Std : XI

CHEMISTRY

SPECIMEN QUESTION BANK

Chapter Number : 1 to 17

Type of questions :

1) MCQ
2) VSA (1 Marks)
3) SA I (2 Marks)
4) SA II (3 Marks)
5) LA (5 Marks)

Sub. : CHEMISTRY

Topics : 1 to 17

SPECIMEN QUESTION BANK

Topic 1 : Some basic concepts of chemistry
Multiple Choice Questions (MCQs)
Subject : Chemistry

Q. 1) A substance that can not be decomposed by a simple chemical process into two or more different substances, is called as an/a.....

a) atom b) element c) compound d) molecule

Q. 2) The drug AZT (azidothymidine) was first isolated from plant which treated for patients of .....

a) AIDS b) T.B. c) CANCER d) DIABETES

Q. 3) The smallest unit of a compound is called as an/a .....

a) molecule b) atom c) element d) ion

Q. 4) The number of molecules = Number of moles x .....

a) 22.414 b) 6.022×10^{23} c) 6.022×10^{22} d) 6.022×10^{21}

Q. 5) Atomicity of copper phosphate molecule is .....

a) 4 b) 8 c) 12 d) 13

Q. 6) At S.T.P. 8 g of helium gas (molar mass = 4) occupies a volume of .....

a) 22.4 dm^3 b) 44.8 dm^3 c) 11.2 dm^3 d) 5.6 dm^3

- **Questions of One Mark :**

Q. 1) Write a chemical reaction of photosynthesis ?

Q. 2) What is a homogeneous mixture ?

Q. 3) Write the SI unit of 'the amount of substance'.

Q. 4) Calculate the molar mass of water ?
(Given : H = 1, O = 16).

Q. 5) Write the statement of, 'the law of conservation of mass'.

Q. 6) Find the atomicity of ammonium phosphate molecule.

Q. 7) Define, the empirical formula of a compound.

Q. 8) State Avogadro's law.

Q. 9) Find n (number of moles) in 16g of methane. (C = 12, H = 1).

Q. 10) Define, Stoichiometry.

Q. 11) Write the correct chemical formula for Aluminium sulphate.

- **Questions of Two Marks :**

Q. 1) Define : (i) An element

(ii) A compound

Q. 2) What are units ? Write SI unit symbols for length and mass.

Q. 3) State and illustrate Gay Lussac's law of combining volumes of gases with a suitable example.

Q. 4) Define : (i) Empirical formula

(ii) Molecular formula

Q. 5) Write empirical and molecular formulae of (i) Glucose and (ii) Acetylene.

Q. 6) Chlorine has two stable isotopes Cl-35 and Cl - 37 with atomic masses 34.96 u and 36.95 u respectively. If the average mass of chlorine is 35.453 u, calculate the percentage abundances ?

Q. 7) Calculate the number of moles (n) and molecules present in 3.2×10^{-2} mg of methane. (C=12, H = 1)

Q. 8) Write the balanced chemical equation for the reaction between iron and chlorine.

Q. 9) Calculate the number of moles of ethylene required to produce 44 g of carbon dioxide gas on its complete combustion. (C = 12, H = 1, O = 16).

- **Questions of Three Marks :**

Q. 1) Write the scope of Chemistry in the fields of (i) Food (ii) Drugs (iii) Engineering.

Q. 2) What are derived units ? Write the unit symbols of area, volume, density and velocity.

Q. 3) Volumes are additive property . State whether the statement is true or false and illustrate with the help of Gay Lussac's law of combining volumes of gases.

Q. 4) With the help of Avogadro's law, show that the volume of one mole of any gas at STP is always 22.414 dm^3.

Q. 5) Calculate the number of moles, molecules and total number of atoms present in 1.1×10^{-3} kg of CO_2.

Q. 6) On analysis an organic compound shows that, it contains 40.92% carbon by mass, 4.58% hydrogen by mass. Determine the empirical formula of that compound.

Q. 7) Write the correct chemical formulae of the following compounds -

(i) Sodium Sulphate (ii) Ferric Chloride (iii) Aluminium Phosphate

(iv) Urea (v) Cuprous Chloride (vi) Ammonium Phosphate

- **Questions of Five Marks :**

Q. 1) Explain elements, atoms and molecules. Calculate the number of moles and no. of molecules present in 32 x 10^{-3} mg of methane.

(C = 12, H = 1).

Q. 2) What is Avogadro's number ? How it is related with the number of molecules? A compound with molar mass 159 was found containing 39.62% copper and 20.13% sulphur. Suggest the molecular formula of the compound.

(Cu = 63, S = 32 and O = 16).

Q. 3) Define stoichiometry.

Write the stoichiometric co-efficients in the following chemical reaction.

$2\,N_{2(g)} + 3\,H_{2(g)} \longrightarrow 2\,NH_{3(g)}$.

Express the interaction between aqueous copper sulphate solution and metallic zinc powder with a balanced chemical reaction.

■■■

Topic 2 : States of matter
Multiple Choice Questions (1 Mark each)

Q. 1) The movement of air is responsible for the movement of clouds, which bring rain in the .....

a) rainy season b) monsoon c) summer d) winter

Q. 2) The temperature and ....., decide the physical state of the substance.

a) volume b) pressure c) area d) density

Q. 3) Out of 118 elements discovered so far, only eleven elements exists in ..... state.

a) Solid b) liquid

c) gaseous d) both solid and liquid.

Q. 4) In case of an ideal gas, the actual volume per mole at STP must be equal to .....

a) 22.414 L b) 22.414 cm^3 c) 22.414 ml d) 22414 dm^3

Q. 5) The highest temperature at which the gaseous state starts condensation into liquid state, is called as ..... temperature.

a) absolute b) critical c) standard d) normal

Q. 6) The vapour pressure of the liquid depends on the nature of liquid and the .....

a) temperature b) volume c) pressure d) time

Q. 7) The Viscosity of liquids decreases with increase in .....

a) pressure b) volume c) Vapour Pressure d) temperature

- **Questions of One Mark :**

Q. 1) What is hydrogen bonding ?

Q. 2) Give two examples of polar molecules.

Q. 3) 27^0 C is equal to how many Kelvin ?

Q. 4) State the Boyle's law.

Q. 5) Which is an ideal gas equation ?

Q. 6) Give the relation between number of moles, number of molecules and Avogadro's

number.

Q. 7) State the Charles' law of gas.

Q. 8) Write the relation between ^{0} F and ^{0} C.

- **Questions of Two Marks :**

Q. 1) Explain dipole-dipole intermolecular interaction.

Q. 2) What is hydrogen bonding ? show hydrogen bonding in water molecules.

Q. 3) Mention four measurable properties of gases.

Q. 4) State and explain Boyle's law with Mathematical expression.

Q. 5) Explain Gay Lussac's law by variation of pressure and / with temperature graph.

Q. 6) Write four postulates of kinetic theory of an ideal gas.

Q. 7) At 300 K, a certain mass of a gas occupies 1 x 10^{-3} dm^3 volume. Calculate its volume at 450 K at the same pressure.

Q. 8) A balloon is inflated with He gas at 27^0 C and 1 bar pressure when its initial volume is 2.27 dm^3 and allowed to rise in the air. As it rises in the air, external pressure decreases and volume increases till finally it bursts. When external pressure is 0.3 bar, what is the limit to which volume of the balloon can be inflated ?

- **Questions of Three Marks :**

Q. 1) State , (i) Boyle's gas law and

(ii) Charles' gas law.

Define, Vapour pressure.

Q. 2) State Gay Lussac's law.

Define : (i) Surface tension

(ii) Viscosity.

Q. 3) The boiling point of methane is much lower as compared to that of ammonia, water and hydrogen fluoride Explain.

Q. 4) Explain, with graph, variation of pressure and volume against pressure for three temperatures.

Q. 5) A small bubble rise from a bottom of the sea where the temperature is 15^0 C and pressure of 8.2 atm and reaches the surface of sea where the temperature is 30^0 C

and pressure of 2atm. Calculate the final volume if the initial volume is 2.4 cm^3.

- **Questions of Five Marks :**

Q. 1) Explain hydrogen bonding in : (i) HF and (ii) NH_3 molecules.

Give four properties of gases.

Q. 2) Deduce combined gas equation.

Deduce value of gas constant (R) in two different units.

Q. 3) State and explain mathematically the Boyle's law. Define surface tension.

Explain hydrogen bonding present in HF - H_2O with the help of neat diagram.

Q. 4) Give four properties of liquid state. Define viscosity.

A tungusten filament electricity bulb is filled with argon gas at 1.3 atm pressure at 291 K. A thin glass light bulb can sustain the pressure of argon gas up to 1.6 atm. Calculate the maximum temperature up to which light bulb can sustain heat.

Q. 5) Explain, Surface tension.

Define, Viscosity.

Explain the Winde process for liquification of gases.

■■■

Topic 3 : Structure of atom

Multiple Choice Questions (1 Mark each)

Q. 1) The mass of electron is equal to .....

a) 9.1094×10^{-31} kg b) 9.1094×10^{-31} g

c) 91.094×10^{-31} kg d) 91.094×10^{-31} g

Q. 2) Who discovered the proton ?

a) Chadwick b) Thomson c) Goldstein d) Bohr

Q. 3) The Value of R, the Rydberg Constant was reported to be .....

a) 6.6256×10^{-27} erg b) 0.579 erg S g^{-1}

c) 109677.58 cm^{-1} d) 6.626×10^{-34} J

Q. 4) For n = 3, the radius of Bohr's orbit is obtained as .....

a) 13.225 A^0 b) 2.116 A^0 c) 4.761 A^0 d) 8.464 A^0

Q. 5) According to Heisenberg uncertainty principle .....

a) $E = MC^2$ b) $\Delta x . \Delta p \geqslant \frac{h}{2\pi}$ c) $\lambda = \frac{h}{p}$ d) $\Delta x . \Delta p \geqslant \frac{h}{6\pi}$

Q. 6) Which of the following does not represent the mathematical expression for the Heisenberg uncertainty principle .....

a) $\Delta x . \Delta p \geqslant \frac{h}{4\pi}$ b) $\Delta x . \Delta p \geqslant \frac{h}{4\pi m}$ c) $\Delta E . \Delta t \geqslant \frac{h}{4\pi}$ d) $\Delta E . \Delta x \geqslant \frac{h}{4\pi}$

Q. 7) Calculate the wavelength (in nanometer) associoded with a proton moving at 1.0×10^3 ms^{-1} (mass of proton = 1.67×10^{-27} kg and h = 6.63×10^{-34} Js) .....

a) 0.032 nm b) 0.40 nm c) 2.5 nm d) 14.0 nm

Q. 8) Which is the correct relationship between wavelength and momentum of particles .....

a) $\lambda = \frac{h}{p}$ b) $\pi = \frac{h}{p}$ c) $p = \frac{h}{\lambda m}$ d) $h = \frac{p}{\lambda}$

Q. 9) Maximum number of electron in 'N' shell is .....

a) 18 b) 32 c) 2 d) 8

Q. 10) The maximum number of electrons in a given sub shell is given by .....

a) $2(2l + 1)$ b) $2l + 1$ c) $2(2l - 1)$ d) (n-1)

Q. 11) The spectrum of Helium is expected to be similar to .....

a) H b) Li^+ c) Na d) He^+

Q. 12) The electronic configuration of chromium atom in ground state is .....

a) $[Ar]\ 3d^5\ 4S^1$ b) $[Ar]\ 3d^4\ 4S^2$ c) $[Ar]\ 3d^6\ 4S^0$ d) $[Ar]\ 4d^5\ 4S^1$

Q. 13) The energy of an electron in the first Bohr orbit of H atom is -13.6 eV. The possible energy value (s) of the excited state for electrons in Bohr orbits to hydrogen is .....

a) -3.4 eV b) -4.2 eV c) - 6.8 eV d) + 6.8 eV

Q. 14) The value of Planck's constant is 6.63×10^{-34} Js. The velocity of light is 3.0×10^8 ms^{-1}. Which value is closest to the wavelength in nanometres of a quantum of light with frequency of 8×10^{15} S^{-1}

a) 3×10^7 b) 2×10^{-25} c) 5×10^{-18} d) 4×10^1

Q. 15) Which of the following atoms and ions are iso electronic having the same number of electrons as that of neon atom .....

a) F^- b) oxygen atom c) Mg d) N^-

Q. 16) What is the ratio of mass of electron to the mass of proton .....

a) 1 : 2 b) 1 : 1 c) 1 : 1837 d) 1 : 3

Q. 17) The ratio of charge and mass would be greater for .....

a) Proton b) Electron c) Neutron d) Alpha Particle

Q. 18) Which of the following oxides of nitrogen is isoelectronic with CO_2 ?

a) NO_2 b) N_2O c) NO d) N_2O_2

Q. 19) The ratio between neutron in C and Si with respect to atomic masses 12 and 28 is .....

a) 2 : 3 b) 3 : 2 c) 3 : 7 d) 3

Q. 20) The frequency of one of the lines in Paschen series of hydrogen atom is 2.340×10^{14} Hz. The quantum number n_2 which produces this transition is .....

a) 6 b) 5 c) 4 d) 3

- **Questions of One Mark :**

Q. 1) Define the term. (One mark each)

1) Mass Number 2) Isotopes 3) Isobars

4) Wave length 5) Orbit 6) Orbital

Q. 2) State the following.

1) Heisenberg uncertanity principle.

2) Hund's rule of maximum multiplicity.

3) Pauli's exclusion principal.

- **Questions of Two Marks :**

Q. 1) Write a note on (Two marks each)

1) Spin quantum number

2) Azimuthal quantum number

3) Magnetic quantum number

4) Principal quantum number

Q. 2) Distingnish between Orbit and Orbital.

Q. 3) Distingnish between principal quantum number and Azimuthal quantum number.

Q. 4) Draw the shapes of 's' and 'p' orbital.

Q. 5) State Aufbau principle with suitable example.

Q. 6) Explain the shapes of d - orbitals.

Q. 7) What are quantum numbers ? Give their physical significance.

Q. 8) Write electronic configuration of following elements.

1) $_{(6)}C$ 2) $_{(11)}Na$ 3) $_{(15)}P$ 4) $_{(22)}Ti$

Q. 9) If n = 2 What are the values of quantum number 'l' and 'm' ?

Q. 10) What are Limitations of Bohr's atomic model ?

Q. 11) Explain de-Broglie's equation (relationship).

Q. 12) Give scientific reason, Why 4S orbital is filled before 3d orbital.

- **Questions of Three Marks :**

Q. 1) How are electrons discovered ? Write two properties of cathode rays.

Q. 2) How are protons discovered ? Write two properties of positive rays.

Q. 3) Describe Rutherford's α-particle scattering experiment in terms of abservations and conclusion.

Q. 4) Explain the term shell and sub-shell.

Q. 5) Write Aufbau energy sequence rule for filling electrons in orbital. With suitable examples.

Q. 6) Explain Bohr's atomic model.

- **Questions of Five Marks :**

Q. 1) Define Mass number.

Write four postulates of Bohr's atomic model.

Write electronic configuration of the following elements in the box diagram.

a) C b) O

Q. 2) Define wave number.

State Hund's rule of maximum multiplicity with suitable example.

Draw the shape of 's' & 'p' Orbitals.

■■■

Topic 4 : Periodic table

Multiple Choice Questions (1 Mark each)

Q. 1) According to Unitary theory, ^{40}Ca is made up of

a) 40 units of carbon
b) 40 units of hydrogen
c) 40 units of nitrogen
d) 40 units of oxygen

Q. 2) Which of the following elements has completaly filled two shells ?

a) Ne b) Ar c) Na d) Cl

Q. 3) The atomic number of an element having symbol Uuq is

a) 115 b) 116 c) 114 d) 118

Q. 4) Which one of the following statements is NOT correct regarding the general trends while moving from left to right across the periods, from group 13 to 17 ?

a) The atomic size decreases
b) The atoms lose their valence electrons more easily
c) The elements become less metallic in nature
d) The number of valence electrons increases

Q. 5) Acording to IUPAC recommondations the elements of group 1, 2 and 13 to 17 are called as

a) normal elements
b) inert gas elements
c) transition elements
d) inner transition elements

Q. 6) The law of octaves was given by scientist.

a) Dobereiner
b) Cooke
c) Mendeleev
d)John Newlands

Q. 7) In modern periodic table, the elements are arranged on the basis of their

a) increasing atomic mass
b) increasing atomic number
c) chemical symbols alphabetically
d) physical and chemical properties

Q. 8) O^{2-}, F^{-}, Na^{+} and Mg^{++} have same number of electrons but their ionic radii are different due to

a) different nuclear charge b) same density

c) same electron gain enthalpy d) same ionization enthalpy

Q. 9) The electronegativity value of carbon on Pauling scale is

a) 3.0 b) 2.5 c) 4.0 d) 3.5

Q. 10) In phosphine, valence of phosphorous with respect to hydrogen is

a) 4 b) 3 c) 5 d) 1

Q. 11) In beryllium chloride, valence of beryllium with respect to chlorine is

a) 1 b) 2 c) 3 d) 4

Q. 12) The no. of periods and groups in the long form of periodic table are

a) 7, 18 b) 18, 7 c) 7, 17 d) 17, 7

Q. 13) Which one of the following is the correct order of filling of orbitals according to Aufbau Principle ?

a) 5d, 6s, 4f b) 3p, 4s, 3d c) 4p, 3s, 3d d) 7s, 6p, 5d

Q. 14) In Periodic table, the element without a family is

a) carbon b) helium c) nitrogen d) hydrogen

Q. 15) Rare earth element is

a) Gd b) Ge c) Ga d) W

Q. 16) Total no. of elements present in lanthanide series are

a) 14 b) 10 c) 2 d) 6

- **Questions of One Mark :**

Q. 1) Write the electronic configuration of Cu^{+} (Z = 29). ion

Q. 2) Ionisation enthalpies of noble gases are higher than group 17 elements. Give reason.

Q. 3) Give reason : Ionisation enthalpies of alkali metals are very low.

Q. 4) Define electron gain enthalpy.

Q. 5) First ionisation enthalpy of sulphur is less than that of phosphorus why ?

Q. 6) Why chlorine has most negative electron gain enthalpy than fluorine ?

Q. 7) Write the general electronic configuration of f-block elements.

Q. 8) Give rerason : Why noble gases have large positive electron gain enthalpies ?

Q. 9) Define electronegativity.

Q. 10) Define periodicity.

Q. 11) Why is the ionic radius of Li^{1+} greater than that of Be^{2+} ?

Q. 12) Observe the table given below and write the name of middle element having atomic number 11.

Element	Atomic Weight
Li	3
--------	11
K	19

Q. 13) Why inert gases have zero valencies ?

Q. 14) By considering their positions in modern periodic table. Which one of the following elements is expected to have maximum metallic character ?

