

HALF YEARLY EXAMINATION-2023**XI STD --CHEMISTRY ANSWER KEY -DINDIGUL DISTRICT****PART- I****I. CHOOSE THE CORRECT ANSWER:**

- The balanced equation for the formation of ammonia is $N_2 + 3H_2 \rightleftharpoons 2NH_3$, when 15 moles of H_2 react to form **Ans: b) 10 moles NH_3**
- Which of the following pairs of d-orbitals will have electron density along the axes?
Ans: a) $dx^2, dx^2 - y^2$
- Which among the following oxide is amphoteric? **Ans: c) $Be(OH)_2$**
- Ionic hydrides are formed by **Ans: d) Group one elements**
- Which of the following has highest hydration energy? **Ans: b) $MgCl_2$**
- The value of universal gas constant depends upon **Ans: d) units of pressure and volume**
- In an adiabatic process, which of the following is true? **Ans: a) $q=0$**
- What is the relation between K_p & K_c of the reaction $2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$
Ans: b) $K_p > K_c$
- According to VSEPR theory, the repulsion between different pairs of electrons obey the order
Ans: d) $l.p-l.p > b.p-l.p > b.p-b.p$
- Which of the following binary liquid mixtures exhibits negative deviation from Raoult's law?
Ans: d) chloroform + diethyl ether
- Select the molecule which has only one bond **Ans: b) $CH_3-CH=CH-CH_3$**
- Hyper conjugation is also known as **Ans: c) both (a) and (b)**
- Acetylene heated with Red hot iron tube gives X, what, is X? **Ans: c) Benzene**
- The name of $C_2F_4Cl_2$ is **Ans: c) Freon-114**
- Haemoglobin of the blood forms carboxy haemoglobin with **Ans: c) Carbon monoxide**

PART- II**II. ANSWER ANY SIX QUESTIONS. Q.NO. 24 IS COMPULSORY****6×2=12****16. Distinguish between oxidation and reduction.**

Oxidation	Reduction
Addition of oxygen	Addition of hydrogen
Removal of hydrogen	Removal of oxygen
Loss of an electron	Gain of electron
Oxidation number of the element increases.	Oxidation number of the element decreases.

17. What is effective nuclear charge?

The net nuclear charge experienced by valence electrons in the outermost shell is called the effective nuclear charge. $Z_{eff} = Z - S$ Where Z = Atomic number

S = Screening constant calculated by using Slater's rules.

18, Mention the uses of Plaster of paris.

- ❖ It is used in the building industry as well as plasters.
- ❖ It is used for immobilizing the affected part of organ where there is a bone fracture or sprain.
- ❖ It is also employed in dentistry, in ornamental work and for making casts of statues.

19. What are state and path functions.

- ❖ The State function is thermodynamic property of the system, which has a specific value for a given state does not depend on the path in which a particular state is reached.
- ❖ **Ex: pressure, volume, temperature**
- ❖ A path function is a thermodynamic property of the system whose value depends on the path or manner by which the system goes from its initial to the final state.
- ❖ **Ex: work (w) and heat (q).**

20. Which Geometrical isomers of 2-butene is more stable? why?

In trans-2-butene, the two methyl groups are away from each other and in the opposite direction whereas in cis-2-butene, the two methyl groups are in the same direction but still far from each other leading to no steric hindrance. Therefore, the stability difference is very less.

21. Mention two limitations of Henry's law.

- ❖ It is applicable at moderate temperature and pressure only.
- ❖ Only the less soluble gases obey Henry's law.
- ❖ The gases reacting with solvent do not obey Henry's law.
- ❖ The gases obeying Henry's law should not be associated or dissociated while dissolving in the solvent.

22. Classify the following groups as ortho, Para and meta directors,

- i) $-\text{OH}$ = ortho and para directors ii) $-\text{NO}_2$ = meta directors
 iii) $-\text{NH}_2$ = ortho and para directors iv) $-\text{COOH}$ = meta directors

23. What would happen, if the green house gases were totally missing in the earth's atmosphere?

- ❖ The solar energy radiated back from the earth's surface is absorbed by the greenhouse gases. (CO_2 , CH_4 , O_3 , CFCs) are present near the earth's surface.
- ❖ They heat up the atmosphere near the earth's surface and keep it warm.
- ❖ As a result of these, there is the growth of vegetation that supports life.
- ❖ In the absence of this effect, there will be no life of both plant and animal on the surface of the earth.

