non-volatile hydrocarbon are used

24. Prove that the depression in freezing point is a colligative property.

$$\text{Freezing point of solvent} = T^0$$

$$\text{Freezing point of solution} = T$$

$$\Delta T_f = T^0 - T$$

$$\text{F.P depression} \propto \text{molality (m)}$$

$$\Delta T_f \propto m$$

- Freezing point depression is directly proportional to No. of moles of solute dissolved in a given amount of the solvent.

- ΔT_f is independent of nature of solute as long as it is non-volatile.

- Hence F.P depression is a colligative property

25. Explain: osmosis and osmotic pressure.

spontaneous movement of the solvent particles to the solution side when the solvent and the solution are separated by a semipermeable membrane.

pressure that just stops flow of solvent is called osmotic pressure

26. What are the advantages of Berkley-Hartley method?

- The osmotic pressure is recorded directly and the method is quick.
- No change in concentration of solution during the measurement of osmotic pressure.
- Osmotic pressure is balanced by external pressure and there is minimum strain on the semipermeable membrane.

27. Explain how degree of dissociation of electrolyte may be determined from measurement of a colligative property.

Electrolytes show increase in number of particles present in solution.

This effect results in increase in colligative properties obtained experimentally.

$$\text{Vant Hoff factor} = \frac{\text{experimental colligative property}}{\text{normal colligative property}}$$

$$i > 1 \text{ for dissociation}$$

$$\alpha_{\text{dissociation}} = \frac{i - 1}{n - 1}$$

n = No. of particles furnished by one molecule of solute

28. Define zeroth law of thermodynamics.

- If two systems at different temperatures are separately in thermal equilibrium with 3rd one
- They tend to be in thermal equilibrium with themselves.

29. Define : Adiabatic process.

Adiabatic process is one which does not exchange heat with its surroundings during the change from initial to final states of the system.

30. What are Intensive and extensive properties?.

- Properties that are independent of mass or size of system are called **Intensive properties**

eg. refractive index, surface tension, density, temperature, boiling & freezing point

- Properties that depend on the mass or size of the system are called **Extensive properties**
eg., Volume, No. of moles, mass, energy, internal energy etc.

31. Differentiate: Exothermic-endothermic process

Endothermic process	Exothermic process
Process transformed from initial to final states by absorption of heat	Process transformed from initial to final states by evolution of heat
Final state of system possesses higher energy than initial state.	Final state of system possesses lower energy than the initial state.
Excess energy needed is absorbed as heat by system from surrounding	Excess energy is evolved as heat.
Heat is supplied to bring about initial to final state.	Heat is removed to bring about initial to final state.
Melting of a solid by supplying heat	Freezing of a liquid at its freezing point

32. What is thermal equilibrium processes.

- Thermoequilibrium sets condition that there should be no flow of heat from one portion
- or part of the system to another portion
- or part of the same system.
- ie. temperature of the system remaining constant at every point of the system.

33. What is mechanical equilibrium processes.

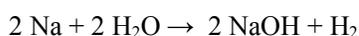
- Mechanical equilibrium implies that there is no work done by one portion
- or part of the system over another portion
- or part of the same system.
- ie. Pressure of system is constant at all points.

34. Relate K_p and K_c when

$\Delta n = 0$	$K_p = K_c (RT)^0$	$K_p = K_c$
$\Delta n = 1$	$K_p = K_c (RT)^1$	$K_p = K_c RT$
$\Delta n = 2$	$K_p = K_c (RT)^2$	$K_p = K_c (RT)^2$

35. Give an example of irreversible reaction

Reactions when go to completion and never proceed in the reverse direction are called as irreversible reactions.



36. Why are equilibrium concentrations remain constant

- Forward reaction rate equals with backward reaction rate
- when products are formed, they react back to form reactants in equal capacity

37. Name factors that affect the rate of reaction.

- Nature of the reactants and products
- Concentration of the reacting species
- Temperature of the system
- Presence of catalyst
- Surface area of reactants
- Exposure to radiation

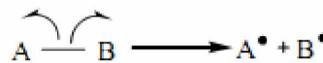
38. What is a rate determining step?

In a multistep reaction the step which has the lowest rate value among the other steps of the reaction is called as the rate determining step

ORGANIC CHEMISTRY

1. Homolytic fission

- A covalent bond between two atoms A and B may be shown as $A \cdot B$ or $A-B$.
- This bond may undergo fission in such a way that each atom retains electrons of shared pair.
- Such species are known as *free radicals* or odd electron molecules.