Cu, Si, C, N, Cl

Q. 15) Arrange the following elements in order of incresing order of electronegativity.

S, P, Si, Na, Cl

Q. 16) Write the atomic number of the element present in the 3rd period and 17 group of the periodic table.

Q. 17) Which is the first element in modern periodic table in which 4s orbital is filled before 3d orbital.

Q. 18) Define Metallic radius.

Q. 19) Arrange the following orbitals in their increasing energy levels.

7s, 5p, 4 p, 3d, 4d, 2p, 4s, 3p

Q. 20) Arrange the following elements in order as mentioned : compounds having central metal atom's valency in the increasing order

$AlCl_3$, MgH_2 , LiCl

Q. 21) The d- block elements has 8 columns, the statement is incorrect give reason.

- **Questions of Two Marks :**

Q. 1) Give reason :

i) An anion is always larger than its parent atom.

ii) Chromium has configuration $3d^5 4s^1$ and not $3d^4 4s^2$.

Q. 2) Give reason : Among the elements Boron and Arsenic

i) Which has the highest first ionisation enthalphy ?

ii) Which has the less negative electron gain enthalpy ?

Q. 3) Explain the variation of electronegativity across the period and down a group of the periodic table.

Q. 4) Among the elements of third period (n = 3) of the periodic table :

i) Which has the most stable electronic configuration ?

ii) Which has very low electronegativity character ?

Q. 5) Explain the variation of electron gain enthalpy across the period and down the group of the periodic table.

Q. 6) Out of the elements Cr (Z=24), Mg (Z = 12), Cu (Z = 29) and Fe (Z = 26) identify the elements with

i) Five electrons in 3d subshell

ii) Ten electrons in 3d subshell

Q. 7) In the modern periodic table Ca (Z=20) is surrounded by elements with atomic number 12, 19, 21 and 38. Which of these have physical and chemical properties similar to calcium ?

Q. 8) Silicon is metalloid. Explain.

Q. 9) Give four main factors that affects the magnitude of ionization enthalpy of an atom.

Q. 10) Explain why high positive first ionization enthlpies of Group 0 elements decreases down the group ?

Q. 11) Write the electronic configurations and draw box diagrams for :

i) Oxygen (Z = 8)

ii) Magnesium (Z = 12)

Q. 12) Give the electronic configurations by notations and diagrams in the abbreviated form for the following elements :

i) Phosphorus (Z = 15)

ii) Chromium (Z=24)

Q. 13) For the element $_{7}N$

i) Write the electronic configuration by notation.

ii) Write its electronic configuration by box diagram.

Q. 14) Write the complete electronic configuration of Vanadium (Z=23) and mention the number of unpaired electrons in it.

- **Questions of Three Marks :**

Q. 1) Fe^{2+} and Fe^{3+} have 2 and 3 electrons less than Fe (Z = 26) respectively. If the electrons are removed from 4s and then 3d sub shells, write the electronic configurations of Fe^{2+} and Fe^{3+}.

Which ion is more stable ?

Q. 2) Explain the following.

i) The atomic radius increases down Group II metals.

ii) The atomic radius decreases across the period from Li to Ne.

Q. 3) Write balanced equations for the following oxides with water.

a) Na_2O b) Al_2O_3 c) Cl_2O_7

Q. 4) Explain with suitable example :

a) Basic oxide b) Amphoteric Oxide c) Acidic Oxide

Q. 5) Give Reason :

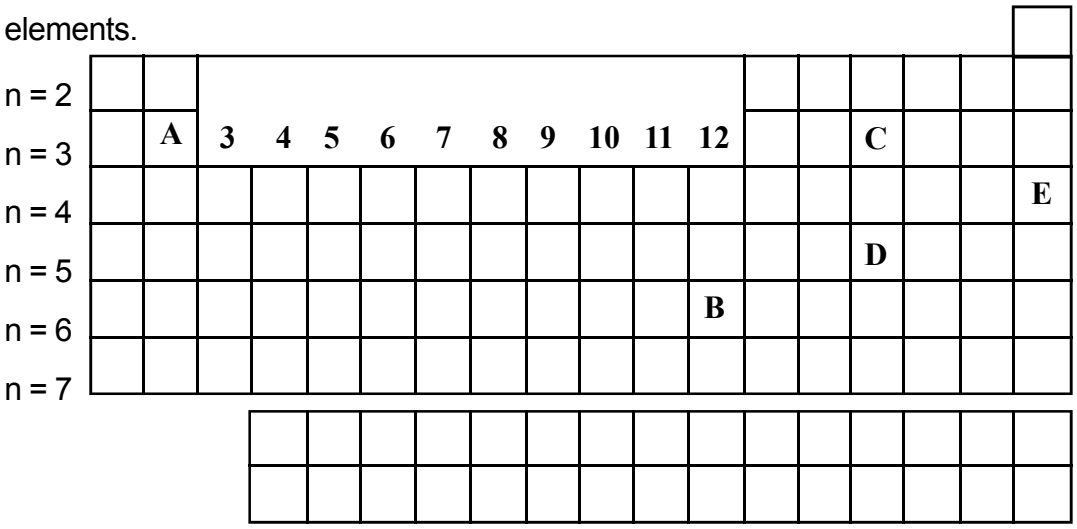
i) Noble gases have high positive values of electron gain enthalpy.

ii) Electron gain enthalpy of Cl (Z = 17) is more negative than that of Fluorine (Z = 9).

iii) Ionisation enthalpy of Nitrogen (Z = 7) is more than that of oxygen (Z = 8).

- **Questions of 5 Marks :**

Q. 1) Observe the following periodic table. The letters shown in the following skeleton of periodic table represents some of the elements but they are not the symbols of those elements.



Which letters shown in the periodic table are :

i) Two elements in the same group ?

ii) Two elements in the same period ?

iii) Two elements that are metals ?

iv) An unreactive gas ?

v) Liquid metal ?

Q. 2) Draw an outline of Modern Periodic Table and label the table with the following terms :

i) Representative elements

ii) Transition elements

iii) Inner transition elements

iv) Inert Gases

Q. 3) Define the following terms :

i) Atomic radius

ii) Electronegativity

iii) Electron gain enthalpy

iv) Oxidation state

v) Ionization enthalpy.

■■■

Topic 5 : Redox reactions
Multiple Choice Questions (1 Mark each)

Q. 1) **In reaction, $Zn_{(s)} + H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + H_{2(g)}$, species undergoing reduction is -**

a) H^+ b) $H_{2(g)}$ c) $Zn_{(s)}$ d) SO_4^{2-}

Q. 2) **In reaction, $Zn^0 + Cu^{2+} \longrightarrow Zn^{2+} + Cu^0$, oxidising agent is -**

a) Cu^0 b) Cu^{2+} c) Zn^0 d) Zn^{2+}

Q. 3) **Oxidation number of manganese in permanganate ion is -**

a) + 7 b) + 6 c) + 5 d) + 4

Q. 4) **In $Na_2S_4O_6$, oxidation number of sulphur is -**

a) 2.5 b) 5 c) - 5 d) 10

Q. 5) **Oxygen atom has (-1) oxidation number in -**

a) H_2O b) OF_2 c) H_2O_2 d) OH^-

Q. 6) **Oxidation state of oxygen atom is (+2) in -**

a) H_2O b) OF_2 c) H_2O_2 d) OH^-

Q. 7) **Oxidation number of Hydrogen is (-1) in -**

a) NH_3 b) H_2O c) $H_2N\text{-}NH_2$ d) MgH_2

Q. 8) **Oxidation number of S is (+6) in -**

a) H_2SO_4 b) H_2SO_3 c) SO_2 d) $SOCl_2$

Q. 9) **In reaction, $Zn + I_2 \longrightarrow ZnI_2$, species undergoing reduction is -**

a) Zn b) I_2 c) Zn^{2+} d) I^-

Q. 10) **Halogen which exhibits same oxidation state in all its compounds is -**

a) F_2 b) Cl_2 c) Br_2 d) I_2

Q. 11) **Oxidation number of oxygen atom is positive in -**

a) O_2 b) OF_2 c) H_2O d) H_2O_2

Q. 12) **When Fe is added to $CuSO_4$ Solution, Cu is precipitated, the reaction involves**

a) Oxidation of Cu b) Reduction of Fe

c) Reduction of Cu d) Reduction of Cu^{2+}

Q. 13) Oxidation state of Vanadium atom in $V_2O_7^{4-}$ ion is -

a) + 2 b) + 3 c) + 5 d) + 7

Q. 14) In the reaction, $Ag_2O + H_2O + 2e^- \rightarrow 2Ag + 2OH^-$

a) Silver is oxidised b) Silver is reduced

c) H_2O is oxidised d) H_2 is reduced

Q. 15) In acidic medium, equivalent mass of $KMnO_4$ (Molar mass 158) is -

a) 31.6 b) 39.5 c) 79 d) 158

Q. 16) In the reaction of ferrous ammonium sulphate with acidified $KMnO_4$ species oxidised is -

a) Fe^{2+} b) NH_4^+ c) MnO_4^- d) SO_4^{2-}

Q. 17) In the reaction of oxalic acid with acid permanganate oxidation state of carbon changes from.

a) + 3 to + 4 b) + 3 to + 5 c) + 4 to + 3 d) + 2 to + 4

Q. 18) Which of the followings has lowest oxidation number of carbon ?

a) CCl_4 b) CH_4 c) CO_2 d) CF_4

Q. 19) In the Conversion, $Br_2 \rightarrow BrO^-_3$, oxidation number of bromine changes from

a) 0 to - 5 b) 0 to + 5 c) -1 to + 5 d) + 1 to + 6

Q. 20) In the reaction, $2Fe^{3+} Sn^{2+} \rightarrow 2Fe^{2+} + A$; Here species A is -

a) Sn^0 b) Sn^{2+} c) Sn^{4+} d) Fe^0

Q. 21) Respiration involves -

a) oxidation b) Reduction c) Redox reaction d) Neutralisation

Q. 22) Sum of oxidation states of all atoms in ClO_4^- ion is -

a) zero b) - 1 c) - 4 d) + 2

Q. 23) In which medium, $KMnO_4$ is a better oxidising agent ?

a) acidic b) Basic c) Neutral d) Aqueous

- **Questions of One Mark :**

Q. 1) Mention oxidant & reductant in following reaction.

a) $CuSO_{4(aq)} + Cd\ (s) \longrightarrow CdSO_{4(aq)} + Cu\ (s)$

b) $SnCl_{2(aq)} + 2\ FeCl_{3(aq)} \longrightarrow SnCl_{4(aq)} + 2\ FeCl_{2(aq)}$

c) $Fe\ (s) + 2AgNO_{3(aq)} \longrightarrow Fe\ (NO_3)_{2(aq)} + 2\ Ag_{\ (s)}$

Q. 2) Mention Two characteristics each for

a) Oxidising agent

b) Reducing agent

Q. 3) Assign oxidation number of atom P, in

$ZnNH_4PO_4$

Q. 4) What will be the change in Oxidation state of 'Mn' when $KMnO_4$ is treated with acidified $FeSO_4$?

Q. 5) Give two characterstics of followings.

a) Oxidation

b) Reduction

- **Questions of Two Marks :**

Q. 1) Define the terms in terms of electron transfer.

a) Oxidation b) Reduction

Q. 2) Define the terms in terms of electron transfer.

a) Oxidant b) Reductant

Q. 3) Explain, redox reaction with suitable example.

Q. 4) Describe importance of oxidation number to identify redox reaction, oxidant & reductant.

Q. 5) What is Oxidation number of Fe., in $K_3[Fe(CN)_6]$?

Given, Oxidation number of K = +1, C =+ 2, N = -3

Q. 6) If Oxidation number of atoms Zn = +2, N = -3, H = +1, O = - 2, what is Oxidation number of P atom in, $Zn\,NH_4\,PO_4$?

Q. 7) In following unbalanced redox reaction, identify in which species Nitrogen atom is oxidised & reduced.

$HNO_{2(aq)} \rightarrow NO^-_{3(aq)} + NO_{(g)}$

Q. 8) In following unbalanced redox reaction, identify in which species Iodine atom is oxidised & reduced.

$IO^-_{3(aq)} + IO^-_{(aq)} \rightarrow I^-_{(aq)} + I^-_{3(aq)}$

Q. 9) Distinguish between oxidising agent & reducing agent with suitable example.

Q. 10) Identify oxidising & reducing agent in following redox reaction-

$Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)}$

Which species undergoes oxidation & which species undergoes reduction ?

Q. 11) Explain with suitable chemical reaction, oxidation & reduction is a simultaneus & complementary process.

Q. 12) Describe two characterstics for each of following -

a) Oxidising agent b) Reducing agent

- **Questions of Three Marks :**

Q. 1) State & explain with example

a) Oxidant b) Reductant

Q. 2) Explain, rules to assign oxidation number to atoms in element.

Q. 3) Find oxidation number of atoms underlined in following.

a) $K_2\underline{Cr}_2O_7$ b) $\underline{Sb}F^-_6$ c) $\underline{V}_2O_7^{4-}$

Q. 4) Assign oxidation number of atoms underlined in following.

a) $Na\underline{B}H_4$ b) $H_3\underline{P}O_3$ c) $K\underline{Mn}O_4$

Q. 5) Arrange following in order of increasing oxidation number of carbon atoms : - C_2H_4, $C_2O_4^{2-}$, CO_3^{2-}

Q. 6) Classify giving reasons, following unbalanced half equations as oxidation & reduction, using oxidation number concept.

a) $Fe^{3+}_{(aq)} \rightarrow Fe^{2+}_{(aq)}$ b) $Sn^{2+}_{(aq)} \rightarrow Sn^{4+}_{(aq)}$

c) $ClO^-_{3\,(aq)} \rightarrow ClO^-_{2\,(aq)}$ d) $Mn^{2+}_{(aq)} \rightarrow MnO_{2(s)}$

Q. 7) Explain, redox reaction with suitable example.

Q. 8) Balance following redox equations by oxidation number method. Reaction occurs in acidic medium.

$PbO_{2(s)} + Cl^-_{(aq)} \rightarrow PbCl_{2\,(s)} + Cl_{2\,(g)}$

Q. 9) Classify giving reasons, following unbalanced half equations as oxidation & reduction.

a) $Cu^{2+}_{(aq)} \rightarrow Cu_{(s)}$ b) $NH_{3(g)} \rightarrow NO_{(g)}$ c) $Br^-_{(aq)} \rightarrow Br_{2\,(g)}$

d) $ClO^-_{(aq)} \rightarrow Cl^-_{(aq)}$ e) $Mn^{2+}_{(aq)} \rightarrow MnO_{2(s)}$ f) $MnO^-_{4\,(aq)} \rightarrow Mn^{2+}_{(aq)}$

Q. 10) Arrange the following in order of increasing oxidation number of Carbon atom : CaC_2, C_2H_4, CH_4, CO_3^{2-}, $C_2O_4^{2-}$

- **Questions of Five Marks :**

Q. 1) What is oxidation number ? Explain in brief the rules to assign the oxidation number to atoms of element. Assign oxidation numbers to each underlined element in -

a) $K_2 \underline{S}O_4$ b) $\underline{Fe}_3O_4$

Q. 2) Identify oxidation numbers to underlined atoms in following molecules or species-

a) $\underline{C}_2O_4^{2-}$ b) $\underline{V}O_4^{3-}$ c) $\underline{Al}(OH)_4^-$ d) $\underline{C}_4H_4O_6^{2-}$ e) $H_2\underline{As}O_4^-$

Q. 3) With suitable example, explain that oxidation & reduction process are simultaneous & complementary to each other. Calculate, oxidation number of Mn atom in .

a) MnO_2 b) Mn_2O_3

Q. 4) Explain applications of redox reactions in

a) Dry Battery

b) Metal corrosion surface.

c) Respiration system.

d) Combustion process.

e) Galvanic cell.

■■■

Topic 6 : Chemical equilibrium
Multiple Choice Questions

Q. 1) The equilibrium between two phases of the same substance is known as -

a) Equilibrium
b) Physical equilibrium
c) Chemical equilibrium
d) Dynamic equilibrium

Q. 2) The example of the homogeneous reaction is

a) $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$
b) $C_{(s)} + O_{2(g)} \rightleftharpoons CO_{2(g)}$
c) $H_2O_{(g)} \rightleftharpoons H_2O_{(l)}$
b) $CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$

Q. 3) If the numerical value of the equilibrium constant K_c, is more, then -

a) The reaction nearly reaches completion.
b) The reaction does not take place.
c) Significant concentation of both, the reactants & product can be present.
d) The reaction is impossible.

Q. 4) The change in the factor pressure in a reversible reaction affects on which amongst the following state ?

a) Gases b) Solid c) Liquid d) Plasma

Q. 5) The position of equilibrium point is not affected by -

a) pressure b) concentration c) temperature d) catalyst

Q. 6) According to Lewis theory, bases are -

a) electron donors
b) electron acceptors
c) proton donors
d) proton acceptors

Q. 7) The monoprotic acid from the following is -

a) formic acid b) malonic acid c) phosphoric acid d) arsenic acid

Q. 8) pH of the most acidic solution will be -

a) fourteen b) seven c) one d) zero

Q. 9) Potossium nitrate is a salt of -

a) strong acid weak base
b) strong base weak acid
c) strong acid strong base
d) weak acid weak base

Q. 10) The aqueous solution of sodium acetate turns -

a) red litmus blue b) blue litmus red

c) blue litmus remains blue d) red litmus remains red

Q. 11) Mixture of ammonium hydroxide and ammonium chloride act as -

a) acidic buffer b) basic buffer c) single salt buffer d)neutral solution

Q. 12) If K_a for CH_3COOH = K_b for NH_4OH = 1.8 X 10^{-5}, then the

a) relative strengths of acid & base are not equal. b) solution is acidic

c) solution is alkaline d) the solution is neutral

Q. 13) In a healthy human the pH of blood is maintained at a value very close to -

a) 6.4 b) 7.4 c) 8.4 d) 9.4

Q. 14) The pH of acidic buffer is given by -

a) $pH = pKa + \log_{10} \frac{[salt]}{[acid]}$ b) $pH = pK_b + \log_{10} \frac{[salt]}{[base]}$

c) $pH = pKa + \log_{10} \frac{[acid]}{[salt]}$ d) $pH = pK_b + \log_{10} \frac{[base]}{[salt]}$

Q. 15) The degree of dissociation of 0.0 1M mono acidic weak base, and $[OH^-]$ equal to 10^{-4} M, is -

a) 10^{-6} b) 10^{-2} c) 10^{-3} d) 10^{-4}

Q. 16) If S is the molar solubility, then the solubility product of $Al(OH)_3$ is -

a) S^2 b) S^3 c) $4S^3$ d) $27S^4$

Q. 17) A salt is precipitated when the value of ionic product -

a) exceeds solubility product. b) becomes less than solubility product

c) becomes equal to solubility product d) is independent of solubility product

Q. 18) The supression of degree of dissociation of a weak electrolyte by addition of a strong electrolyte having an ion in common, is known as

a) Le-chatelier's Principle b) Ostwald's dilution law

c) Solubility product d) Common ion effect

Q. 19) Kidney stone is developed due to the precipitation of salt of -

a) Sodium b) Lithium c) Calcium d) Barium

Q. 20) The process of tooth decay occurs due to dissolution of enamel, composed of -

a) calcium oxalate b) calcium hydroxyapatite

c) barium sulphate d) magnesium hydroxyapatite

- **Questions of One Mark :**

Q. 1) State Law of Mass Action.

Q. 2) State any two uses of equilibrium constant .

Q. 3) Name the factors that affect degree of dissociation.

Q. 4) pH of any acidic solution is less than 7 Explain.

Q. 5) Name the two types of buffer with one example.

Q. 6) What is reverse acidity ?

Q. 7) What is reverse alkalinity ?

Q. 8) What is the condition of precipitation of salt ?

Q. 9) The processes of dissolution and precipitation of a sparingly soluble compound develop which health problems / diseases ?