24. Calculate the entropy change during the melting of one mole of ice into water at 273K and 1 atm pressure. Enthalpy of fusion of ice is 6008 KJ mole⁻¹

$$\text{Enthalpy of fusion of ice} = 6008 \text{ J mol}^{-1} = \Delta H$$

$$\Delta S = \frac{\Delta H}{T_m} \quad T_m = 0^\circ \text{C} = 273 \text{ K}$$

$$\text{Entropy of fusion} = \frac{\text{Enthalpy of fusion of ice}}{\text{Melting point (Kelvin)}}$$

$$\Delta S = \frac{6008}{273} = 22.007 \text{ JK}^{-1} \text{ mol}^{-1}$$

PART- III

II. ANSWER ANY SIX QUESTIONS. Q.NO. 33 IS COMPULSORY

6×3=18

25 Give the electronic configuration of Mn^{2+} and Cr^{3+}



Mn^{2+} electronic configuration is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$



Cr^{3+} electronic configuration is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$

26. How do you convert para hydrogen into ortho hydrogen.

- ❖ By treating with catalysts platinum or iron.
- ❖ Bypassing an electric discharge
- ❖ By heating to 800°C.
- ❖ By mixing with paramagnetic molecules such as O_2 , NO , NO_2 .
- ❖ By treating with nascent/atomic hydrogen.

27. Define compressibility factor.

- ❖ The ratio of a gas's molar volume to that of an ideal gas at constant temperature and pressure is known as the compressibility factor (Z), sometimes known as the compression factor.
- ❖ The compressibility factor for an ideal gas is unity, which is typically written as $Z = PV / RT$

28. Define Le-chateliers principle.

It states that If a system at equilibrium is disturbed, then the system shifts itself in a direction that nullifies the effect of that disturbance.

29. Draw the Lewis structures for the following species

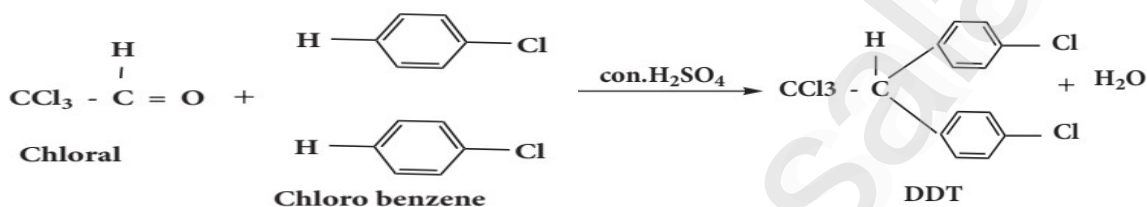
SPECIES	LEWIS STRUCTURE	SPECIES	LEWIS STRUCTURE
NO_3^-		SO_4^{2-}	
HNO_3		O_3	

30. What are electrophiles and nucleophiles? Give one example for each.

Electrophiles:	Nucleophiles:
❖ Electron deficient species	❖ Electron rich species having a lone pair of electron
❖ Positively charged ions	❖ Negatively charged ions
❖ All are Lewis acids	❖ All are Lewis acids
❖ $\text{FeCl}_3, \text{NO}^+, \text{NO}^+$	❖ $\text{R-OH}, \text{CN}^-, \text{OH}^-$

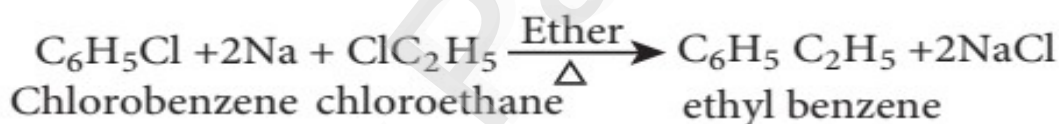
31. How is prepared DDT?

DDT (*p,p'*-dichloro diphenyl trichloro ethane) can be prepared by heating a mixture of chlorobenzene with chloral (Trichloro acetaldehyde) in the presence of $\text{con.H}_2\text{SO}_4$.