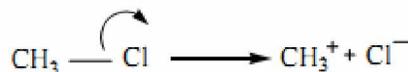
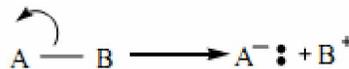


Ethane

Methyl free radicals

2. Heterolytic fission.

- A covalent bond breaks such that shared pair of electron stay on any one of the atoms.
- Breaking of the bond in this manner is known as heterolytic fission or heterolysis.



3. Substitution reaction.

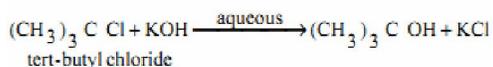
- An atom or group linked to a carbon atom is removed
- in its place another atom or group is attached.

Types.

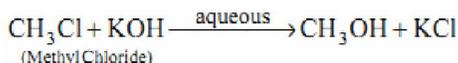
a) Nucleophilic substitution reaction (SN)

- S - substitution N - nucleophile.
- Substitution is brought about by a nucleophile
- Classes :

SN¹ (substitution, nucleophilic, unimolecular)



SN² (Substitution, nucleophilic, bimolecular)

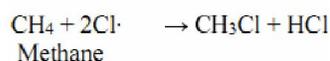
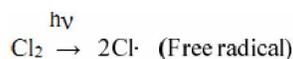


b) Electrophilic substitution reaction (SE)

- S - substitution E - electrophile.
- Involves attack by an electrophile

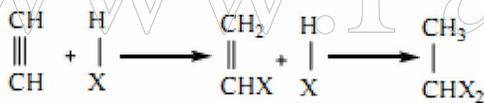
c) Free radicals substitution reaction

Initiated by free radicals.

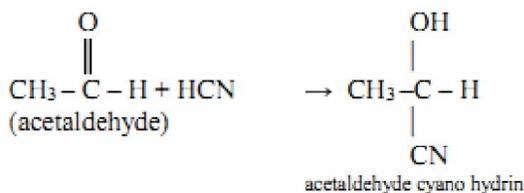


4. Addition reaction.

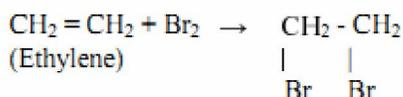
- All organic compounds having double or triple bond adopt addition reactions
- in which two substances unite to form a single compound.



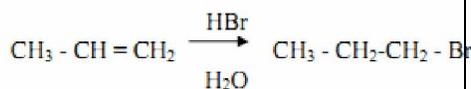
(a) Nucleophilic addition



(b) Electrophilic addition



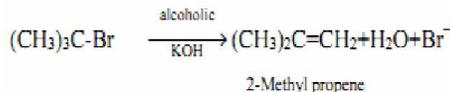
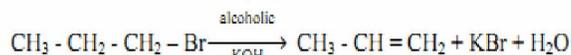
(c) Free radical addition



5. Elimination reaction.

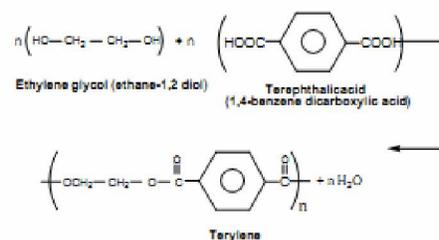
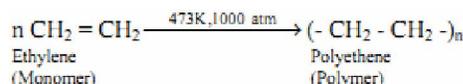
- In these reactions, two atoms or groups are removed from a molecule without being substituted by other atoms (or) groups.

- The reverse of addition reactions are eliminations. These reactions are classified into two types.

(a) Unimolecular elimination (E₁)(b) Bimolecular elimination (E₂)

6. Polymerisation reaction.

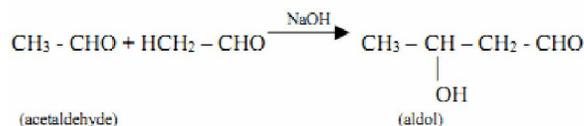
- Union of two or more molecules to form a large single molecule is called polymerisation
- Product is a polymer.



7. Condensation reaction.

- Two molecules combine to form a single molecule with or without elimination of simple molecules like H₂O, NH₃, HCl, CO₂,
- it is called a condensation reaction.

Aldol condensation reaction

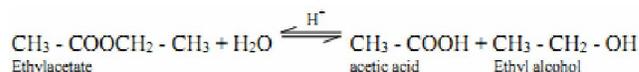


8. Hydrolysis.

Esters are hydrolysed by boiling with mineral acids or alkalis.