Q. 10) State the expression, which shows relation between degree of dissociation concentration & dissociation constant ?

Q. 11) Identify the conjugate acid and base in the following reaction.

$HCl + NH_3 \rightleftharpoons NH_4^+ + Cl^-$

Q. 12) What is an acid according to Lewis theory.

Q. 13) NH_3 is a base, explain on the basis of Lewis theory.

Q. 14) What is the pH of 0.02 M NaOH solution ?

Q. 15) Calculate dissociation constant of 0.01 M acid, Whose degree of dissociation is 4×10^{-4}

Q. 16) What is meant by pOH ?

Q. 17) What is meant by Buffer Action ?

Q. 18) State any two propereties of buffer solutions.

Q. 19) Explain the term solubility product.

Q. 20) State Ostwald's dilution law.

Q. 21) State the equation showing relation between K_c and K_p of a reversible reaction

$a A + b B \rightleftharpoons cC + dD$

Q. 22) What is Physical Equilibrium.

Q. 23) Which equilibrium exists when S (monoclinic) $\rightleftharpoons$ S (orthorbombic)

Q. 24) Classify the following reactions into homogeneous & heterogeneous equilibrium.

a) $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$

b) $C_{(s)} + CO_{2(g)} \rightleftharpoons 2CO_{(g)}$

Q. 25) Which equilibrium exists in the reaction of esterification ?

- **Questions of Two Marks :**

Q. 1) Ferric chloride reacts, acidic to litmus Explain.

Q. 2) Concentrated HCl is added while preparing the stock solution of ferric chloride,explain

Q. 3) Formic acid is 3.5% dissociated in its decinormal (O.I M) Solution at 298 K. Calculate the ionisation constant of the acid.

Q. 4) How is acidic buffer prepared ?

Q. 5) Write the equation for Ksp for the following reactions.

a) $Bi_2S_{3(s)} \rightleftharpoons 2\ Bi^{3+}_{(aq)} + 3S^{2-}_{(aq)}$

b) $Ag_2CrO_{4(s)} \rightleftharpoons 2Ag^{+}_{(aq)} + CrO_4^{2-}{}_{(aq)}$

Q. 6) Define a) pH and b) pOH.

Q. 7) State four applications of buffer solutions ?

Q. 8) Derive the mathematical expression for Law of Mass action for the following

$a\,A + b\,B \rightleftharpoons c\,C + d\,D$

Q. 9) Explain the relation between K_p & K_c for the reaction

$a\,A_{(g)} + b\,B_{(g)} \rightleftharpoons c\,C_{(g)} + d\,D_{(g)}$

Q. 10) State the form of equilibrium constant expression & the numerical value of the equibrium constant for following balanced equation if $[NO_2] = 0.187 mol\ L^{-1}$ & $[N_2O_4] = 0.03 mol\ L^{-1}$

$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$

Q. 11) Explain the effect of the factor pressure on the following equilibrium.

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

Q. 12) Define pH what is the relation between pH & pOH

Q. 13) Calculate the hydrogen i on concentration of a solution whose pH is 6.25

Q. 14) Solubility of silver chloride is 1.67×10^{-5} mol dm^{3-} at 298 K. Calculate the solubility product at this temperature.

- **Questions of Three Marks :**

Q. 1) The solubility product of silver bromide is 1.7×10^{-10} What is its solubility in mol dm^{-3} & g dm^{-3} ($S = 1.304 \times 10^{-5}$ mol dm^{-3})

Q. 2) Explain (a) Common i on effect with suitable example. Define ionic product of water.

Q. 3) NaCl does not undergo hydrolysis explain.

Q. 4) Derive the expression for Ostwals's dilution law for the weak acid H A.

Q. 5) NH_3 is a base & BF_3 is an acid, explain.

Q. 6) Explain the primary, secondary and tertiary stages in the dissociation of Phosphoric acid.

Q. 7) A solution of NaOH has pH 11.5 Calculate its molarity assuming complete ionization.

Q. 8) What are buffer solutions ? What will happen, when strong acid HCl is added to the buffer solution of acetic acid & sodium acetate ?

Q. 9) State two properties of buffer solutions. How is basic buffer prapered ? State the chemical reaction that will take place when small amount of strong acid is added to the basic buffer ?

Q. 10) State the reactions for solubility equilibria & their corresponding solubility product constants for the following salts.

a) PbI_2 b) $Al(OH)_3$

Q. 11) Explain the terms Kc and Kp in detail, with examples.

Q. 12) State & Explain Law of Mass Action.

Q. 13) State three different conditions that help in predicting the direction of a reversible chemical reaction.

Q. 14) State the name of the three factors that affect the equilibrium point directly. Which principle predicts the qualitative effect of changes in factors on the equilibrium composition ? Explain with suitable example.

Q. 15) State and explain Le-chatelier's principle Explain the effect of catalyst on the equilibrium point of a reverible chemical reaction.

- **Questions of Five Marks :**

Q. 1) Consider the following equilibrium $2CO_{(g)} + O_{2(g)} \rightleftharpoons 2CO_{2(g)} + 564$ kJ Predict the changes on the equilibrium point of the reversible reaction when-

a) O_2 is added

b) Pressure is increased on the reactants of the forward half of the reaction.

c) Temperature is increased on the reactants of the forward half.

d) Catalyst is introduced.

Q. 2) Explain what will happen when-

a) Ionic Product $>$ Solubility product.

b) Ionic Product $=$ Solubility product.

c) Ionic Product $<$ Solubility product.

for the saturated solution of Ag_2CrO_4. Define the term solubility product and pH.

Q. 3) Explain the effect of change in concentration of H_2 in following-equilibrium $C_2H_{4(g)} + H_{2(g)} \rightleftharpoons C_2H_{6(g)}$ + Heat also explain the effect of catalyst on the equilibrium of the above reaction.

Q. 4) What is pH ? Explain pH Scale. Calculate pH of 0.04 M acetic acid if it is 2.5% ionised.

Q. 5) State and explain Le-chatelier's principle. Predict the effect of pressure on the following equilibrium. Justify your answer.

$S_{(S)} + O_{2(g)} \rightleftharpoons SO_{2(g)}$

Q. 6) What are buffers ? Explain reverse acidity and reverse alkalinity concept with reference to the acidic buffer. Show that pH + pOH = 14.

Q. 7) What is molar solubility of a compound ? How is it expressed ? How is solubility defined, when it is expressed in g/L. What is the relation between solubility in mol/dm^3 & solubility in g/L ? If S is the molar solubility of a compound, then what will be the expression for equilibrium concentration of the ions in the saturated solution of PbI_2 ?

Topic 7 : Surface chemistry
Multiple Choice Questions

Q. 1) Adsorption is due to .....

a) balanced force of attraction. b) unbalanced force of attraction.

c) precipitation d) coagulation

Q. 2) The substance decreasing the rate of reaction is .....

a) catalyst b) inhibitor c) promoter d) enzyme

Q. 3) Tydall effect is ..... property.

a) mechanical b) electrical c) chemical d) optical

Q. 4) The size of particles in true solution is between .....

a) l nm to 10 nm b) 10 nm to 100 nm

c) 100 nm to 1000 nm d) 0.1 nm to 1 nm

Q. 5) As the temperature of solid surface increases, the extent of adsorption of gas .....

a) increases b) decreases

c) remains unchanged d) first increases then decreases

Q.6) The rate of reaction does not depend on surface area of catalyst in ....

a) homogeneous catalyst b) acid catalyst

c) heterogeneous catalyst d) base catalyst

Q.7) Fruit jam is an example of .....

a) sol b) gel c) emulsion d) true solution

Q.8) For the conversion of O_2 to O_3 in atmosphere nitric oxide acts as .....

a) enzyme catalyst b) heterogeneous catalyst

c) homogeneous catalyst d) base catalyst

- **Questions of One Mark :**

Q. 1) Write the name of the effect which explain scattering of light by particles in dark room.

Q. 2) How is the rate of a chemical reaction reduced ?

Q. 3) What is the role of caesin in milk ?

Q. 4) Write two uses of metal oxide nanoparticles.

- **Questions of Two Marks :**

Q. 1) Define disperse phase and dispersion medium with a suitable example.

Q. 2) Construct a labelled diagram for movement of colloidal particles under an applied electric potential.

Q. 3) Write the name of the colloidal system for the following examples.

a) Whipped cream b) Fog c) Milk d) Cheese

Q. 4) Write a note on suspension.

Q. 5) Write the particle size for :

a) Sand in water b) Sugar in water.

Q. 6) Classify the following examples as reversible colloids and irreversible colloids.

a) Protein in water b) Metal sulphide in water

c) Rubber in benzene d) Cellulose acetate in acetone.

- **Questions of Three Marks :**

Q. 1) What is adsorption ? Name the factors affecting adsorption of gases on solid.

Q. 2) Write empirical equation for adsorption of gas on solid and name the terms used in it, Give its graphical representation.

Q. 3) Define Brownian movement. What are macromolecular colloids ? Write two examples of single macromolecular colloids.

- **Questions of Five Marks :**

Q. 1) Define : i) Adsorbent

ii) Activated adsorption.

What effect does a catalyst have on the rate, path and activation energy of a chemical reaction ?

Q. 2) What are heterogeneous catalyst ? Give its two examples.

Describe optical property of colloids with a suitable diagram.

■■■

Topic 8 : Nature of chemical bond
Multiple Choice Questions

Q. 1) Energy released when one mole of an ionic crystal is formed by the close packing of gaseous cations & anions is .....

a) Bond energy b) Potential energy c) Kinetic energy d)Lattice energy

Q. 2) The bond enthalpy of a C = C is .....

a) same as that of single bond b) greater than that of single bond

c) double than that of single bond d) half of that of single bond

Q. 3) The correct order of dipole moment for the molecules of hydrogen and its halide is .....

a) $HF < HCl < HBr < H_2$ b) $HCl > HF > HBr > H_2$

c) $HBr > HCl > HF > H_2$ d) $HF > HCl > HBr > H_2$

Q. 4) The covalent character of aluminium, magnesium and sodium in its chloride decreases as .....

a) $Al^{3+}(Cl^{-1})_3 > Mg^{2+}(Cl^{-1})_2 > Na^{+}Cl^{-}$ b) $Na^{+}Cl^{-} > Mg^{+2}(Cl^{-1})_2 > Al^{3+}(Cl^{-1})_3$

c) $Mg^{2+}(Cl^{-1})_2 > Al^{3+}(Cl^{-1})_3 > Na^{+}Cl^{-}$ d) $Al^{3+}(Cl^{-1})_3 = Mg^{2+}(Cl^{-1})_2 = Na^{+}Cl^{-}$

Q. 5) The percentage of S character in hybridised methane molecule is .....

a) 100% b) 75% c) 50% d) 25%

Q. 6) The type of hybridisation in SF_6 molecule

a) sp^3d^2 b) sp^3d^3 c) sp^3d d) sp^3

Q. 7) Paramagnetic molecule among the followings is .....

a) O_2 b) H_2 c) He_2 d) Ne_2

Q. 8) The total number of pi bonds present in acetylene is

a) zero b) one c) two d) three

Q. 9) The expected valency of carbon, according to VBT is .....

a) one b) two c) three d) four

Q. 10) The diamagnetism and paramagnetism of a molecule is explained on the basis of .....

a) VSEPR b) VBT c) MOT d) hybridisation

Q. 11) Which of the followings contains both polar and non - polar covalent bonds ?

a) NH_4Cl b) H_2O_2 c) HCN d) CH_4

Q. 12) Which of the following molecules contains no π Bonds ?

a) H_2O b) SO_2 c) C_2H_4 d) C_2H_2

Q. 13) Which of the following molecules has trigonal planar geometry ?

a) NH_3 b) PH_3 c) BF_3 d) IF_3

Q. 14) What is the shape of IF_7 molecule ?

a) Octahedral b) Traigonal bipyramidal

c) Tetrahedral d) Pentagonal bipyramidal

Q. 15) The sulphur atom in H_2SO_4 is surrounded by

a) 8 electrons b) 10 electrons c) 12 electrons d)16 electrons

Q. 16) Bond polarity in a molecule and hence the dipole moment depends primarily on electronegativity of the constituent atoms and shape of a molecule. Which of the following has highest dipole moment?

a) CO_2 b) BeF_2 c) H_2O d) BF_3

Q. 17) The type of hybridisation of nitrogen in NO_2^+, NO^- and NH_4^+ respectively are expected to be.

a) sp, sp^3 and sp^2 b) sp, sp^2 and sp^3

c) sp^2, sp and sp^3 d) sp^2, sp^3 and sp

Q. 18) Number of sigma and pi bonds in acetylene molecule are

a) 3σ and 2π b) 2σ and 3π

c) 4σ and 2π d) 4σ and 1π

Q. 19) Which has tetrahedral geometry ?

a) CH_4 b) C_2H_4 c) C_2H_2 d) BeF_2

Q. 20) Which of the following angle corresponds to sp hybridisation ?

a) 90^0 b) 120^0 c) 180^0 d) 109.5^0

Q. 21) Which of the following represents correct bond order ?

a) $O_2^- > O_2 > O_2^+$ b) $O_2^- < O_2 < O_2^+$

c) $O_2^- > O_2 < O_2^+$ d) $O_2^- < O_2 > O_2^+$

Q. 22) The electronic configuration of the outer most shell of the most electronegative element is

a) $2s^2\ 2p^5$ b) $3s^2\ 3p^5$ c) $4s^2\ 4p^5$ d) $5s^2\ 5p^5$

Q. 23) Which of the following order of energies of molecular orbitals of N_2 is correct ?

a) $\pi\ 2p_y < \sigma\ 2p_z < \pi^*\ 2p_x = \pi^*\ 2p_y$ b) $\pi\ 2p_y > \sigma\ 2p_z > \pi^*\ 2p_x = \pi^*\ 2p_y$

c) $\pi\ 2p_y < \sigma\ 2p_z > \pi^*\ 2p_x = \pi^*\ 2p_y$ d) $\pi\ 2p_y > \sigma\ 2p_z < \pi^*\ 2p_x = \pi^*\ 2p_y$

Q. 24) Dipole moment is non zero for

a) CO_2 b) CH_4 c) $CHCl_3$ d) CCl_4

Q. 25) S-S overlap is observed in case of following molecules

a) H_2 b) F_2 c) Cl_2 d) HF

Q. 26) In water, oxygen atom undergoes SP^3 hybridisation, bond angle in water molecule is

a) 109.5^0 b) 107^0 c) 104.5^0 d) 110^0

Q. 27) Bond angles are different in which of the following molecule

a) BeF_2 b) PCl_5 c) SF_6 d) CH_4

Q. 28) See saw shape is observed in which of the molecular type ?

a) AB_2E b) AB_3E c) AB_2E_2 d) AB_4E

Q. 29) Example of Intra molecular hydrogen bonding is

a) NH_3 b) H_2O c) HF d) O-Nitrophenol

Q. 30) Bond angle is minimum in which of the following molecule ?

a) CH_4 b) C_2H_2 c) NH_3 d) H_2O

Q. 31) The geometry of SF_6 is

a) linear b) octahedral

c) Triangular d) Triagonal bipyramidal

Q. 32) The ion that is iso electronic with carbon monoxide is

a) CN^- b) O_2^+ c) O_2^- d) N_2^+

Q. 33) In a change from PCl_3 to PCl_5, the hybrid state of phosphorus changes from

a) sp^2 to sp^3 b) sp^3 to sp^2

c) sp^3 to sp^3d d) sp^3 to dsp^2

- **Questions of One Mark :**

Q. 1) Explain the term bond.

Q. 2) State the two factors which compel atoms to combine.

Q. 3) Which theory was proposed by Kossel & Lewis ?

Q. 4) State octet rule.

Q. 5) State any two examples illustrating presence of ionic bond.

Q. 6) What is meant by Lattice energy ?

Q. 7) How is a covalent bond formed ?

Q. 8) Classify the following as incomplete and expanded octet

a) $BeCl_2$ b) H_2SO_4 c) PCl_5 d) BF_3

Q. 9) What is the relation between strength of bond & bond dissociation energy ?

Q. 10) What is resonance ?

Q. 11) State the expression to calculate dipole moment.

Q. 12) Which unit is used to express dipole moment ?

Q. 13) Between HCl and HF, which compound will have more dipole moment ?

Q. 14) How do ionic compounds develop partial covalent character ?

Q. 15) What does Fajan's rule explain ?

Q. 16) Draw the diagram of H_2 molecule showing s-s overlap .

Q. 17) Which is the type of overlap present in H-F molecule ?

Q. 18) Define hybridisation ?

Q. 19) State the angle & geometry of hybridized molecule of BF_3

Q. 20) Draw the geometrical structure for the hybridized methane molecule.

Q. 21) State the geometry & angle of hybridisation in water molecule.

Q. 22) What is the molecular structure shown by BrF_5 and ClF_3, according to VSEPR ?

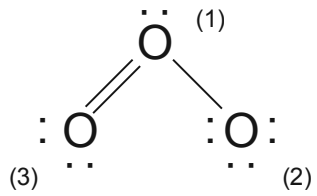
Q. 23) Which of the physical properties are affected by intermolecular hydrogen bonding ?

Q. 24) Which theory explains paramagnetic & diamagnetic properties of any molecule ?

Q. 25) Name two types of molecular orbitals.

Q. 26) Define electrovalent bond

Q. 27) Calculate formal charge on second oxygen atom in ozone molecule.



Q. 28) Draw Lewis structure of O_2 molecule.

Q. 29) Write an example of incomplete octet.

Q. 30) Define Bond enthalpy.

Q. 31) How much difference in electronegativity of the combining atoms produces 50% ionic character in covalent bond.

Q. 32) What is the unit of dipole moment?

Q. 33) Define polarisation in bond.

Q. 34) Draw energy profile diagram during formation of Hydrogen molecule.

Q. 35) Write example of s-p overlap.

Q. 36) Give type of hybridisation and geometry in methane molecule.

Q. 37) Give reason, bond angle in ammonia is $107^0 18'$ instead $109^0 28'$

Q. 38) Draw formation of BeF_2 molecule on the basis of sp hybridisation.

Q. 39) What is the percentage of s character in sp^2 Hybridisation?

Q. 40) Write geometry of PCl_5 molecule.

Q. 41) What is the relation between bond order and bond length.

Q. 42) Define hydrogen bond.

Q. 43) What type of hydrogen bonding is present in HF molecule?

Q. 44) Calculate bond order of H_2 molecule on the basis of MOT.

Q. 45) What is the magnetic property of oxygen molecule on the basis of MOT?

Q. 46) Why HF is weak acid.

Q. 47) How the extent of polarisation in an ionic compound is related to dielectric constant.

Q. 48) Write bond order of Dinitrogen molecule.

Q. 49) Write odd electron molecule which violate the octet rule.

Q. 50) What is the relation between multiplicity of bond and bond dissociation enthalpy?

Q. 51) Write Lewis structure of carbon monoxide.

Q. 52) Why HF is polar molecule.

- **Questions of Two Marks :**

Q. 1) What are valence electrons ? Explain with suitable example. How are they denoted ?

Q. 2) An ionic bond is generally established between metallic and non-metallic atoms, State whether the Statement is true or false, with reason.