32. Write short note on Wurtz-Fittig reaction.

- ❖ Aryl halide and alkyl halide couple in presence of sodium metal / dry ether to form alkyl benzene.
- ❖ For example, chlorobenzene reacts with methyl chloride in presence of sodium and dry ether to form ethyl benzene



33. Give the IUPAC Names of the following compounds:

STRUCTURE	STRUCTURE	STRUCTURE
IUPAC NAME 2-bromo 3-methyl butane	IUPAC NAME 2-hydroxy butanal	IUPAC NAME Pent-2-yne

PART- IV

IV. ANSWER THE FOLLOWING QUESTIONS: (5 x 5 =25)

34. a) i) Calculate the molar mass of the following compounds.

i) Urea [$\text{CO}(\text{NH}_2)_2$]:

$$\begin{aligned}
 \text{Molar mass of urea} &= (4 \times \text{Atomic mass of hydrogen}) + (1 \times \text{Atomic mass of carbon}) + (2 \times \\
 &\text{Atomic mass of nitrogen}) + (1 \times \text{Atomic mass of oxygen}) \\
 &= (4 \times 1.008) + (1 \times 12) + (2 \times 14) + (1 \times 16) \\
 &= 4.032 + 12 + 28 + 16 = 60.032 \text{ g mol}^{-1}
 \end{aligned}$$

ii) sulphuric acid $[H_2SO_4] = (2 \times \text{Atomic mass of hydrogen}) + (1 \times \text{Atomic mass of sulphur}) + (4 \times \text{Atomic mass of oxygen}) = (2 \times 1.008) + (1 \times 32) + (4 \times 16) = 2.016 + 32 + 64 = 98.016 \text{ g mol}^{-1}$.

ii) Write the Pauli's exclusion principle

"No two electrons in an atom can have the same set of values of all four quantum numbers".

[OR]

b) Explain the Pauling's method for the determination of ionic radius.

- ❖ Ionic radius is defined as the distance from the centre of the nucleus of the ion up to which it exerts its influence on the electron cloud of the ion.
- ❖ The ionic radius of a uni-univalent crystal can be calculated using Pauling's method from the interionic distance between the nuclei of the cation and anion.
- ❖ Pauling assumed that ions present in a crystal lattice are perfect spheres, and they are in contact with each other and therefore,

$$d = r_{C^+} + r_{A^-} \text{ ----- (1)}$$

where 'd' is the distance between the centre of the nucleus of the cation C^+ and A^- , r_{C^+} , r_{A^-} are the radius of the cation and anion respectively.

- ❖ Pauling also assumed that the radius of the ion having noble gas electronic configuration is inversely proportional to the effective nuclear charge felt at the periphery of the ion.

$$\text{i.e. } r_{C^+} \propto \frac{1}{(Z_{\text{eff}})_{C^+}} \text{ ----- (2)}$$

and

$$r_{A^-} \propto \frac{1}{(Z_{\text{eff}})_{A^-}} \text{ ----- (3)}$$

Where Z_{eff} is the effective nuclear charge and $Z_{\text{eff}} = Z - S$

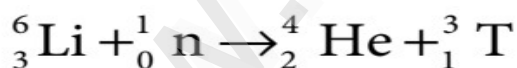
Dividing the equation 2 by 3

$$\frac{r_{C^+}}{r_{A^-}} = \frac{(Z_{\text{eff}})_{A^-}}{(Z_{\text{eff}})_{C^+}} \text{ ----- (4)}$$

On solving the equations (1) and (4), the ionic radius of cation and anion are calculated.

36. A) i) How will you prepare Tritium from Lithium?

Tritium is artificially prepared by bombarding lithium with slow neutrons in a nuclear fission reactor.



ii) Describe briefly the biological importance of calcium and magnesium.

Magnesium:

- ❖ Magnesium plays an important role in many biochemical reactions catalyzed by enzymes.
- ❖ It is the co-factor of all enzymes that utilize ATP in phosphate transfer and energy release.
- ❖ It is also essential for DNA synthesis and is responsible for the stability and proper functioning of DNA.
- ❖ It is also used for balancing electrolytes in our body.
- ❖ Deficiency of magnesium results in convulsion and neuromuscular irritation.
- ❖ The main pigment that is responsible for photosynthesis, chlorophyll, contains magnesium which plays an important role in photosynthesis.

Calcium:

- ❖ Calcium is a major component of bones and teeth.
- ❖ It is also present in blood and its concentration is maintained by hormones (calcitonin and parathyroid hormone).
- ❖ The deficiency of calcium in the blood causes it to take a longer time to clot. It is also important for muscle contraction.

[OR]

b) i) Derive ideal-gas equation

- ❖ The gaseous state is described completely using the following four variables T, P, V and n.
- ❖ Each gas law relates one variable of a gaseous sample to another while the other two variables are held constant.
- ❖ Therefore, combining all equations into a single equation will enable to account for the change in any or all of the variables.
- ❖ Boyle's law: $V \propto 1/P$ --(1)
- ❖ Charles' law: $V \propto T$ --(2)
- ❖ Avogadro's law: $V \propto n$ --(3)

We can combine these equations into the following general equation that describes the physical behaviour of all gases. $V \propto nTP$ $V = nRTP$ where R = Proportionately constant.