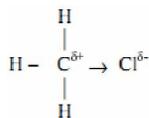
a) Acid hydrolysis

An ester can be hydrolysed to give parent carboxylic acid and alcohol by using mineral acid (H₂SO₄ or HCl) as catalyst.



b) Basic hydrolysis

When an ester is treated with an alkali (NaOH or KOH) as catalyst, the hydrolysis yields parent alcohol and sodium salt of the carboxylic acid.



- In Methyl chloride molecule, chlorine atom is more electronegative than carbon atom.
- Due to this, chlorine pulls electron pair and acquires a small negative charge.

16. Resonance effect.

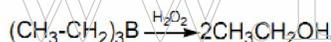
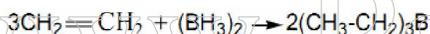
- Several structures may be assumed to contribute to true structure of a molecule
- But none of them can be said to represent it uniquely
- This molecule is called a resonance hybrid
- The phenomenon is termed as resonance.
- Structure of CO₂ molecule.



(I)

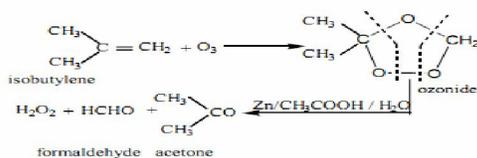
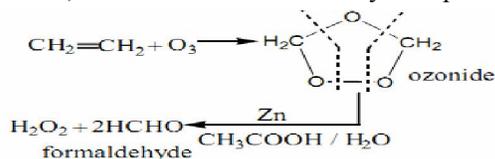
17. What is hydroboration?

- Alkenes readily react with diborane to form trialkyl boranes
- which on oxidation with alkaline hydrogen peroxide yield primary alcohols.



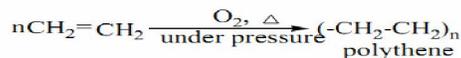
18. What is ozonolysis?

- When ozone is added to an alkene first an ozonide intermediate is formed.
- When ozonide is further treated with a reducing agent such as zinc metal in acetic acid, it is converted into carbonyl compounds.



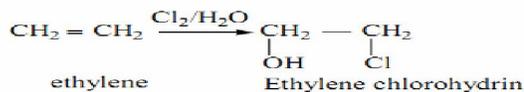
19. What is polymerisation?

- Conversion of a large number of monomers into a single polymer is *polymerisation*.
- When ethylene is heated under pressure in presence of oxygen, a compound of high molar mass known as polyethylene or polythene is formed.



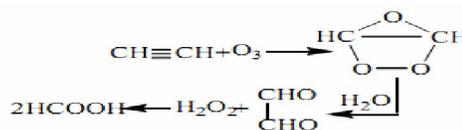
20. How is ethylene hydrated?

- Water can be added to simple alkenes to yield alcohols.
- Hydration reaction takes place on treatment of the alkene with water in presence of a strong acid-catalyst.



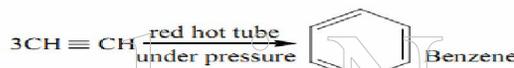
21. What is the action of ozone on acetylene.

- Acetylene react with ozone to give ozonides.
- Ozonides get decomposed with water to yield glyoxal and further oxidised to formic acid.



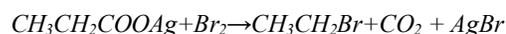
22. What happens when acetylene is passed through red-hot tube?

When acetylene is passed through red-hot tube under pressure it polymerises to benzene.



23. What is Hunsdiecker reaction?

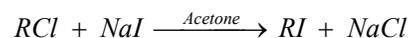
- Silver carboxylates in carbon tetrachloride are decomposed by chlorine or bromine to form alkyl halide.



- Bromine is better than chlorine as later gives poor yield.

24. What is Finkelstein reaction?

- Alkyl iodides are prepared by treating corresponding chloride or bromide with a solution of sodium iodide in acetone.
- Exchange of halogen between alkyl halide and sodium iodide occurs.



25. What are the uses of alkyl halides?

1. Trichloromethane (chloroform)
 - Anaesthetic & industrial solvent
2. Tetra chloromethane (carbon tetrachloride)
 - Industrial solvents.
3. Iodoform
 - antiseptic
4. Carbon tetrachloride
 - fire extinguisher
5. dichloro difluoro methane (freon)
 - refrigerant