Q. 3) Explain the formation of a single and double covalent bond with one example each ?

Q. 4) Write Lewis structure of

a) NO_2^- and b) CO

Q. 5) Explain incomplete octet with the example of $BeCl_2$

Q. 6) Explain expanded octet in SF_6 ?

Q. 7) Name the four bond parameters of the covalent bond. Explain bond order.

Q. 8) The magnitule of bond enthalpy incrcases with the multiplicity of the bond. Explain the statement with example of carbon-carbon bonds.

Q. 9) Explain the ionic character of a covalent bond.

Q. 10) Which of the following is more covalent

a) AgCl and b) KCl

Q. 11) H - F molecule is a polar covalent molecule, explain.

Q. 12) What conditions are essential for hybridisation ?

Q. 13) The SP^3 hybridised structure of NH_3 molecule has distorted tetrahedral structure. Explain.

Q. 14) Differentiate between sigma (σ) & pi (π) bond .

Q. 15) Explain the VSEPR approach to determine molecular structure in ammonia molecule.

Q. 16) Classify the following molecules as diamagnetic or paramagnetic, state the reason.

a) Lithium molecule b) Oxygen molecule

c) Boron molecule c) Nitrogen molecule

Q. 17) State and explain the types of hydrogen bonds.

Q. 18) Define - i) Bond energy

ii) Bond length

Q. 19) Draw MOT diagram for He_2 molecule. Calculate bond order of He_2 molecule.

Q. 20) Explain - i) Inter molecular hydrogen bonding.

ii) Intra molecular hydrogen bonding.

Q. 21) Explain, dipole moment of NF_3 is lower than NH_3.

Q. 22) Calculate number of lone pair of electron and draw structure of XeF_4 and IF_5.

Q. 23) Draw s-p and p-p overlap in the formation of HF and F_2 molecule.

- **Questions of Three Marks :**

Q. 1) State octet rule. State the Lewis symbols for the Neon & Nitrogen atoms.

Q. 2) Define a) Ionic bond and b) Lattice energy with example

Q. 3) Explain the term formal charge with ozone as an example.

Q. 4) Explain expanded octet with example of H_2SO_4 In which criteria is sulphur dichloride different from H_2SO_4 ?

Q. 5) Write a short note on Dipole moment.

Q. 6) State & Explain Fajan's rules (extent of polarisation)

Q. 7) Polarization in LiCl is more than that of NaCl

Q. 8) Explain the interactive forces in covalent bond formation.

Q. 9) Draw :

a) p-p overlap in F_2 molecule

b) Energy profile diagram in the formation of hydrogen molecule

Q. 10) Explain the need for the concept of hybridization.

Q. 11) Explain the three essential conditions for hybridization with reference to $BeCl_2$

Q. 12) Explain the formation of sigma & pi bonds in formation of ethylene molecule.

Q. 13) Complete the following table

Molecule	**Geometry**	**Hybridisation**	
		Type	**Angle**
$BeCl_2$	.....	sp	.....
BF_3	.....	.....	120^0
.....	Tetrahedral	sp^3	.....

Q. 14) With VSEPR approach, explain, how to determine, molecular structure of ammonia and water molecule.

Q. 15) Explain whether, Oxygen molecule is diamagenetic ar paramagnetic with the help of molecular obital diagram.

Q. 16) What are the postulates of valence bond theory?

Q. 17) What are the steps involved in hybridisation ?

Q. 18) What are the different types of overlap?

Q. 19) What are the salient features of hybridisation?

Q. 20) Explain sp^3 hybridisation in ammonia molecule.

Q. 21) Explain, formation of sulphur hexafluoride on the basis of hybridisation.

Q. 22) Valence shell electron pair repulsion theory was developed and refined by Nyholm and Gillespie. What are the main postulates of VSEPR?

Q. 23) The extent of polarisation in an ionic compound is given by Fajan rule. What are the factors which affect polarisation?

Q. 24) Explain the formation of PCl_5 on the basis of hybridisation.

Q. 25) Write limitations of VBT.

Q. 26) Draw MOT diagram for N_2 molecule. Calculate bond order of N_2 Molecule.

Q. 27) Draw MOT diagram to show paramagnetic behaviour of O_2 molecule.

Calculate bond order of O_2 molecule.

Q. 28) Explain formation of ammonia on the basis of VSEPR approach.

Q. 29) What is Resonance? Draw resonating structure of O_3 molecule.

- **Questions of Five Marks :**

Q. 1) Define bond State and explain the bond parameters.

Q. 2) Explain Born-Haber cycle -

a) Define Ionic bond b) Co-valent bond

Q. 3) State & explain inadequacies of octet rule with one example each.

Q. 4) Define

a) Resonance b) Dipole moment Explain partial ionic character in H-F molecule. State octet rule.

Q. 5) State & explain the factors that affect the extent of polarisation in a molecule.

Q. 6) Draw the energy profile diagram for the formation of hydrogen molecule H-F is a polar molecule, explain giving reasons. Define Hybridisation.

Q. 7) Explain the hybridisation in Boron trifluoride (BF_3) molecule, with the steps involved in hybridisation.

Q. 8) State the limitations of valence bond theory. Explain the molecular structure of chlorine trifluoride & bromine trifluoride.

Q. 9) Write the salient features of molecular orbital theory.

Q. 10) Draw the molecular orbital diagrams for He_2 and Be_2 molecules. Justify your answer, regarding their existence and magnefic properties.

Q. 11) Define formal charge. What are the inadequacies of octet rule?

Q. 12) Define

i) Bond Length

ii) Bond angle

iii) Bond order

What are the essential conditions for hybridisation?

Q. 13) What are the salient freatures of molecular orbital theory?

Q. 14) Draw MOT diagram for B_2 molecule.

Calculate bond order and write magnetic behaviour of B_2 molecule.

■■■

Topic 9 : Hydrogen
Multiple Choice Questions

Q. 1) Which of following properties of hydrogen is similar to alkali metals ?

a) Ionization enthalpy b) Existence of H^+

c) Bonding in Hydrogen halides d) Reducing property.

Q. 2) Which of following properties of hydrogen is dissimilar to halogens ?

a) Electronic configuration b) Atomicity

c) Absence of unshared electron d) Oxidation state

Q. 3) Which of following statements is correct about hydrogen ?

a) Ionization enthalpy of hydrogen is very similar to ionization enthalpy of alkali metals.

b) In electrolysis of molten metal hydrides hydrogen evolves at anode.

c) Hydrogen does not form covalent compounds with non metals.

d) At ordinary temperature halides of hydrogen and alkali metals are in same physical state.

Q. 4) Which of following properties is NOT correct about hydrogen ?

a) Oxide of hydrogen is either acidic or basic in nature.

b) Hydrogen also has radioactive isotopes

c) Hydrogen isotopes deuterium and tritium are used as tracers in study of reaction mechanism.

d) H^+ ion does not exist freely in water.

Q. 5) Commercially Dihydrogen is prepared by

a) reacting zinc with aqueous alkali b) electrolysis of acidified water.

c) reacting zinc with dil. HCl d) action of water on sodium hydride.

Q. 6) Which of following preparation methods of dihydrogen is a laboratory method?

a) Lane's process b) Bosch process

c) Uyeno's process d) Electrolytic process

Q. 7) Which of following halogens combines with hydrogen in absence of light and at very low temperature ?

a) Chlorine b) Iodine c) Bromine d) Fluorine

Q. 8) Syngas is obtained by action of

a) iron oxide with water gas b) iron with steam

c) hydrocarbons with steam d) dinitrogen with hydrogen.

Q. 9) In Lane's process dihydrogen is obtained from

a) sodium hydride and water at room temperature.

b) superheated steam and iron filling

c) magnesium ribbon and dill H_2SO_4

d) zinc and aqueous alkali at room temperature.

Q. 10) Which of following statements is correct for preparation of dihydrogen by electrolysis of acidified water ?

a) Dihydrogen is liberated at cathode

b) Dihydrogen is liberated at anode

c) Dioxygen is liberated at cathode

d) Sulphate ions are discharged at anode

Q. 11) What will be the change in enthalpy when 3.6g of water is obtained by treating dioxygen with dihydrogen if heat liberated per mole of formation of water is 286 kJ ?

a) -286kJ b) 672 kJ c) -57.2 kJ d) 286 kJ

Q. 12.)What will be quantity of dihydrogen needed to obtain 7.2 g of liquid water by reacting dihydrogen and dioxygen at STP ?

a) 114.4 L b) 4.0 L c) 96.7 L d) 8.96 L

Q. 13. What will be the quantity of ammonia gas obtained by reacting 67.2 L dihydrogen with 11.2 L of dinitrogen under ideal conditions ?

a) 22.414 L b) 67.242 L c) 11.207 L d) 44.828 L

Q. 14) Which of following statements for uses of dihydrogen is not correct ?

a) It is used to prepare methanol.

b) It is used to convert metals to metal oxides.

c) Atomic hydrogen and oxyhyhrogen torch is used for cutting and welding.

d) It is used in preparation of hydrochloric acid.

Q. 15) Which of following compounds is an ionic hydride ?

a) CH_4 b) NH_3 c) KH d) HF

Q. 16) Which of following compounds is electron rich hydride ?

a) CH_4 b) H_2O c) KH d) TiH

Q. 17) What type of hydrides does not hold good the law of constant proportion ?

a) Ionic c) electron difficient convalent

c) Interstitial d) electron precise covalent

Q. 18) Enthalpy of fusion of water is

a) 40.66 kJ mol^{-1} b) -285.9 kJ mol^{-1}

c) 18.0151 kJ mol^{-1} d) 6.01 kJ mol^{-1}

Q. 19) X - ray study of ice shows that each oxygen atom is surrounded by

a) 2- 'H' atoms b) 4 - 'H' atoms

c) 6 - 'H' atoms d) 3 - 'H' atoms

Q. 20) Number of coordinated water molecules in $CuSO_4 . 5H_2O$ is

a) 5 b) 4 c) 2 d) 1

Q. 21) Which of following compounds has water molecules associated as interstitial water ?

a) $BaCl_2 . 2H_2O$ b) $CuSO_4 . 5H_2O$

c) $[Al (H_2O)_6] Cl_3$ d) $[Cr (H_2O)_6] Cl_3$

Q. 22) 20 volume solution of H_2O_2 means

a) 20 L of H_2O_2 liberate 20 L O_2 at STP

b) 1 L of H_2O_2 liberate 20 L O_2 at STP

c) 20 L of H_2O_2 liberate 1 L O_2 at NTP

d) 20 L of H_2O_2 liberate 10 L O_2 at NTP

Q. 23) Dihedral angle in H_2O_2 is

a) 94.8^0 b) 90.2^0 c) 111.5^0 d) 101.9^0

Q. 24) What is the volume of dioxygen liberated from 1 L of 30- volume solution of H_2O_2 at STP?

a) 10 L b) 20 L c) 1 L d) 30 L

Q. 25) Which of following reactions demonstrates that H_2O_2 acts as oxidizing agent in basic medium ?

a) $Na_2CO_3 + H_2O_2 \longrightarrow Na_2O_2 + H_2O + CO_2$

b) $2 [Fe (CN)_6]^{3-} + H_2O_2 + 2OH^- \longrightarrow 2 [Fe(CN)_6]^{4-} + 2H_2O + O_2$

c) $Mn^{2+} + H_2O_2 + 2 OH^- \longrightarrow MnO_2 + 2H_2O$

d) $MnO_2 + H_2O_2 + 2H^+ \longrightarrow Mn^{2+} + 2H_2O + O_2$

- **Questions of One Marks :**

1) What is the name of radioactive isotope of hydrogen?
2) How many neutrons are present in protium?
3) What type of particles are emmited by tritium?
4) Which isotope of hydrogen is present predominantly?
5) What is action of water on sodium hydride?
6) How is dihydrogen obtained in Uyeno's method?
7) Write equation for preparation of syngas.
8) What is bond enthalpy of H-H bond in kJ mol^{-1}?
9) What happens when carbon monoxide is treated with dihydrogen at higher temperature in presence of catalyst.
10) Explain hardening of oils?
11) Write examples of saline hydrides.
12) Write balanced chemical equation for preparation of butanal from propene using carbon monoxide and hydrogen gases.
13) Write an example of electron deficient hydride and electron precise hydride.
14) Draw a structure of water molecule showing its bond angle and bond length.
15) How many different kinds of water molecules are formed due to isotopic nature of hydrogen and oxygen? Write formula of supper heavy water.
16) Why is heavy water used in nuclear reactor?
17) Write equation for preparation of hydrogen peroxide by bubbling carbon dioxide gas through paste of barium oxide.
18) How is hydrogen peroxide obtained by Merck's method?
19) What care is taken for storage of hydrogen peroxide?

20) How is the strength of hydrogen peroxide expressed?

21) What do you mean by 10 vol. of H_2O_2?

22) Define percentage strength of hydrogen peroxide.

23) Write uses of hydrogen peroxide.

24) What happens when 2n moles of sodium hydroxide reacts with n moles of hydrogen peroxide ?

25) Draw the structure of hydrogen peroxide representing different bond angles and bond lengths in gaseous phase.

26) Explain bleaching action of hydrogen peroxide.

27) What is acton of hydrogen peroxide with ethylene?

28) Write any two examples of electron rich hydrides?

29) What is a use of deuterium and tritium?

30) What type of bonds break when water evaporates?

31) What different substances are added in hydrogen peroxide to avoid decomposition?

32) What happens when alkali metal hydrides (MH) treated with water?

- **Questions of Two Marks :**

1) Write note on isotopic varieties of water.

2) Describe amphoteric nature of water.

3) Write note on interstitial hydrides.

4) Write four uses of dihydrogen.

5) Explain electron deficient and electron precise molecular hydrides.

6) Write note on isotopes of hydrogen.

7) Describe position of hydrogen in long form of periodic table.

8) Write similarities of hydrogen with alkali metals.

9) Write similarities of hydrogen with halogens.

10) What are differing properties of hydrogen as compared with alkali metals?

11) Write properties of hydrogen which differ from alkali metals?

12) Why are substances like AgCl, and $BaSO_4$ less soluble but carboxylic acids and urea are highly soluble in water?

13) Explain structure of ice.

14) How is hydrogen peroxide prepared from

i) Sodium peroxide ii) Barium peroxide paste

15) Explain oxidizing and reducing actions of hydrogen peroxide in acidic medium by suitable example.

- **Questions of Three Marks :**

1) Explain the use of dihydrogen as fuel. How is it advantageous?

2) Write a note on generation of electricity using dihydrogen fuel cell.

3) What is hydrogenation of vegetable oil? Explain.

4) Calculate strength of hydrogen peroxide in g/L of 30 volume solution.

5) Calculate the strength of 10 volume solution of H_2O_2.

6) What is the volume of ammonia gas obtained when 67.2 L of dihydrogen is treated with sufficient dinitrogen at STP?

7) Identify the limiting factor and calculate the quantity of ammonia gas obtained by reacting 67.2 L of dihydrogen with 11.2 L of dinitrogen at STP.

8) What is the change in enthalpy when 3.6g of water melts under ideal conditions?

(Δ H (fusion) H_2O = 6.0 kJ mol^{-1})

9) Compare the structures of H_2O and H_2O_2.

10) Write equation to prepare H_2O_2 industrially by auto oxidation of 2-Ethylanthraquinol.

● **Questions of Five Marks :**

1) What is meaning of 40 volume hydrogen peroxide ?

Calculate its strength in gL^{-1}, molarity and normality.

2) What is dihedral angle between two H atoms of H_2O_2?

if H_2O_2 solution contains 30.36 gL^{-1} of H_2O_2 calculate its volume strength. What is acton of dihydrogen with i) Copper oxide ii) Pd^{2+} ion?

3) What is the role of H_2O_2 in reaction shown below?

$H_2O_2 + Cl_2 \longrightarrow 2HCl + O_2$.

Why H_2O_2 is not stored in glass bottles?

What happens when benzene reacts with hydrogen peroxide?

4) Explain saline hydrides with example and write uses of hydrogen peroxide.

5) Explain Bosch process and Lane's process for manufacture of dihydrogen.

What is action of dihydrogen on fluorine and nitrogen gases respectively?

6) Write a note on covalent and metallic hydrides.

7) Explain amphoteric nature of water and redox reactions of water with example.

8) How different kinds of water molecules are formed? Prepare a chart to show different kinds of water molecules with their molecular mass.

9) Explain i) Preparation of hydrogen peroxide by electrolysis of 50% sulphuric acid.

ii) Dihydrogen as a source of fuel.

10) Write balanced equations for following

i) Action of water on sodium hydride.

ii) Zinc reacts with aqueous sodium hydroxide.

iii) Action of steam with methane at higher temperature in presence of catalyst Ni.

iv) Zinc oxide reacts with dihydrogen.

v) Action of watergas on propene.