The above equation can be rearranged to give

$$PV = nRT - \text{Ideal gas equation. Where R is also known as Universal gas constant.}$$

constant.

ii) State the third law of thermodynamics.

- ❖ The third law of thermodynamics states that the entropy of pure crystalline substance at absolute zero is zero. (Or)
- ❖ Otherwise, it can be stated as it is impossible to lower the temperature of an object to absolute zero in a finite number of steps.
- ❖ Mathematically, $\lim_{T \rightarrow 0} S = 0$ for a perfectly ordered crystalline state.

36 . a) i) Derive the relation between Kp & Kc

Let us consider the general reaction in which all reactants and products are ideal gases.



The equilibrium constant, K_c is $K_c = \frac{[\text{C}]^l [\text{D}]^m}{[\text{A}]^x [\text{B}]^y}$ (1) and K_p is, $K_p = \frac{p_C^l \times p_D^m}{p_A^x \times p_B^y}$ (2)

The ideal gas equation is $PV = nRT$ or $P = n V/RT$

Since Active mass = molar concentration = n/V

$P = \text{active mass} \times (RT)$

Based on the above expression the partial pressure of the reactants and products can be expressed as,

$$p_A^x = [\text{A}]^x (RT)^x \quad p_B^y = [\text{B}]^y (RT)^y \quad p_C^l = [\text{C}]^l (RT)^l \quad p_D^m = [\text{D}]^m (RT)^m$$

On substitution in Eqn. 2

$$K_p = \frac{[\text{C}]^l [\text{RT}]^l [\text{D}]^m (\text{RT})^m}{[\text{A}]^x [\text{RT}]^x [\text{B}]^y (\text{RT})^y} \quad (3)$$

$$K_p = \frac{[\text{C}]^l [\text{D}]^m (\text{RT})^{l+m}}{[\text{A}]^x [\text{B}]^y (\text{RT})^{x+y}}$$

$$K_p = \frac{[\text{C}]^l [\text{D}]^m}{[\text{A}]^x [\text{B}]^y} (\text{RT})^{(l+m) - (x+y)} \quad (4)$$

By comparing equation (1) and (4), we get $K_p = K_c (RT)^{\Delta n_g}$ (5)

where, Δn_g is the difference between the sum of number of moles of products and the sum of number of moles of reactants in the gas phase.

[OR]

b) ii) Discuss the formation of N_2 molecule using MO-theory.

Molecular orbital diagram of nitrogen molecule (N_2)

Electronic configuration of N atom



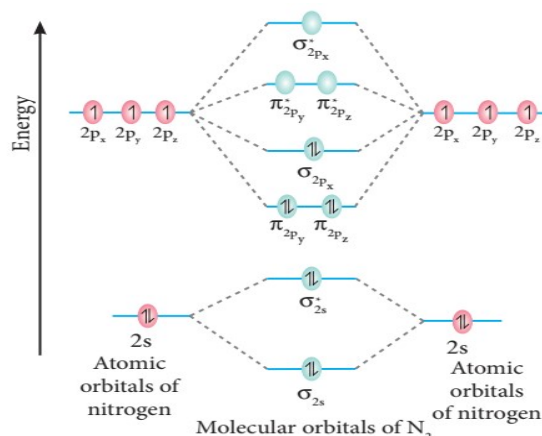
Electronic configuration of N_2 molecule:



Bond order = $N_b - N_a / 2$

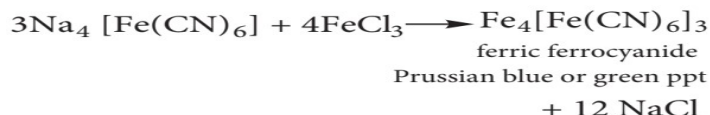
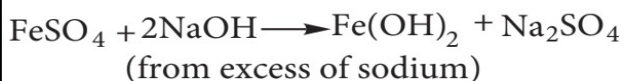
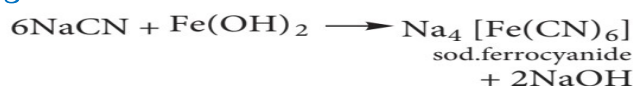
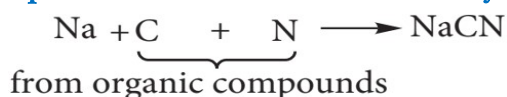
$$= 10 - 4 / 2 = 3$$

Molecule has no unpaired electrons hence it is diamagnetic.