■■■

Topic 10 : s - Block elements
Multiple Choice Questions

---

1) Lithium shows diagonal relationship with.

a) Magnesium b) Aluminium c) Silicon d) Sodium

2) Alkali metals react with water vigorously to form hydroxides and evolve hydrogen. Which of the following alkali metals react with water least vigorously ?

a) Li b) Na c) K d) Cs

3) Which of the alkali metal combine with NH_3 to form imide.

a) Li b) Na c) K d) Rb

4) Which of the alkali metal carbonate decomposes on heating to evolve CO_2 ?

a) Li_2CO_3 b) Na_2CO_3 c) K_2CO_3 d) Rb_2CO_3

5) Some of the Group 1 metal halides are covalent and soluble in organic solvents. Among the following metal halides, the one which is soluble in ethanol is.

a) LiCl b) NaCl c) KCl d) CsCl

6) Density of alkali metal is highest for

a) Li b) Na c) Rb d) Cs

7) Which hydroxide is most basic in nature ?

a) CsOH b) KOH c) NaOH d) LiOH

8) Potassium is kept in

a) Alcohol b) Water c) Kerosene d) Liquid NH_3

9) The reactivity of alkali metals towards dihydrogen is

a) Li > Na > K > Rb > CS b) Li < Na > K > Rb > CS

c) Li > Na < K > Rb > CS d) Li < Na < K < Rb < CS

10) In the synthesis of Na_2CO_3 by solvay process, the recovery of ammonia is done by treating NH_4Cl with $Ca(OH)_2$. The by - product obtained in this process is.

a) $CaCl_2$ b) NaCl d) Na_2CO_3 d) $NaHCO_3$

11) The order of Ionisation enthalpy in alkali metal is

a) Na > Li > K > Rb b) Rb < Na < K < Li

c) Li > Na > K > Rb d) K < Li < Na < Rb

12) The formula of soda ash is

a) $Na_2CO_3 . 10 H_2O$ b) $Na_2CO_3 . 2H_2O$

c) $Na_2CO_3 . H_2O$ d) Na_2CO_3

13) When sodium chloride is heated with conc. H_2SO_4 and MnO_2, it liberates.

a) Cl_2 b) SO_2 c) O_2 d) H_2

14) The composition of Baking soda is

a) NaCl b) $NaHCO_3$ c) KCl d) K_2CO_3

15) Alloy of Lithium used for aircraft construction is

a) Li - Pb b) Li - Al c) Li - Ca d) Li - Mn

16) Which of the following chemicals, in addition to water are used for the manufacture of Na_2CO_3 by Solvay process ?

a) NaCl, CO and NH_3 b) NaCl, CO_2 and NH_3

c) NaCl, NH_4Cl and CO_2 d) NaH CO_3, CO, and NH_3

17) Density of alkaline earth metal is highest for.

a) Ba b) Be c) Ca d) Sr

18) The following hydride of Group 2 element is covalent

a) BeH_2 b) SrH_2 c) CaH_2 d) BaH_2

19) The composition of Elektron alloy is

a) 95% Mg + 5% Zn b) 5% Mg + 95% Zn

c) 50% Mg + 50% Zn d) 60% Zn + 40% Mg

20) Which hydroxide suspension of alkaline earth metal is used as antacid in medicines ?

a) Ra b) Ba c) Be d) Mg

21) Chlorophyll pigment in plant contains

a) Mg b) Ca c) Sr d) Ra

22) Chemical formula of Hydrolith is

a) LiH b) BeH_2 c) CaH_2 d) CsH

- **Questions of One Mark :**

1) State Modern periodic law.
2) Write general electronic configuration of alkali metal and alkaline earth metal.
3) Write name of fourth element of Group I
4) What is the oxidation state of sodium in Na_2O_2?
5) Give only chemical reaction for the preparation of sodium hydrogen carbonate from sodium carbonate.
6) Identify (A) and (B) in the following equation.

$$BeO + C + Cl_2 \xrightleftharpoons{600 - 800\ K} A + B$$

7) Which chloride of Group 2 is used as catalyst in Fridel Craft reaction?
8) Which alkali metals are very important and play a vital role in Biological system ?

9) In diagonal relationship with respect to aluminium, which carbide of alkaline earth metal of Group 2 gives methane?

10) Which compound of lithium is used in air conditioning plants to regulate humidity?

11) Which ion of Group 1 element permit the heart muscles to relax between the beats ?

12) Which compound of sodium is used to make spongy cake and bread?

13) Write use of caesium.

14) In Wurtz synthesis, which element of Group 1 is used?

15) Which compound of alkali metal is used for preservation of meat and fish?

16) Why elements of Group 2 are called alkaline earth metals ?

17) Which alkaline earth metal is diagonally related with lithium?

18) Why alkali metals are reactive ?

19) Write chemical equation when sodium amalgam is treated with water ?

20) Why K_2CO_3 cannot be prepared by Solvay process ?

21) Write name of superoxide of alkali metal which is used as a source of oxygen in sub marine, space shuttles and in emergency breathing apparatus.

22) Thermal decomposition of some compounds of alkaline earth metals in presence of CO_2 gives BeF_2. Write chemical formula of compound.

23) Why controlled addition of CO_2 is required to prepare calcium carbonate by slaked lime

24) Write chemical equation when quick lime is heated with silica.

- **Questions of Two Marks :**

1) Write uses of washing soda.

2) Complete the following reactions.

a) $Be_2C + H_2O \rightarrow$ b) $Al_4C_3 + H_2O \rightarrow$

3) Write oxidation states of alkali metals and alkaline earth metals.

4) Write chemical formula of Hydrides of Lithium and Sodium used as powerful reducing agents.

5) Write cell reaction involved at cathode and anode during electrolysis of fused sodium chloride.

6) Write uses of lithium.

7) What is the action of HCl and H_2SO_4 on calcium carbonate? Write only balanced chemical equation.

8) What is the action of following on magnesium?

a) O_2 b) N_2

9) What happens when ?

i) Slaked lime is subjected to the action of chlorine

ii) Action of $LiAlH_4$ on $BeCl_2$

10) How is Baking Soda prepared ? Write chemical equation to prepare it. Write use of baking soda

- **Questions of Three Marks :**

1) Write anomalous behaviour of lithium.

2) Write three points of similarities between lithium and magnesium in terms of diagonal relationship.

3) Complete the equations.

a) $NaNO_3 \xrightarrow{\Delta}$

b) $Li_2CO_3 \xrightarrow{\Delta}$

c) $Na + NH_3 \xrightarrow{\Delta}$

4) Write two applications of baking soda and write equation of its hydrolysis.

5) Write anomalous behaviour of Beryllium.

6) What are the points of similarities between Beryllium and aluminium in terms of diagonal relationship?

7) How is quick lime prepared ? What happens when quick lime is treated with

a) Water

b) Carbon dioxide ?

8) What is soda lime?

Write biological importance of calcium.

9) Write biological importance of potassium. Write Compound of lithium used as a sedative in medicine.

10) Write name of alloys of magnesium used in aircraft construction. Write composition of magnesium used in medicine as an antacid.

11) Write electronic configuration of potassium and calcium. Does chlorides of lithium and magnesium are soluble in ethanol ?

12) Write chemical formula of Quick lime. What is the action of silica and phosphorus pentoxide on quick lime?

- **Questions of Five Marks :**

1) Give reasons

A) i) Lithium is different from rest of family members.

ii) Alkali metals are kept in kerosene oil

iii) Alkali metals tarnish in dry air.

B) What is the trend of reactivity of alkali metals down the group and write use of Lithium hydroxide.

2) How is washing soda prepared by Solvay process? Write chemical equations involved in it. Write uses of washing soda.

3) Write uses of Beryllium, Magnesium and calcium. What are the constituents of cement and mortar?

4) What is the action of following on calcium oxide.

i) NH_4Cl

ii) SiO_2

iii) P_4O_{10} ?

What is the name of substance produced when dry slaked lime is subjected to the action of chlorine? What is slaking of lime ?

■■■

Topic 11 : p - Block Elements

Multiple Choice Questions

Gr. 13 elements.

1) Borax is.....

a) $Na_2B_40_7$ b) $Na_2B_40_7\ 4H_20$

c) $Na_2B_40_7\ 7H_20$ d) $Na_2B_40_7\ 10H_20$

2) Sapphire is a mineral of

a) Cu b) Zn c) Al d) H_2O

3) Hoope's Process is used in the refining of

a) Al b) Zn c) Ag d) Cu

4) The number of electron present in the valency shell of group 13 elements is

a) one b) two c) three d) zero

5) Aluminium becomes passive in nitric acid because it -

a) is a nobel metal b) forms a thin flim of oxide

c) has positive reduction potential d) forms meta aluminate.

6) Al reduces most of the metallic oxide due to its greater affinity for.....

a) oxygen b) metals c) electron d) proton

7) Al dissolves in molten NaOH with the formation of.....

a) Sodium aluminate b) Sodium meta - aluminate

c) Aluminium hydroxide d) Alumina

8) Aluminium is mainly extracted from.....

a) magnetite b) bauxite

c) alumina d) haematite

9) **Which is not a mineral of aluminium ?**

a) Anhydrite b) Bauxite c) Corundum d) Diaspora

10) Aqueous solution of potash alum is....

a) alkaline b) acidic c) neutral d) soppy

11) Hybridization of boron in diborane is.....

a) sp b) sp^2 c) sp^3 d) sp^3d^2

12) Alumina is..... in nature

a) acidic b) basic c) amphoteric d) neutral

13) The purification method used for purification of bauxite ore containing high silica content as impurities is.....

a) Bayer's process b) Hall's process

c) Hoope process d) Serpeck's process

14) Tendency of catenation is strongest in

a) C b) O c) N d) Si

15) Metalloid among the following is

a) Si b) C c) Ge d) Pb

16) The element which forms neutral as well as acidic oxide is

a) Sn b) Si c) C d) P

17) An ionic compound is

a) CCl_4 b) $SnCl_2$ c) $SiCl_4$ d) $CeCl_4$

18) Good conductor of heat and electricity is.....

a) anthracite b) diamond c) charcoal d) graphite

19) Highest electronegativity among the following is of

a) C b) Si c) Sn d) Pb

20) Teflon is

a) Fluorocarbon b) Hydrocarbon c) Pesticide d) Insecticide

21) The hybridization of carbon in carbon monoxide is

a) sp^3 b) sp^2 c) sp d) dsp^2

22) Which compound is solid ?

a) CO_2 b) NH_3 c) PH_3 d) SiO_2

23) Which glass has the highest percentage of lead ?

a) Soda glass b) Flint glass

c) Pyrex glass d) Jena glass.

24) Silicon hydrides are named as

a) silicones b) silicates c) silicols d) silanes

25) The fraction by volume of carbon monoxide in producer gas is about.

a) $^1/_2$ b) $^1/_3$ c) $^1/_4$ d) $^2/_3$

26) Sesquioxide of lead is.....

a) PbO b) PbO_2 c) Pb_2O d) Pb_2O_3

27) In graphite, the sheets are held by .....

a) Ionic forces b) covalent forces

c) van der Waal's forces d) metallic forces

28) Oxides of silicon are.....

a) liquids b) solids c) gases d) semisolid

29) The general electronic configuration of Boron family is.....

a) ns^2np^1 b) ns^2np^2 c) ns^2np^3 d) ns^2np^4

30) With respect to electronic configuration which is the exceptional element in p-Block ?

a) He b) Ne c) Ar d) Kr

31) Element belongs to chalcogen family is ...

a) Boron b) Carbon c) Nitrogen d) Oxygen

32) Metalloid in Group 14 is

a) Selenium b) Gallium c) Lead d) Germanium

33) Soft metal in carbon family is .....

a) Tellurium b) Lead c) Antimony b) Indium

34) Maximum tendency of catenation is shown by.....

a) Carbon b) Silicon c) Germanium d) Tin

35) Chemical formula of Borax is .....

a) $Na_2[B_4O_5(OH)_4]\,8H_2O$ b) $Na_2B_4O_7.\,8H_2O$

c) $Na_2B_4O_7.\,6H_2O$ d) $Na_2B_4O_7.\,4H_2O$

36) Which of the following is a Lewis acid.....?

a) BCl_3 b) $MgCl_2$ c) $CaCl_2$ d) $BaCl_2$

37) Inorganic Benzene is.....

a) $B_3N_3H_6$ b) $B_3N_3H_3$ c) B_2H_6 d) $B_3N_3H_2$

38) Alloy used in the preparation of permanent magnet is.....

a) Bronze b) Duralumin c) Magnalium d) Alnico

39) Water gas is prepared by passage of steam over hot coke. Its composition is

a) $CO + H_2$ b) $CO + N_2$ c) $CO + X_2$ d) $CO + H_2O$

40) Producer gas is obtained by passage of air over hot coke, its composition is....

a) $CO + H_2$ b) $CO + O_2$ c) $CO + N_2$ d) $CO + O_3$

41) Boron when heated with carbon forms carbide. Molecular formula of carbide is.....

a) B_3C b) B_4C c) B_4C_4 d) B_2C_3

42) When Borax is heated with CoO on a loop of platinum wire a blue coloured bead is obtained. The Composition of bead is.....

a) $Co(BO_2)_3$ b) $Co(BO_2)_2$ c) B_2O_3 d) CoO

43) The general electronic Configuration of chalcogen family is.....

a) ns^2np^1 b) ns^2np^2 c) ns^2np^3 d) ns^2np^4

44) Which element of Group 13 shows allotropy ?

a) Boron b) Sulphur c) Carbon d) Phosphorus

45) Stable hydride of Group 13 is of

a) Aluminium b) Gallium c) Indium d) Boron

- **Questions of One Mark :**

1) Write Valence shell electronic configuration of p- Block elements.

2) Write the expected oxidation state of Boron family.

3) Write balanced chemical equation when boron is treated with Dinitrogen.

4) Write the names of oxides of Group 13 elements which is amphoteric in nature.

5) Pure boron does not react with water. Which elements of Group 13 evolve hydrogen with boiling water?

6) Write name of element of Group 13 which forms covalent compound.

7) Write the equation when boron combines with active metal like magnesium.

8) Write the equation when boron is fused with sodium hydroxide.

9) Write one equation which indicates powerful reducing behaviour of boron.

10) Write molecular formula of orthoboric acid.

11) Write chemical formula of inorganic benzene.

12) Draw structure of Borazine / Borazole.

13) Chloride of Group 13 element is used as a catalyst in Fridel Craft reaction. Write the name of substance.

14) Give reason, Aluminium become passive when heated with conc. HNO_3

15) Give reason, Ionisation Enthalpy increases from tin (Sn) to lead (Pb).

16) Give reason, stability of + 4 oxidation state decreases while that of + 2 oxidation state increases for carbon family.

17) Write chemical composition of cassiterits.

18) Write uses of aluminium.

19) Write name of element from Group 14 which is soft with low melting point.

20) Define catenation.

21) Red form of PbO is called litharge write the name of yellow form of PbO.

22) Define allotropes.

23) Which element of carbon family does not show catenation ?

24) Write compound of carbon which is used as refrigerant under the name Freon.

25) Write use of pyrene.

26) Write chemical formula of sodium zeolite.

27) Write chemical equation when calcium carbide is treated with water.

- **Questions of Two Marks :**

1) How is Borax preoared from colemanite.

2) Complete the following equation.

$Na_2 B_4O7.10 H_2O \xrightarrow{\Delta} A \xrightarrow{\Delta} B + B_2O_3$

3) What is the action of CO_2 and Silica on Boron?

4) Does Boron reacts with water ? What happens when boron is treated with carbon?

5) Write chemical equations involved when boron is heated with Nitric acid and sulphuric acid.

6) Identify A and B in the following.

$H_3BO_3 \xrightarrow{\Delta} A \xrightarrow{\Delta} B$

7) Write two uses of Boric acid. What is the action of NaOH on Boric acid ?

8) How is diborane prepared from

i) Sodium borohydride

ii) Boron trifluoride.

9) How is borazine prepared from diborane.

10) Draw structure of diborane.

11) Write composition of cassiterite and galena.

12) What is inert pair effect ? What is the trend of oxidation state in heavier element for group 14?

13) Discuss reactivity of Group 14 towards water.

14) Give classification of amorphous carbon.

15) Write composition of water gas and producer gas.

16) Explain poisoning effect of Carbon monoxide with respect to human life.

17) What are the types of zeolites? Write application of zeolite.

18) Explain the formation of silicones.

- **Questions of Three Marks :**

1) What is the action of following on Boron

i) Carbon

ii) Carbon dioxide

iii) Nitrogen.

2) Write anomalous behaviour of boron.

3) How is orthoboric acid prepared from

i) Borax

ii) Colemanite ?

Write uses of Boric acid.

4) Give classification of allotropic modification of carbon.

5) Explain structure of diamond on the basis of hybridisation.

6) What are the points of differences between carbon and other members of family of group 14?

7) Write composition of feldspar and mica, draw structure of SiO_4^{4-} unit in Silicate.

- **Questions of Five Marks :**

1) How is carbon monoxide prepared from

i) Formic acid

ii) Oxalic acid

iii) Carbon ?

What is the action of carbon monoxide on Nickel and Iron?

2) How is carbon dioxide prepared from

i) Calcium carbonate

ii) Methane ?

Discuss role of CO_2 during photosynthesis. Write use of Graphite.

3) Silica is attacked by HF and NaOH. Write chemical equation. What are silicones? Write uses of silicones.

4) Draw structure of SiO_2. Give method of preparation of $SiCl_4$. Why CCl_4 is not hydrolysed by water while $SiCl_4$ is hydrolysed. Write chemical equation when $SiCl_4$ undergoes hydrolysis.

■■■

Topic 12 : Basic principle and techniques in organic chemistry

Multiple Choice Questions

---

1. The technique used to make pure water from a solution of common salt in water is .....

a) Filtration b) Distillation

c) Sublimation d) Steam distillation

2. The sodium fusion extract of an organic compound on acidification with acetic acid and addition of lead acetate solution gave a black precipitate. The organic compound contains .....

a) Nitrogen b) Halogen

c) Sulphur d) Phosphorus

3. The empirical formula of a compound is CH_2. It is .....

a) alkane b) alkene c) alkynes d) Arenes

4. The empirical formula of a compound is CH_2O and its vapour density is 30. The molecular formula of the compound is.....

a) $C_2H_4O_2$ b) $C_2H_6O_2$ c) $C_2H_2O_2$ d) C_2H_4O

5. In Victor Mayer method O.2 gm of an organic compound displaced 56 ml of air at STP. The molecular mass of compound is....

a) 56 b) 44 c) 80 d) 28

6. 0.5 gm of hydrocarbon gave 0.9 gm of water on combustion. The percentage of carbon in hydrocarbon is .....

a) 60.6 b) 28.8 c) 80.0 d) 68.6

7. The best method for separation of benzoic acid and naphthalene from their mixture is .....

a) fractional crystallisation b) crystallisation

c) distillation d) sublimation

8. How are benzene and chloroform separated from their mixture ?

a) Fractional distillation b) Sublimation

c) Distillation d) Differential extraction

9. Sodium nitroprusside, when added to sodium fusion extract of sulphide ion gives a

a) blood red colouration b) black precipitate

c) prussian blue colouration d) violet colouration

10. Dehydrohalogenation of an alkyl halide is.....

a) nucleophillic substitution reaction b) elimination reaction

c) rearrangement reaction d) electrophillic substitution reaction

11. The hybridisation of carbon atom in C-C single bond in $HC \equiv C - C = CH_2$ is...

a) $sp^3 - sp^3$ b) $sp^2 - sp$ c) $sp - sp^2$ d) $sp^2 - sp^2$

12. Which of the following represents neopentyl alcohol ?

a) $CH_3 - CH(CH_3) - CH_2 - CH_2 - OH$

b) $(CH_3)_3 C - CH_2 - OH$

c) $CH_3 - (CH_2)_3 - OH$

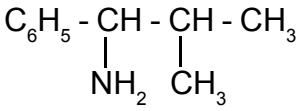
d) $CH_3 - CH_2 - CH(OH) - CH_3$

13. Isomers which can be interconverted through rotation around a single bond are...

a) conformers b) diastereomers

c) enantiomer d) position isomer

14. The IUPAC name of the compound



a) 1- Amino, - 1- phenyl, - 2- methyl propane

b) 1- Amino, - 2- methyl, - 1- phenyl propane

c) 1- Phenyl, - 1- amino, - 2- methyl propane

d) 1- Isopropyl, - 1- phenyl methenamine

15. The number of isomers of dibromo derivative of an alkene having molar mass 186 g mol^{-1} is (At mass of C = 12, H = 1 and Br = 80)

a) two b) three c) four d) six

16. Which of the following functional group shows + I effect ?

a) - OH b) - OCH_3 c) - COOH d) - CH_3

17. Which of the following is the most stable carbocation.

a) $^{+}CH_3$ b) R - $^{+}CH_2$ c) $R_2{}^{+}CH$ d) R_3C^{+}

18. Resonating structure of a molecule should not have....

a) identical arrangement of atoms b) nearly same energy contents

c) identical bonding d) the same number of paired electrons

19. The displacement of Pi electrons in a multiple bond in presence of attacking reagent is called.

a) inductive effect b) electrometric effect

c) resonance d) hyper conjugation

20. Which of the following is an electrophile ?

a) BF_3 b) CO_2 c) H_2O d) NH_3

21. Which of the following series contains only nucleophiles ?

a) H_2O, SO_3, H_3O^+ b) NH_3, H_2O, R - OH

c) NH_3, H_2O, $AlCl_3$ d) CN^-, SO_3, OH^-

22. Hyper - Conjugation effect is also known as...

a) no - bond effect b) Kharash - Myo effect

c) inductive effect d) electrometric effect

23. The total number of tertiary carbon atom in 4, 5 dimethylhexan - 2 - ol is/ are

a) two b) three c) one d) four

24. How many sigma and pi bonds are there in the molecule of tetra cyno ethylene?

a) Nine sigma and nine pi bonds. b) Nine sigma and seven pi bonds.

c) Five sigma and nine pi bonds. d) Five sigma and eight pi bonds.

25. In which of the following functional isomerism is not possible?

a) Alcohols b) Aldehyde c) Alkyl halide d) Cyanides

26. The correct representation involving a heterolytic fission of methyl bromide is .....

a) $H_3C - Br \longrightarrow {}^+CH_3 + Br^-$

b) $H_3C - Br \longrightarrow {}^+CH_3 + Br^-$

c) $H_3C - Br \longrightarrow {}^-CH_3 + Br^+$

d) $H_3C - Br \longrightarrow CH_3 + Br$

- **Questions of One Mark :**

1. Write an example of Geometrical isomerism.
2. What is resonance energy ?
3. What is heterolytic cleavage?
4. What is functional isomerism?
5. Name a suitable technique of separation of the components from a mixture of calcium sulphate and camphor.
6. Name the reagents used in the following reactions

   a) $(CH_3)_2\ \underset{\underset{Cl}{|}}{C} - CH_2 - CH_3 \longrightarrow (CH_3)_2\ C{=}\ CH - CH_3$

   b) $H_3C - \underset{\underset{O}{\|}}{C} - CH_3 \longrightarrow CH_3 - CH_2 - CH_3$
7. Ethyl cation is stabilised by hyper conjugation Explain.
8. What is the use of Liebig's test ?
9. Why is it necessary to use aceticacid for acidification of sodium extract for testing sulphur by lead acetate test and not by sulphuric acid ?
10. Define the following terms with suitable example.

    i) Nucleophile ii) Electrophile iii) Free Radical

    iv) Carbanion v) Carbocation
11. Arrange the following carbocations in the decreasing order of their stability

    a) $(C_6H_5)_3\ C^+$

    b) $CH_3 - {}^+CH - CH_2 - CH_3$

    c) $(CH_3)_3\ C - {}^+CH_2$

    d) $CH_3 - {}^+CH_2$

- **Questions of Two Marks :**

1. Draw the structures of cis-trans isomers of the following compounds

   a) CHCl = CHCl b) $C_2H_5C(CH_3) = C(CH_3)C_2H_5$

2. Draw a neat labelled diagram of simple distillation process.

3. The percentage composition of an organic compound has C=10.06%, H=0.84% and Cl = 89.10% Calculate the molecular formula of the compound (V.D. = 60).

4. Explain importance of organic chemistry in plastic and food industries.

5. Explain the term homolysis with suitable example.

6. Distinguish between carbocation and carbanion.

7. Define following terms

   a) empirical formula

   b) molecular formula

8. Write a note on resonance.

9. What is chromatography and Rf Value?

10. Determine the empirical formula of an oxide of iron which has 69.9% iron and 30.1% dioxygen by mass.

11. Draw bond line structures for the following compounds

    a) $CH_3 - CH = C(CH_3)_2$

    b) $CH_2 = CH - CH = CH - CH_3$

12. Why is Wurtz reaction not preferred for preparation of alkanes containing odd numbers of carbon atoms?

13. Explain the term Hyperconjugation with suitable example.

- **Questions of Three Marks :**

1. Explain the process of determination of boiling point of an organic compound with neat labelled diagram.
2. State principle of the following techniques by taking an example

   a) Steam distillation

   b) Chromatography
3. What is resonance energy, explain.
4. What is inductive effect, explain with suitable example.
5. Differentiate between the principle of estimation of nitrogen by Duma's method and Kjeldahl's method.
6. Explain Carius method for estimation of halogen in an organic compound.
7. What are the rules for drawing resonating structures?
8. Write three steps for determination of empirical formula of an organic compound.
9. What are the characteristics of homologus series?
10. Explain geometrical isomerism with suitable example.

- **Questions of Five Marks :**

1. Discuss, the chemistry of the Lassaigne's test.
2. Describe the principle of estimation of phosphorus and oxygen in an organic compound.
3. State general characteristics of organic chemistry.
4. Give classification of organic compound with suitable example.
5. Explain fractional distillation with neat labelled diagram.
6. Define following terms

   a) Inductive effect

b) Electromeric effect

c) Hyperconjugation

d) Empirical formula

e) Molecular formula

7. A welding fuel gas contains carbon and hydrogen only. Burning a small sample of it in oxygen gave 3.38 g of CO_2 0.690 g of H_2O and no other product. A volume of 10L at STP of this gas is found to weigh 11.6 g Calculate

i) empirical formula

ii) molecular mass of gas

iii) molecular formula

■■■

Topic 13 : Alkanes
Multiple Choice Questions

1. Common component of mangoes, the cyclic alkanes is.....

a) cyclobutane b) cyclopentane

c) cyclohexane d) cycloheptane

2. In Alkanes carbon atoms are linked together by.....

a) ionic bond b) electrovalent bond

c) covalent bond d) mettalic bond

3. Energy required to rotate ethane molecute about carbon - carbon bond is called.....

a) potential energy b) kinetic energy

c) torsional energy d) rotational energy

4. Alkane obtained by fusion of sodalime with sodium acetate is.....

a) Methane b) Ethane c) Propane d) Butane

5. Alkane obtained by catalytic reduction of propyne using Raney - Nickel is.....

a) Ethane b) Propane c) Butane d) Methane

6. Lowest energy containing conformation of ethane is.....

a) eclipsed b) staggered c) skew d) gauche

7. Halogenation of alkane proceeds through mechanism of.....

a) free radical b) electrophilic substitution

c) nucleophilic substitution d) ionic

8. Maximum number of isomers possible for C_6H_{14} are.....

a) 3 b) 4 c) 5 d) 6

9. For aromatisation minimum number of C-atoms required are.....

a) 4 b) 5 c) 6 d) 7

10. In alkane, the hybridisation of carbonatom is.....

a) sp b) sp^2 c) sp^3 d) sp^3d

11. Sixth member of alkane series is.....

a) C_6H_{10} b) C_6H_{12} c) C_6H_{14} d) $C_6H_{14}O$

12. Possible Isomerism in alkane is.....

a) chain isomerism b) position isomerism

c) functional isomerism d) geometrical Isomerism

13. Decarboxylation of sodium propionate gives.....

a) ethane b) propane c) butane d) pentane

14. Among the following boiling point is highest for.....

a) ethane b) propane c) butane d) 2-Methyl propane

15. General molecular formula for alkane is.....

a) C_nH_{2n} b) C_nH_{2n-1} c) C_nH_{2n-2} d) C_nH_{2n+2}

16. Neopentane among following is.....

a) $CH_3 - (CH_2)_3 CH_3$ b) $(CH_3)_2 CH-CH_2-CH_3$

c) $C_2H_5 -CH_2 -C_2H_5$ d) $(CH_3)_4C$

17. When ethyl iodide is heated with metallic sodium in presence of dry ether alkane obtained is.....

a) ethane b) propane c) butane d) methane

18. Alkanes show conformations due to free rotation about C-C

a) sigma bond b) π -bond c) ionic bond d) electrovalent bond

19. LPG, CNG and LNG contain members of alkane ranging from

a) C_1 to C_4 b) C_6 to C_8 c) C_{15} to C_{18} d) C_{29} to C_{31}

20. In alkanes carbon atoms are linked together by

a) ionic bond b) covalent bond c) co-ordinate bond d) metallic bond

21. General molecular formula for alkane is -

a) C_nH_{2n} b) C_nH_{2n+2} c) C_nH_{2n-2} d) C_nH_n

22. Molecular formula of an alkane containing 15 carbon atoms is

a) $C_{15}H_{30}$ b) $C_{15}H_{32}$ c) $C_{15}H_{28}$ d) $C_{15}H_{15}$

23. A hydrocarbon molecule represented by using lines, carbon-carbon bonds in a zig-zag manner is known as

a) molecular fermula b) structural formula

c) electronic formula d) bond-line formula

24. Molecular formula of wood spirit is

a) CH_3OH b) C_2H_50H c) C_3H_7OH d) C_4H_90H

25. Acid found in red ant is

a) formic acid b) acetic acid c) oxalic acid d) propionic acid

26. Major product of chlorination of mehtane with limiting supply of chlorine gas in presence of diffused sunlight is

a) CH_3Cl b) CH_2Cl_2 c) $CHCl_3$ d) CCl_4

27. Candles are constituents of parrafin wax, contain solid alkanes ranging from

a) C_1 to C_4 b) C_6 to C_8 c) C_{17} to C_{20} d) C_{21} to C_{30}

28. Incomplete cambusition fo alkanes in limited amount of air produces

a) carbon black b) carbon White

c) carbon monoxide d) carbon dioxide

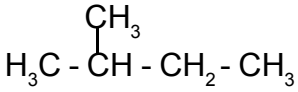
29. Undecane secreted by cockroaches attract opposite gender of its species contain carbon atoms

a) 11 b) 12 c) 13 d) 14

- **Questions of One Mark :**

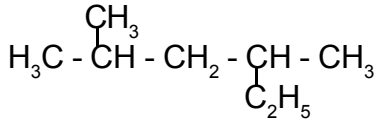
1. Suggest molecular formula for an alkane having molecular mass 142
2. Write molecular formula for alkane containing carbon atoms 21 & 31 respectively.
3. Draw

   a) Electronic structure & b) Dash structure for ethane.
4. How many primary, secondary & tertiary carbon atoms are three in following structure?



5. Write name & structure of alkane having minimum number of C-atoms containing quaternary C-atom.
6. Draw structures of.....

   a) 1- Ethyl - 2 - Methyl cyclopentane b) 2 - Ethyl - 1, 1 - dimethyl cyclohexane
7. Write a reaction to prepare ethane from ethy bromide by using Zn - Cu couple & alcohol.
8. Write decarboxylation reaction of anhydrous sodium salt of propionic acid with sodalime.
9. Write IUPAC name of following structure



10. Write molecular & structural formula for compound 2 - methylbutane.
11) Name the alkane which is secreted by cockroaches help to attract opposite gender of its species.

Q. 12) Name two alkanes, which are used for the manufacture of polymers.

Q. 13) Give one example each of (I) Domestic fuel, (ii) Automobile fuel.

Q. 14) Give a short classification of class of hydrocarbon.

Q. 15) Alkanes do not undergo chemical reactions easily, justify.

Q. 16) Write (i) general moecular formula of alkane (ii) molecular formula of alkane containing 25 carton atoms.

Q. 17) Draw structure of (i) n- butane (ii) isobutane.

Q. 18) Write correct IUPAC name of alkane, 2 -ethylpropane, which is wrongly written

Q. 19) Write total number of primary, secondary and tertiary carbon atoms in isopentane molecule.

Q. 20) Name the alkane obtained by decarboxylation of sodium propionate.

Q. 21) Write chemical equation for combustion of methane.

Q. 22) Write structure of the isomer of pentane that on chlorination gives only one monochloro derivative.

- **Questions of Two Marks :**

1. What are hydrocarbons? Write full form of CNG & LNG.

2. Write name & molecular formula of alkanes having number of C- atoms 5 & 6.

3. What is structural difference between Sawhorse projection & Newmann projection, for ethane.

4. Write correct structure of.....

   a) 3 - Ethyl - 4 - methylhexane

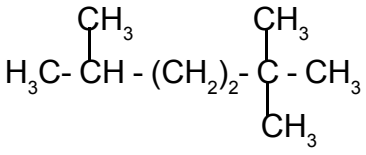
   b) 2, 2, 3 - Trimethylbutane.

5. Write the reaction when ethyl bromide is heated with sodium metal in etheral solution.

6. Predict the product obtained when n-Hexane is heated under 10-20 atm pressure, at about 773K in presence of Cr_2O_3.

7. Write the reactions for combustion of methane & ethane.

8. Write the total number of primary, secondary, tertiary & quaternary c- atoms in following structure.....



9. Define.....

   a) Conformations

   b) Torsional Energy.

10. Why branched chain isomers have lower boiling point than straight chain isomers ?

11. Explain isomerism Write all possible isomers of butane.

12. Write (a) structural formula, (b) Condensed formula for parent hydrocarbon n-butane.

Q. 13) Indicate bond line formula of butane with explaining its meaning.

Q. 14) Write complete structural formula condensed structural formula and bond line formula of isoheptane.

Q. 15) Write all possible structural formulae of alkane containing five carbon atoms & classify them straight chain or branched chain.

Q. 16) Define conformations. Draw staggered and eclipsed conformation structure for ethane.

Q. 17) Define torsional energy of ethane molecule. Mention relation between torsional energy and stability of conformation.

Q. 18) Define alkyl group. Draw structure of (i) isobutyl group (ii) sec-butyl group

Q. 19) Draw IUPAC names and structures of (i) Isohexne (ii) Neo-hexane

Q. 20) Write (i) condensed formula (ii) bond- line formula for isohexane

Q. 21) Write balanced equation showing catalytic reduction of (i) propene (ii) propyne.

Q. 22) Convert ethyl chloride into (i) ethane & (ii) n-butane

Q. 23) Predict the alkanes obtained by (i) action of sodium metal on ethereal solution of n-butyl bromide (ii) catalytic hydrogenation of isobutylene.

Q. 24) For isomeric alkanes, branched chain isomers have lower boiling points than a straight chain isomer, Justify reason.

Q. 25) Give one example each of (a) molecular formula (b) structural formula

(c) electronic formula & (D) bond line formula.

- **Questions of Three Marks :**

1. Write correct, IUPAC names for wrongly named alkanes.....

   a) 4 - Methylpentane b) 2- Ethylbutane,

   c) 2 - Ethylhexane.

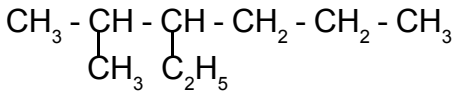
2. Explain, chlorination of methane with free radical mechanism, by indicating intermediate steps.

3. How is ethane obtained from its lower alkyl halide methyl iodide? Can methane be obtained by a similar method?

4. Write a note on "structural isomerism" exhibited by alkanes.

5. Write different possible isomeric structures of pentane.

   Write IUPAC rules which will be used to write IUPAC name of following alkane.



Q. 6) Define Decarboxylation. Methane is formed by decarboxylation of sodium acetate. Write reaction for ethane formation by decarboxylation of sodium propionate. Write two uses of methane

Q. 7) i) Write balanced equation indicating formation of butane from ethyl bromide in presence of dry ether and metallic sodium.

ii) Write importance of this reaction.

iii) Can alkane with carbon atom one, be prepared by the method?

Q. 8) Indicate by equation preparation of ethane, starting from

i) Ethyne

ii) Sodium propionate

iii) Reducing ethyl bromide.

Q. 9) Write complete structural formula, bond line formula and IUPAC names of all three isomeric alkanes, represented by formula C_5H_{12}

Q. 10) i) Write down complete products of vapour phase nitration obtained, by heating mixture of propane and concentrated nitric acid at about 423 K to 698 K.

ii) Write the thermal decomposition products, obtained by strongly heating propane. Hence, explain (i) Dehydrogenation and (ii) Cracking, involved.

Q. 11) i) Write bond line formula and IUPAC name for a) Neo-pentane b) Neo-hexane.

ii) Write correct IUPAC names of following wrongly named alkanes -
a) 4 - Methylpentane b) 3, 5 - Dimethylhexane.

iii) Write the structures of all possible alkanes and alkenes that would be produced on thermal cracking of n-Butane.

- **Questions of Five Marks :**

1. How will you obtain propane from a) propyne b) Sodium butanoate ?

Identify compounds 'A', 'B' and 'C' in following sequence of reactions & rewrite complete equations.

'A' $\xrightarrow[\Delta]{NaoH/Cao}$ 'B' $\xrightarrow[\Delta]{Br_2/AlBr_3}$ 'C' $\xrightarrow[\Delta]{Na/Dryether}$ n - Butane.

2. What is halogenations of alkanes? Describe only steps involved in mechanism of chlorination of methane.

Mention two uses of methane.

3. a) Using Newman projection formula, represent staggered & eclipsed confirmation of ethane.

b) Draw only structures of different alkyl groups derived from butane & pentane.

4. a) Write structures of following compounds.

i) 3, 4, 5 - Trimethylheptane.

ii) 3, 5 - Dimethylheptane.

iii) 2, 3 Dimethylbutane

b) Assign IUPAC names to following structures.

i) $H_3C - \underset{\displaystyle CH_3}{\underset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - CH_3$

ii) $CH_3 - (CH_2)_2 - \underset{\displaystyle CH_2}{\underset{|}{\underset{\displaystyle CH_3}{\underset{|}{CH}}}} - (CH_2)_2 - CH_3$

Q. 5) Write (i) structural formula

(ii) IUPAC name for neohexane.

(iii) Indicate decarboxylation of sodium propionate with equation.

(iv) Write only names of chlorination product of methane in presence of diffused sunlight.

Q. 6) i) Describe mechanism of halogenation of methane, with steps involved only.

ii) Predict product obtained by aromatization of n-hexane at 773 K, 10-20 atm in presence of chromium oxide as catalyst iii) Write complete structural formula and IUPAC name of alkanes a) $(CH_3)_2 C (C_2H_5)_2$ b) $(C_2H_5)_4C$

Q. 7) i) Write structure of alkyl groups - i) 2- methylpropyl ii) 2, 2- Dimethylpropyl.

ii) Write name & structure of alkane obtained i) By catalytic reduction of propyne ii) Decarboxylation of sodium propionate iii) By reduction of n-butyl bromide with Zn-Cu/ alcohol.

iii) Write structural formula of 2, 3 - Dimethylbutane.

Q. 8) a) Bring out following conversions form ethane

i) Ethyl bromide ii) Nitroethane iii) Ethyl alcohol

b) Give only chemical reaction indicating aromatization of n-hexane.

c) Write two uses of alkanes.

■■■

Topic 14 : Alkenes
Multiple Choice Questions

Q. 1) The number of pi-bonds present in ethene molecule is

a) Only one b) Two c) Three d) Four

Q 2) Total number of electrons shared between doubly bonded carbon atoms in propene is

a) 2 b) 4 c) 6 d) 8

Q 3) Hybridization of carbon atom carrying double bond in alkenes is

a) sp b) sp^2 c) sp^3 d) sp^3d

Q 4) Alkene exhibiting geometrical isomerism among the following is

a) Ethene b) Propene c) But-1- ene d) But-2-ene

Q 5) Maximum number of possible structural isomers for molecular formula C_4H_8 are -

a) 2 b) 3 c) 4 d) 5

Q 6) In dehydration of monohydric alcohols by alumina at 623K the hybridization of carbon atom changes from

a) sp^3 to sp^2 b) sp^3 to sp c) sp^2 to sp d) sp^2 to sp^3

Q 7) In addition of HBr to propene in presence of benzoyl peroxide major product obtained is

a) 1 - Bromopropane b) 2 - Bromopropane

c) 1,2 - Dibromopropane d) 1,3 Dibromopropane.