37. a) i) Describe the reactions involved in the detection of nitrogen in an organic compound by Lassaigne method.

If nitrogen is present it gets converted to sodium cyanide which reacts with freshly prepared ferrous sulphate and ferric ion followed by conc. HCl and gives a Prussian blue color



ii) Define Resonance.

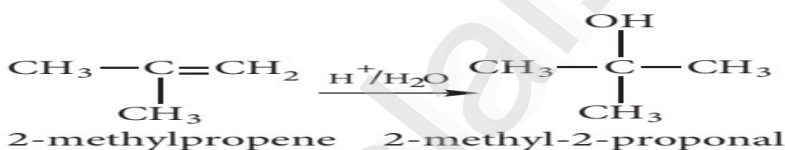
- ❖ Certain organic compounds can be represented by more than one structure and they differ only in the position of bonding and lone pair of electrons.
- ❖ Such structures are called resonance structures (canonical structures) and this phenomenon is called resonance.

b) i) Explain Markownikoff's rule with suitable example.

"When an unsymmetrical alkene reacts with hydrogen halide, the hydrogen adds to the carbon that has more number of hydrogen and halogen add to the carbon having fewer hydrogen".

Addition of water:- (Hydration of alkenes)

Normally, water does not react with alkenes. In the presence of concentrated sulphuric acid, alkenes react with water to form alcohols. This reaction follows carbocation mechanism and Markownikoff's rule



ii) Differentiate BOD and COD

Biochemical oxygen demand (BOD)	Chemical Oxygen Demand (COD)
The total amount of oxygen in milligrams consumed by microorganisms in decomposing the waste in one litre of water at 20°C for a period of 5 days	The amount of oxygen required by the organic matter in a sample of water for its oxidation by a strong oxidising agent like $\text{K}_2\text{Cr}_2\text{O}_7$ in acid medium for a period of 2 hrs.
BOD is used as a measure of degree of water pollution.	COD used to indirectly measure the amount of organic compounds in water.
its value is expressed in ppm	It expressed in mg/l

38. a) A compound on analysis gave Na-14.31% 8-9.97% H-6.22% and O-69.5% calculate the mole formula of the compound, if all the hydrogen in the compound is present in combination with oxygen as of crystallization. (molecular mass of the compound is 322)

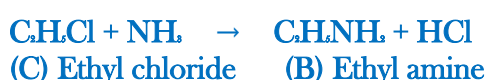
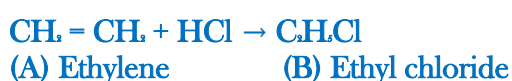
Element	%	Relative no. of atoms	Simple ratio
Na	14.31	$\frac{14.31}{23} = 0.62$	$\frac{0.62}{0.31} = 2$
S	9.97	$\frac{9.97}{32} = 0.31$	$\frac{0.31}{0.31} = 1$
H	6.22	$\frac{6.22}{1} = 6.22$	$\frac{6.22}{0.31} = 20$
O	69.5	$\frac{69.5}{16} = 4.34$	$\frac{4.34}{0.31} = 14$

$$\begin{aligned} \therefore \text{Empirical formula} &= \text{Na}_2\text{SH}_{20}\text{O}_{14} \\ \eta &= \text{Molar mass} / \text{Calculated empirical formula mass} \\ &= 322/322 = 1 \\ [\text{Na}_2\text{SH}_{20}\text{O}_{14}] &= (2 \times 23) + (1 \times 32) + (20 \times 1) + (14 \times 16) \\ &= 46 + 32 + 20 + 224 = 322 \\ \text{Molecular formula} &= \text{Na}_2\text{SH}_{20}\text{O}_{14} \end{aligned}$$

Since all the hydrogen in the compound present as water \therefore Molecular formula is $\text{Na}_2\text{SH}_{20}\text{O}_{14}$

[OR]

b) Simplest alkene (A) reacts with HCl to form compound (B). Compound (B) reacts with ammonia to compound (C) of molecular formula $\text{C}_2\text{H}_7\text{N}$. compound (C) undergoes carbylamine test, Identify (A), (B) and (C). Explain the reactions.



COMPOUND	NAME	MOLECULAR FORMULA
A	ETHYLENE	$\text{CH}_2 = \text{CH}_2$
B	CHLOROETHANE	$\text{C}_2\text{H}_5\text{Cl}$
C	ETHYL AMINE	$\text{C}_2\text{H}_5\text{NH}_2$