Q 8) In dehydration of butan -2 - ol, major product obtained is

a) But-1-ene b) But-2-ene

c) Propene d) 2 - Methylpropene

Q 9) Addition of hydrogen bromide to unsymetrical alkenes in presence of peroxide follows

a) free radial mechanism b) ionic mechanism

c) electrophilic substitution d) nucleophilic substitution

Q 10) Addition of hydrogen bromide to an unsymmetrical alkenes is an example of

a) eletrophilic addition b) nucleophilic addition

c) electrophonic substitution d) nucleophilic substitution

Q 11) An alkene, responsible for smell of oranges containing two carbon - carbon double bonds is

a) Limonene b) Isoprene

c) Ethene d) Propene.

Q 12) General molecular formula for alkene is

a) C_nH_{2n+2} b) C_nH_{2n-2}

c) C_nH_n d) C_nH_{2n}

Q 13) B - Carotene decomposes to typical vitamin. Vitamin undergoes number of chemical reactions in presence of light which is responsible for the ocular activity. Vitamin among following is

a) Vitamin - A b) Vitamin - C

c) Vitamin - D d) Vitamin - K

Q 14) Basic unit of natural rubber is obtained from alkene

a) ethene b) propene

c) isoprene d) isobutylene

Q 15) Zingiberene a ginger flavoring agent contains

a) one C=C b) Two C=C

c) Three C=C d) Four C=C

Q 16) For germination of seeds, flower maturation and ripening of fruits the alkene responsible is

a) ethene b) propene c) butene d) pentene

- **Questions of One Mark :**

Q. 1) Name the alkene & write its formula used for artificial ripening of fruits.

Q 2) Write structure of alkene which on ozonolysis produces only acetone.

Q 3) Write structure of aldehydes that are obtained on ozonolysis of But -1- ene.

Q 4) Write major difference that alkenes have, from alkane.

Q 5) Write the electronic structures of (a) Ethene (b) Propene.

Q 6) Write the name & structure of product obtained, by action of cold/ alkaline $KMnO_4$ on ethylene.

Q 7) Write only IUPAC name of structure, $H_3C\text{-}CH = CH\text{-}CH_3$

Q 8) Draw cis - & trans isomers of compound $CH_3\text{-}CH = CH\text{-}CH_3$

Q 9) Draw structure of position isomers exhibited by butene.

Q 10) Write balanced equation, indicating dehydration of n-propylalcohol by alumina at 623 K.

Q 11) State the conditions only under which n-propyl alcohol can be converted to propene.

Q 12) Suggest a simple chemical test to distinguish between propane & propene.

Q 13) Write name & formula of two alkenes undergoing polymerization process.

Q 14) Write name & structural formula of basic unit, from which natural rubber is obtained.

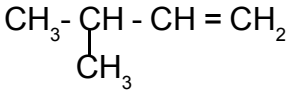
Q 15) Write name & structural formula of alkene, used sometimes as anesthetic.

- **Questions of Two Marks :**

Q. 1) How are following compounds prepared form ethene?

a) Ethyl alcohol b) Ethylene glycol

Q 2) Write down IUPAC rules explaining nomenclature of the compound, given below



Q 3) Write balanced reaction to explain Markownikoff's rule. Can presence of Benzoyl peroxide affect reaction products?

Q 4) Indicate by equation, following conversions.

a) Ethylene to ethyl alcohol

b) Ethyl alcohol to ethylene

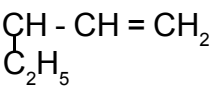
Q 5) Draw cist-trans isomers of but-2ene. Which structure among these is more stable? Give reason.

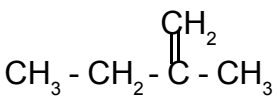
Q 6) Assign structures to following alkenes

a) 2 - Methylbuta -1, 3 - diene

b) 2, 5 - dimethylhept -3 - ene

Q 7) Write IUPAC names of following alkenes'.

a) 

b) 

Q 8) Draw structures of geometrical isomers of 3, 4 - Dimethylhex - 3 - ene

Q 9) Write IUPAC names of major product obtained by addition of HBr to Pent -1 ene in

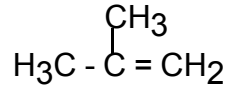
a) presence of peroxide

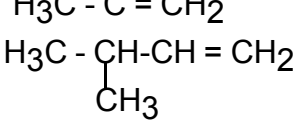
b) absence of peroxide

Q 10) Ethylene on treatment with cold and dilute alkaline $KMnO_4$ gives ethylene glycol. similarly, can ethylene glycol be obtained from acetylene? Indicate by equation.

Q 11) Explain, cis - trans isomerism exhibited by an alkene having molecular formula C_4H_8

Q 12) Using IUPAC rules of nomenclature, assign names to structure

a) 

b) 

Q 13) Lindlar's catalyst is used for partial reduction. Using Lindlar's catalyst obtain

(a) ethene from ethyne (b) Propene from propyne.

Q 14) Write name & formulae of alkenes which on ozonolysis give (a) only formaldehyde b) Mixture of formadehyde & acetaldehyde.

Q 15) Write two a) Chemical properties, b) uses of ethene

Q 16) Starting from ethylene prepare following compounds-

a) Ethyl alcohol

b) Polythene

- **Questions of Three Marks :**

Q. 1) Define isomerism. Write types of isomerism exhibited by butene.

Q 2) Show - a) Structural isomerism & b) geometrical isomerism with alkene having molecular formula C_4H_8.

Q 3) How is ethylene prepared form a) ethyl bromide b) ethyl alcohol c) ethylene dibromide?

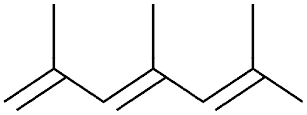
Q 4) Mention condition for cis-trans isomerism, for doubly bonded carbon atoms. Draw cis-trans isomerism of But - 2- ene. Can But -1- ene exhibit cis-trans isomerism?

Q 5) State Markownikoff's rule. Indicate products obtained by equation when propene reacts with HBr. Write IUPAC names of major product obtained in above reaction.

Q 6) Predict product obtained, on treatment of 2 - Methyl propene with

a) HBr b) HBr / Na_2O_2 c) Dilute H_2SO_4 / H_2O

Q 7) Considering following compound, answer the following questions



a) Write molecular formula of compound

b) Write structural formula and IUPAC name

c) How many sigma and pi - bonds are present in structure ?

Q 8) Define, polymerization. Indicate by equation, polymerization of ethene. Write two properties of polythene.

Q 9) Ethene on treatment with cold concentrated sulphuric acid followed by hydrolysis gives ethyl alcohol similar way indicate by equation formation of, isopropyl alcohol form propene. Write two uses of ethylene.

Q 10) Write structure & IUPAC name of different structural isomers of pentene.

- **Questions of Five Marks :**

Q. 1) (i) Write number of sigma & pi - bonds present in (a) ethene (b) propene
(ii) Explain C-C sigma bond in ethene is stronger than C-C Pi-bond in ethane

(iii) Indicate by equation vapour phase dehydration of n-propyalcohol to propylene, by Al_2O_3/ 623K

Q 2) a) Write down any two reactions of propylene, indicating presence of double bond

b) Write structure of isomeric alkenes that on catalytic hydrogenation give

i) isobutane ii) isopentane.

c) Write complete structural formula & bond line formula of

i) Buta - 1, 3 - diene ii) Penta -1, 2 -diene

Q 3) a) What is ozonolysis? Write reactants & products obtained when ozone gas is bubbled through propylene, followed by reduction with zinc dust and water. Predict product obtained if Zn/H_2O is not used with ozonide formed.

b) Indicate with equation product obtained when isobutylene is oxidized with acidic potassium dichromate.

c) Write two use of ethene.

Q 4) a) Write name and number of double bonds of alkene, responsible for the smell of lemons and oranges.

b) Write name and number of double bonds of alkene, responsible for decomposition of vitamin A for ocular activity

c) Write two chemical properties of alkenes.

d) Indicate by reaction products obtained, when

i) Ethyl alcohol and ii) propyl alcohol heated with 95% H_2SO_4 at 453 K.

Q 5) a) Write name and structures of alkene which on ozonolysis give following compounds : i) Formaldehyde

ii) Formaldehyde & acetone

iii) Acetone

b) Write name & structures of geometrical isomers of Hex - 3 - ene

c) Write name and structures of (i) structural isomers (ii) position isomers of alkene having molecular formula C_4H_8.

■■■

Topic 15 : Alkynes
Multiple Choice Questions

---

1. Cicutoxin, a poisonous substance found in

a) Pests b) Fungi

c) Water hemlock d) Chrysanthemum

2. Capillin found in

a) Pests b) Fungi

c) Water hemlock d) Chrysanthemum

3. Correct structural formula of cicutoxin is

a) $HO — (CH_2)_3 — C \equiv C — C \equiv C — (C_{10}H_{14}) — OH$

b) $HO — (CH_2) — C \equiv C — C \equiv C — (C_{10}H_{14}) — CH_3$

c) $H_3C — C \equiv C — C \equiv C — \overset{\overset{O}{\|}}{C} — C_6H_5$

c) $H_3C — C \equiv C — C \equiv C — \overset{\overset{O}{\|}}{C} — O — CH_2CH_3$

4. Oxy-acetylene flame used for cutting and welding of metal can generate temperature upto

a) 3073 K b) 2098 K c) 1000 K d) 1500 K

5. In acetylene, C ≡ C bond enthalpy is

a) 823 kJ mol^{-1} b) 723 kJ mol^{-1}

c) 623 kJ mol^{-1} d) 523 kJ mol^{-1}

6. In hybridized state, the electronegativity of carbon atom, increases in alkynes with increase in its percentage of

a) f - character b) d - character

c) s - character d) p - character

7. Which one of the following reactions indicate acidic nature of acetylene

a) $HC\equiv CH + 2\,H_2 \xrightarrow{\text{Raney Ni / }\Delta} H_3C - CH_3$

b) $HC\equiv CH + HCl \xrightarrow{HgCl_2} H_2C \equiv CH - Cl$

c) $2\,HC\equiv CH + 2\,Na \longrightarrow 2\,HC\equiv C - Na^+ + H_2$

d) $3\,HC\equiv CH \xrightarrow[873K]{\text{red hot iron tube}}$ 

8. Which of the following metals are used as a catalyst in the catalytic hydrogenation of both alkenes and alkynes?

a) Palladium b) Iron c) Zinc d) Copper

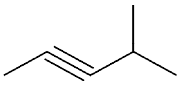
9. The major product of the following reaction is

$H_3C - C \equiv CH \xrightarrow[HgCl_2\ \Delta]{HCl\ (g)\ excess}$

a) $H_3C - \underset{\displaystyle Cl}{\overset{\displaystyle |}{C}} = CH_2$ b) $H_3C - CH = CH - Cl$

c) $H_3C - CH_2 - \underset{\displaystyle Cl}{\overset{\displaystyle Cl}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}} - H$ d) $H_3C - \underset{\displaystyle Cl}{\overset{\displaystyle Cl}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}} - CH_3$

10. The IUPAC name of the following structure is



a) 2 - Methylpent - 3 - yne b) 2, 2 - Dimethylbut - 2 - yne

c) 1, 4 - Dimethylpent - 3 - yne d) 4 - Methylpent - 2 - yne

11. Which statement is incorrect about but-1-yne?

a) It has no acetylenic hydrogen b) It reacts with soda-amide

c) It undergoes hydrogenation d) It undergoes halogenations

12. The major product of the reaction of 1,2-dibromobutane and excess of sodamide is

a) 2 - Bromobut - 1 - ene b) 1 - Bromobut - 1 - ene

c) But - I - yne d) 1, 2 - Butadiene

13. Which of the following is most acidic?

a) But -1 - yne b) But - 2 - yne

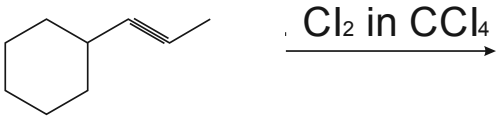
c) But -1 - ene d) Butane

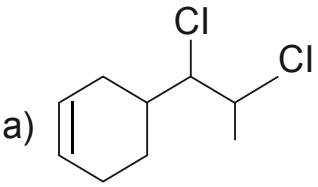
14. The product obtained after protonation of the reaction between acetylide anion and a ketone is

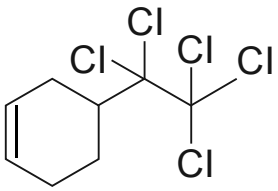
a) Carboxylic acid b) Primary alcohol

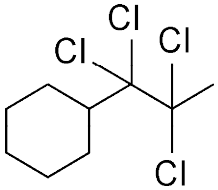
c) Secondary alcohol d) Tertiary alcohol

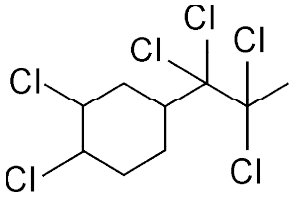
15. The final product of the following reaction is



a) 

b) 

c) 

d) 

16. Which one of the following alkynes exists in liquid state at a room temperature?

a) Ethyne b) But-1-yne

c) But-2-yne d) Propyne

17. The order of reactivity of hydrogen halides toward alkynes is

a) HCl > H Br > HI b) HI > HCl > H Br

c) H Br > HI > HCl d) HI > H Br > HCl

18. In the preparation of acetylene from calcium carbide and water, copper sulphate is used to remove

a) PH_3 and H_2S b) PH_3 and SO_2

c) H_2S and PCl_3 d) H_2S and SO_3

19. The proton (hydrogen atom) of terminal alkynes is acidic and can be removed by

a) NaOH b) NH_4OH

c) $Mg(OH)_2$ d) $NaNH_2$

- **Questions of One Mark :**

1. Hydrogen atom of ethyne is acidic in nature. Why?

2. Write the IUPAC name of the following

$$H_2C = CH — C \equiv CH$$

3. Define geminal dihalides.

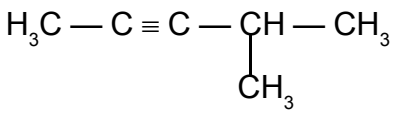
4. Define vicinal dihalides.

5. How many C-H sigma (σ) bonds are present in the given structure ?

$$H_2C = CH — C \equiv CH$$

6. Write balanced chemical equation for reaction between calcium carbide and water.

8. **Write the IUPAC name of the following compound.**



9. **Convert: Vinyl bromide into acetylene.**

10. **Give two uses of ethyne.**

11. **Write the chemical formula of Westron.**

12. **Draw the structure of polyethyne.**

13. **Alkynes do not exhibit geometrical isomerism while alkenes do so why?**

14. **Draw the structure of 5-ethyl - 2, 2 - dimethylhept - 3 - yne.**

15. **Predict the product of 4 H — C ≡ C — H** $\xrightarrow[873K]{\text{red hot Fe tube}}$

- **Questions of Two Marks :**

1. **Write the structures of product A and B in the following reactions:**

i) $H_2C{=}CH - Cl \xrightarrow{NaNH_2}$ **A** $\xrightarrow{Na}$ **B**

ii) $HC \equiv CH \xrightarrow[2\ Br_2]{\text{liquid}}$ **A** $\xrightarrow[\text{in alcohol}]{Zn}$ **B**

2. **What are vicinal dihalides?**

   What happens when ethylene dibromide is boiled with alcoholic caustic potash?

3. **What are germinal dihalides?**

   What happens when ethylidene dibromide is boiled with alcoholic caustic potash?

4. **Explain double dehydrohalogenation with suitable examples.**

5. **What is the action of the following on acetylene?**

   i) Bromine water

   ii) Liquid bromine?

6. **Convert:**

   i) Acetylene into ethylidene diiodide

   ii) Acetylene into glyoxal?

7. **What happens when -**

   i) Acetylene is passed through warm 40% H_2SO_4 in presence of 1% $HgSO_4$

   ii) Acetylene is passed through red hot iron tube at 873 K?

8. **Write two chemical reactions to show acidic nature of acetylene.**

9. **Convert methyl acetylene into methyl glyoxal.**

10. **Eplain one addition and one substitution reaction shown by alkynes.**

11. **Distinguish between ethane and ethyne? (Write FOUR points)**

12. **Complete the following reactions:**

   i) $H_3C - C \equiv C - CH_2 - CH_3 \xrightarrow{Br_2}$

   ii) $H_3C - C \equiv CH \xrightarrow[ii)\ Zn/H_2O]{i)\ O_3}$

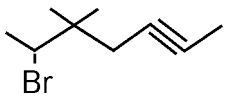
13. **Complete the following reaction (Two steps) :**

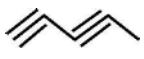
   $H_3C - C \equiv C - CH_3 \xrightarrow[Slow]{2HBr}$

14. **Complete the following reaction:**

   i) $H_3C - C \equiv CH \xrightarrow{excess\ liqBr_2}$

15. **Write the IUPAC name of the following bondline structures.**

   i) 

   ii) 

16. **Convert : Propyne into acetone.**

17. **Write two chemical reactions for the detection of terminal alkynes.**

- **Questions of Three Marks :**

1. Explain the formation of sigma (σ) and Pi (π) bond in acetylene with the help of diagram. Mention the hybrid state of two carbon atoms.

2. Write balanced equations for reaction between :

a) CaC_2 and water.

b) Ethylene tetrabromide and Zn in alcohol

c) Acetylene and sodamide.

3. Convert ethyne into:-

a) monosodium acetylide

b) trans-1,2-dibromoethene

c) ethane

4. Write chemical balanced equations for ozonolysis reaction of the following compounds:

a) Methyl acetylene

b) Dimethyl acetylene

c) Ethyl methyl acetylene

5. Arrange ethyne, ethane and ethene in increasing order of acidic behaviour and give reason for this behaviour.

6. What is the action of sodamide (1 mole) on:-

a) But-1-yne

b) Cyclohexylacetylene

c) But-2-yne?

- **Questions of Five Marks :**

1. Complete the reaction and Identify A, B, C, D and E.

$$H_3C - CH_3 \xrightarrow{\Delta} A \xrightarrow{Br_2/CCl_4} B \xrightarrow{alc.KOH} C \xrightarrow[\substack{liq.\ NH_3 \\ 196K}]{NANH_2} D \xrightarrow[873K]{\text{red hot Fe tube}} E$$

2 Complete the reaction and Identify A,B,C,D and E

$$H_3C - CH_3 \xrightarrow[Sunlight]{Cl_2} A \xrightarrow[\Delta]{alc.KOH} B \xrightarrow{Br_2/CCl_4} C \xrightarrow{alc.KOH} D \xrightarrow{Na} E$$

3. Compound A on reaction with allotrope of oxygen gives highly unstable compound which on reduction gives aldehyde B. B on reduction with lithium aluminium hydride gives dihydroxy compound C. C on strong heating gives compound D containing at least one triple bond. D on treatment with hydrochloric acid in presence of $HgCl_2$ gives only monochloroalkene E. Write the structures of A, B, C, D and E.

4. What are alkynes?

How is 4-Octyne prepared from starting compound which do not contain more than 3 carbon atoms?

5. Distinguish between but-1-yne and but-2-yne. (Write three points) Complete the following reaction :

■■■

Topic 16 : Aromatic compounds
Multiple Choice Questions

1. Friedrich August Kekule's structure of benzene was inspiration of a

a) Chemist b) Nature c) Dream d) Cloud

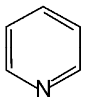
2. The total number of electrons present in one molecule of benzene are

a) 24 b) 42

c) 28 d) 30

3. Which one of the following is non-aromatic?

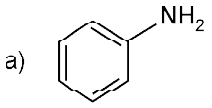
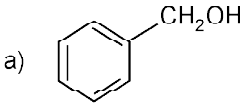
a)  b) 

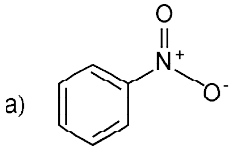
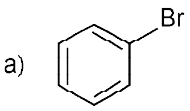
c)  d) 

4. Carbon carbon bond length in benzene is

a) 1.14 A^0 b) 1.40 A^0 c) 1.46 A^0 d) 1.04 A^0

5. In which one of the following structure, common and IUPAC name are same

a)  a) 

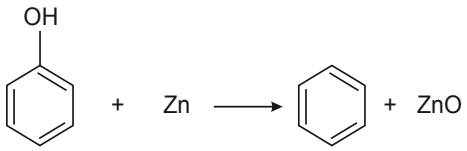
a)  a) 

6. Soda-lime is a mixture of

a) NaOH + CaO b) KOH + CaO

c) NaOH + MgO d) KOH + MgO

7. In the following reaction, Zn acts as



a) Dehydrating agent b) Reducing agent

c) Oxidizing agent d) Hydrating agent

8. In sulphonation of benzene, fuming sulphuric acid is used which helps in the formation of free

a) SO_3 b) SO_2

c) $-SO_3H$ d) $-OSO_3H$

9. In σ (sigma) complex or arenium ion, one of the carbon atom is —— hybridized.

a) sp^3d b) sp^3

c) sp^2 d) sp

10. Which one of the following group reduces the electron density in benzene ring and is meta directing group

a) $-NH_2$ b) -F c) $-NO_2$ d) $-CH_3$

11. Ortho - and para - directing group is

a) -CHO b) -CN c) $-SO_3H$ d) -OH

12. Which of the following is NOT associated with electrophilic aromatic substitution?

a) The formation of nitrobenzene

b) The formation of benzyne

c) The formation of bromobenzene

d) The formation of benzene sulphonic acid

13. With respect to the electrophilic aromatic substitution of benzene which of the statement is NOT true ?

a) A non-aromatic intermediate is formed

b) Benzene acts as an electrophile

c) A proton is lost in the final step

d) Resonance forms are important

14. Friedel-Crafts alkylation works very well

a) for primary chlorides

b) for tertiary chlorides

c) for acyl chloride

d) without a catalyst.

15. Lindane is used as

a) insecticide b) antiseptic

c) pesticide d) analgesic

16. The boiling point of benzene is

a) 320 K b) 300 K c) 353 K d) 298 K

17. Which one of the following is correct for aromatic compounds according to Huckels rule?

a) Have delocalised π electrons of 39, 40, 41

b) Have delocalised π electrons of 35, 36, 37

c) Have delocalised π electrons of 30, 34, 38

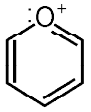
d) Have delocalised π electrons of 31, 32, 33

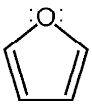
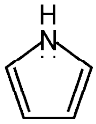
18. The group which makes the ring more reactive than benzene is

a) — NHCOR b) — NO_2

c) — CCl_3 d) — F

19. Which one of the following is non-aromatic compound?

a)  b) 

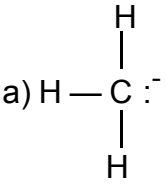
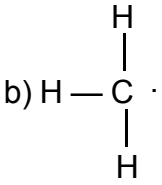
c)  d) 

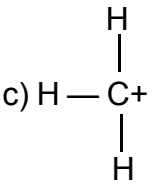
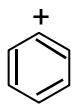
20. Which one of the following compounds is most reactive towards electrophilic nitration?

a) Toluene b) Benzene

c) Benzoic acid d) Nitrobenzene

21. Which of the following is an intermediate in the reaction of benzene with methyl chloride and anhydrous aluminium chloride?

a)  b) 

c)  d) 

22. In benzene molecule, six carbon atoms are connected to each other through :

a) one p - orbital per carbon atom

b) Two p - orbitals per carbon atom

c) four p - orbitals per carbon atom

d) three p - orbitals per carbon atom

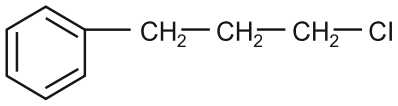
23. The p - orbital system in benzene contains:

a) 24 electrons b) 18 electrons

c) 12 electrons d) 6 electrons

- **Questions of One Mark :**

1. Write the IUPAC name of the following compound



2. What happens when benzene is treated with chlorine in dark in presence of anhydrous $AlCl_3$?

3. Convert - Sodium benzoate into benzene.

4. What are polycyclic aromatic hydrocarbons?

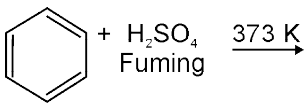
5. Write the IUPAC name of the product obtained by addition reaction of HBr to hex-1-ene in presence of peroxide.

6. Convert benzene into nitrobenzene?

7. Give reason : In Friedel-Crafts alkylation, the product formed is more nucleophilic than the reactant.

8. Give reason : In Friedel - Crafts acylation, the ketone product formed is always less reactive than the original molecule.

9. Complete the following reaction:



10. What happens when benzene is treated with bromine in presence of

anhydrous $FeBr_3$?

11. Give two examples of non - benzenoid aromatic compounds.

12. Write the name of the important source of benzene from which it is obtained.

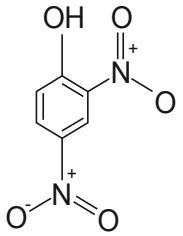
- **Questions of Two Marks :**

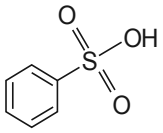
1. Write the chemical equations for the following reactions:

a) Friedel-Craft's alkylation

b) Friedel - Craft's acylation

2. Write the IUPAC names of the following compounds:

i) 

ii) 

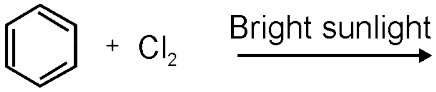
3 Give reason for the following:

a) C-C bond length in benzene ring is 140 pm which is in between C-C single bond 154pm and C=C double bond 133 pm.

b) Benzene does not decolourize alkaline $KMnO_4$

4. Differentialte between aromatic and aliphatic compounds.

5. Complete the following reaction and write use of the product formed in the reaction.



6. Draw the resonating structures of phenol.

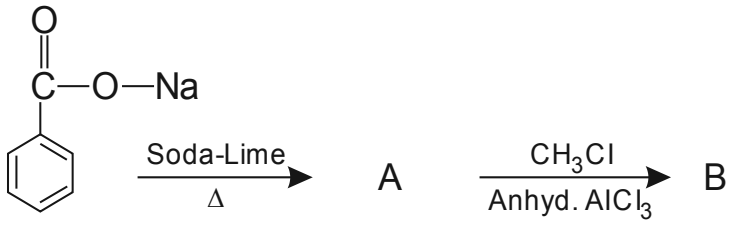
7. Draw the resonating structures of nitrobenzene.

8. Explain the ozonolysis of benzene.

9. Convert benzene into cyclohexane?

10. **-NO_2 group attached to benzene ring is meta directing but -OH group is ortho - and para-directing. Explain why?**

11. **Identify 'A' and 'B' in the following reaction :**



12. **Convert**

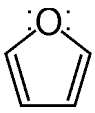
    a) Phenol into acetophenone

    b) Benzene into m-chloro nitrobenzene

13. **Write the criteria of aromaticity.**

14. **Using the criteria of aromaticity, predict whether following compounds are aromatic or not.**

15. **Calculate the value of 'n' by Huckel rule and state the following compound is aromatic or not.**



16. **What are activating groups, explain it with example.**

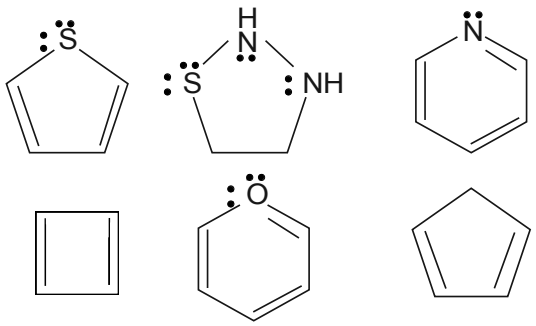
17. **Convert : n- hexane to benzene.**

18. **Define : a) aromatic hydrocarbons B) aromaticity.**

19. **Fluorine deactivates the benzene ring but it is ortho and para directing. Justify the statement.**

- **Questions of Three Marks :**

1. Classify the following compounds into aromatic and non-aromatic.



2. What happens when -

i) Benzene is treated with chlorine in dark in presence of anhydrous $FeCl_3$.

ii) Benzene is treated with ethyl chloride in presence of anhydrous $AlCl_3$.

iii) Phenol is heated with zinc dust?

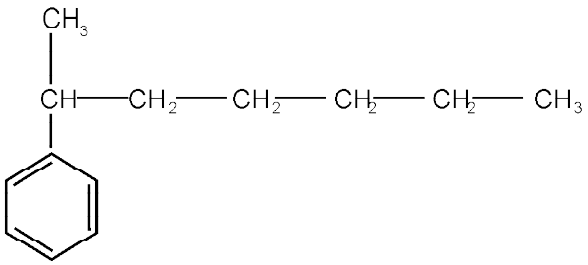
3. What are electron withdrawing groups? Write two examples.

Why are they meta-directing?

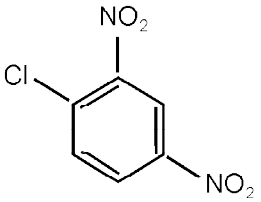
4. What are the necessary conditions for any system to be aromatic?

5. Write the IUPAC name to the following compounds:

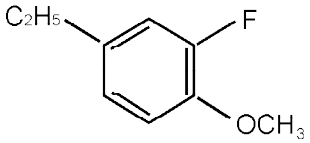
a)



b)



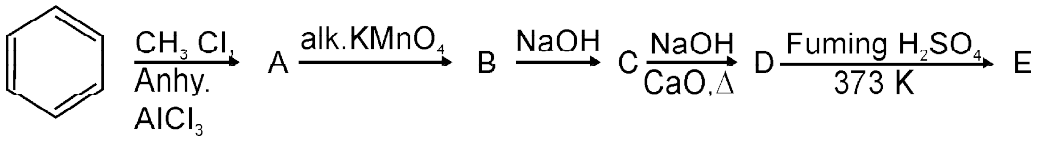
c)



- **Questions of Five Marks :**

1. Explain the mechanism of electrophilic aromatic substitution of benzene.

2. Complete the reaction and Identify A, B, C, D and E.



■■■

Topic 17 : Environmental chemistry

Multiple Choice Questions

Q. 1) Which of following chemical substanecs was responsible for Bhopal gas tragedy ?

a) CH_3COOCH_3 b) CH_3Cl

c) CH_3NO_2 d) CH_3NCO

Q. 2) Identify primary constituents of photochemical smog

a) oxides of carbon and smoke particulates

b) water vapour and hydrocarbons

c) oxides of nitrogen and hydrocarbons

d) oxides of sulphur and oxides of carbon

Q. 3) Which of followings does not take part in formation of photochemical smog ?

a) Oxidesof nitrogen b) Oxides of sulphur

c) Ozone d) Hydrocarbons

Q. 4) Which of following statements is not correct for photochemical smog?

a) It does not involve any smoke or fog

b) It is reducing in nature

c) It is formed in hot days of summer

d) It is formed from hydrocarbons and nitrogen oxides

Q. 5) Which of following chemical substances is released from Chlorofluorocarbons?

a) Fluorine free radical b) Nitrogen dioxide

c) Chlorine free radical d) Sulphur dioxide

Q. 6) How many molecules of ozone are destroyed by each chlorine atom ?

a) 100 b) 1000

c) 10,000 d) 100,000

Q. 7) Indentity correct chemicl formula for PAN

a) CH_3CONH_2 b) $CH_3COOONO_3$

c) $CH_3COOONO_2$ d) CH_3CONO_3

Q. 8) One of the important constituent of classical smog is

a) oxides of phosphorus
b) oxides of sulphur
c) ozone
d) chlorofluorocarbons

Q. 9) Which of following causes depletion of ozone layer and green house effect also ?

a) Sulphur dioxide
b) Carbon dioxide
c) Dinitrogen
d) Chlorofluorocarbons

Q. 10) When rain drops come in contact with atmosphere rich in oxides of sulphur and nitrogen the PH of rain water.

a) Remains at 5.6
b) 5.6 up to 7
c) In the ravage 7.0 - 14.0
d) Less than 5.6

Q. 11) Most signifiacnt role in green house effect is played by

a) water vapour
b) oxides of nitrogen
c) carbon dioxide
d) Chlorofluorocarbons

Q. 12) In green house effect temperature of earth rises due to

a) absorption of u.v. radiations by upper layer of green house gases
b) unfiltered u.v. radiations due to depletion of ozon layer
c) u.v. radiations are not allowed to reflect back by green house gases
d) I.R. radiations are not reflected back due to green house gases.

Q. 13) Which of following statements is not correct for green house effect?

a) Polarice caps may melt
b) It may reduce crop productions
c) Oceanic water level may lower
d) It may affect marine life

Q. 14) Which of following statements is correct about eutrophication?

a) Plant nutrient level increases highly
b) Aquatic plant populations decrease
c) Dissolved oxygen level increases
d) It helps to increase population of aquatic animals

Q. 15) Increasing risk of skin cancer is due to

a) water pollution caused by to release of sewage

b) depletion of ozone layer

c) photochemical smog

d) green house effect

Q. 16) Which of following in not considered as pollutant?

a) CO b) CFC c) SO_2 d) CO_2

Q. 17) Which part of atmosphere is useful to filter ultraviolet radiations?

a) Troposphere b) Stratosphere

c) Mesosphere d) Thermosphere

Q. 18) Which one of following will help to depletion of ozone layer ?

a) $C_6H_6Cl_6$ b) C_6F_6

c) C_9F_{16} d) CF_2Cl_2

Q. 19) Which of following pollutants at higher proportions causes bone disease ?

a) Pesticides from water b) Carbon oxide from atmosphere

c) Dissolved fluorides in water d) Sulphur dioxide gas in air

Q. 20) PAN in highly injurious to

a) eyes b) skin

c) aqutic animals d) micro phytoplanktons

- **Questions of One Mark :**

Q. 1) What is environmental chemistry?

Q. 2) Define environmental pollution.

Q. 3) Define pollutant.

Q. 4) Why deforestation is disadvatageous ?

Q. 5) What is threshold limit value?

Q. 6) Which natural source control CO_2

Q.7) How is CO added in environment by human activities?

Q. 8) Write the oxides of sulphur responsible for air pollution.

Q. 9) What are different natural ways to lower concentration of oxides of suphur?

Q. 10) Write atmospheric pollutant of oxides of nitrogen.

Q. 11) Write the name and formula of antiknocking agent added in gasoline previously?

Q. 12) Why were dichloro ethane and dibromo ethane were added in gasoline along with tetraethyl lead?

Q. 13) What is the effect of particulate pollutants on visibility?

Q. 14) What is the way to control CO_2 pollution in atmosphere?

Q. 15) Up to what distance from earth surface lies stratosphere?

Q. 16) Which is the distant layer of atmosphere?

Q. 17) What is the role of ozone layer?

Q. 18) What is depletion of ozone layer?

Q. 19) Which gas is obtained from ozone by action of CFC gases?

Q. 20) Which gases are responsible for acid rain?

Q. 21) Which pigment of plants is affected by acid rain?

Q. 22) How is green house effect occur on earth?

Q. 23) What is effect of sewage water when released in river?

Q. 24) What is BOD?

Q. 25) What are herbicides?

Q. 26) What is green chemistry ?

- **Questions of Two Marks :**

Q. 1) How is CO_2 level maintained in atmosphere?

Q. 2) Explain toxic effects of oxides of sulphur ?

Q. 3) What is the main source of H_2S and it's toxic effects on humans?

Q. 4) Write note on photochemical smog

Q. 5) Differentiate between photochemical smog and classial smog?

Q. 6) Write harmful effects of photochemical smog.

Q.7) Write note on depletion of ozone layer ?

Q. 8) How chlorofluorocarbons react with ozone?

Q. 9) What are effects of depletion of ozone layer?

Q. 10) Name harmful effects of acid rain.

Q. 11) What happens to sea water level due to green house effect?

Q. 12) What is global warming ? Name the major green house gases.

Q. 13) What is the effect of oil given out by refineries and automobiles on river and ocean water ?

Q. 14) How deforestation is harmful for soil?

Q. 15) What is a role of inescticides in environmental pollution?

- **Questions of Three Marks :**

Q. 1) What are the ways to control soil pollution?

Q. 2) Explain recycling of waste material.

Q. 3) Explain ways to control water pollution.

Q. 4) Explain the effect of hot water of industries and nuclear plants on river and sea water.

Q. 5) Explain acid rain and it's effects on living things.

Q. 6) Explain effect of acid rain on historical buildings.

Q.7) Explain lead salts and dust particulates as air pollutants.

Q. 8) Explain toxic effects of oxides of nitrogen.

Q. 9) How can domestic waste be used as manuers ?

Q. 10) Name three natural sources of air pollution.

Q. 11) What is required limit of fluoride ions in drinking water? What may happen when it's concentation increases and decreases than a limit ?

Q. 12) What is green chemistry? how the objectives of green chemistry can be achieved?

Q. 13) What are the factors causing soil pollution ?

Q. 14) What are harmful effects of green house effect ?

Q. 15) Explain formation of sulphuric acid, carbonic acid and nitric acid formation in atmosphere?

- **Questions of Five Marks :**

Q. 1) How is soil polluted by indiscriminate use of fertitizers and dumping of waste materials? How are waste materials disposed ?

Q. 2) Explain biodegradable and non biodegradable industrial waste? Write harmful effects of higher concentrations of pollutants lead, fluorides and nitrates in drinking water.

Q. 3) What are different layers of atmosphere with their distances from earth surface? In which layer the depletion of ozone occurs? How?

Q. 4) Explain mechanism of formation of photochemical smog?

Q. 5) Explain different natural ways to control nitrogen oxides, carbon oxides and oxides of sulphur as environmental pollutant.

Q. 6) Enlist the different goals of green chemistry.

Q.7) What are different ways of disposal of solid waste ?

■■■