Class XI Session 2025-26
Subject - Chemistry
Sample Question Paper - 8

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. The use of log tables and calculators is not allowed

Section A

1. The number of electrons in an atom of an element is equal to **[1]**

   a) Atomic weight
   b) Atomic number
   c) Electron affinity
   d) Equivalent weight

2. Thermodynamics is the branch of physical science concerned with **[1]**

   a) kinetic energy and its transformations to and from other forms of energy.
   b) potential and its transformations to and from other forms of energy.
   c) heat and its transformations to and from other forms of energy.
   d) mass and its transformations to and from other forms of energy.

3. In which of the following compounds the carbon marked with asterisk is expected to have greatest partial positive charge? **[1]**

   a) $*CH_3 - CH_2 - I$
   b) $*CH_3 - CH_2 - CH_3$
   c) $*CH_3 - CH_2 - Br$
   d) $*CH_3 - CH_2 - Cl$

4. Enthalpy of atomization is enthalpy change on breaking: **[1]**

   a) one kg of bonds completely to obtain atoms in the gas phase.
   b) one kg of bonds completely to obtain atoms in the liquid phase.
   c) one mole of bonds completely to obtain atoms in the liquid phase.
   d) one mole of bonds completely to obtain atoms in the gas phase.

5. Predict the position of an element having the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$. **[1]**

a) Period 2, group 3

b) Period 3, group 1

c) Period 4, group 5

d) Period 4, group 6

6. An atom of an element contains 29 electrons and 35 neutrons. The electronic configuration of an element **[1]**

a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ 4s^2\ 3d^6\ 4s^2\ 4p^2$

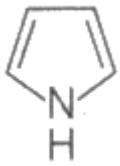
b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ 4s^2\ 3d^8\ 4s^2$

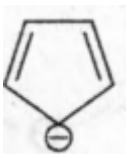
c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ 4s^1\ 3d^9\ 4s^2$

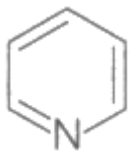
d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

7. Which of the following compounds is not aromatic? **[1]**

a) 

b) 

c) 

d) 

8. Around 10^{15} Hz corresponds to the region of the electromagnetic spectrum **[1]**

a) microwave region

b) infrared region

c) ultraviolet region

d) visible light

9. When methane is burnt in oxygen to produce CO_2 and H_2O the oxidation number of carbon changes by? **[1]**

a) -8

b) +8

c) +4

d) Zero

10. The gram molar mass of $ZnSO_4$ is **[1]**

a) 136.40 g/mol

b) 166.04 g/mol

c) 161.44 g/mol

d) 156.42 g/mol

11. Among the following compounds one that is most reactive towards electrophilic nitration is: **[1]**

a) Nitrobenzene

b) Toluene

c) Benzene

d) Benzoic Acid

12. The enthalpies of all elements in their standard states are: **[1]**

a) < 0

b) different for each element

c) unity

d) zero

13. **Assertion (A):** Hot water is used for separation of benzoic acid from naphthalene. **[1]**
Reason (R): Whenever a crystal is formed it tends to leave out the impurities.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

14. **Assertion (A):** Addition of HCl on  is faster than  . **[1]**

Reason (R): Alkene that can form more stable carbocation they have higher rate of addition with HX.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

15. **Assertion (A):** Threshold frequency is a characteristic for a metal. **[1]**

Reason (R): Threshold frequency is the maximum frequency required for the ejection of electrons from the metal surface.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

16. **Assertion (A):** The balancing of chemical equations is based on the law of conservation of mass. **[1]**

Reason (R): Total mass of reactants is equal to the total mass of products.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

17. At 500 K, equilibrium constant, K_c, for the following reaction is 5. **[2]**

$\frac{1}{2}H_2(g) + \frac{1}{2}I_2(g) \rightleftharpoons HI(g)$

What would be the equilibrium constant K_c for the reaction?

$2HI(g) \rightleftharpoons H_2(g) + I_2(g)$

18. What will be the mass of one ^{12}C atom in g? **[2]**

19. Unsaturated compounds undergo addition reactions. Why? **[2]**

OR

Explain why the system are not aromatic.

20. Give the number of electrons in the species: H_2^+, H_2 and O_2^+. **[2]**

21. The electronic configuration of an element is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$. Locate the element in the periodic table. **[2]**

Section C

22. Which of the following sets of orbitals are degenerate and why? **[3]**

1. 1s, 2s and 3s in Mg atom
2. $2p_x$, $2p_y$ and $2p_z$ in C atom
3. 3s, $3p_x$ and 3d orbitals in H atom

23. **Answer:** **[3]**

(a) Two liters of an ideal gas at a pressure of 10 atm expands isothermally at 25 °C into a vacuum until its total volume is 10 liters. How much heat is absorbed and how much work is done in the expansion? **[1]**

(b) What is the enthalpy change for an adiabatic process? **[1]**

(c) Predict the sign of ΔS for the following reaction: $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$ **[1]**

24. 1 g of graphite is burnt in a bomb calorimeter in excess of oxygen at 298 K and 1 atmospheric pressure **[3]**

according to the equation C (graphite) + O2(g) $\longrightarrow$ CO_2 (g). During the reaction, temperature rises from 298 K to 299 K. If the heat capacity of the bomb calorimeter is 20.7 kJ / K, what is the enthalpy change for the above reaction at 298 K and 1 atm?

25. Identify the substances oxidised reduced oxidizing agent and reducing the agent for each of the following reactions: **[3]**

i. $2AgBr(s) + C_6H_6O_2(aq) \longrightarrow 2Ag(s) + 2HBr(aq) + C_6H_4O_2(aq)$

ii. $HCHO(l) + 2[Ag(NH_3)_2]^+(aq) + 3OH^-(aq) \longrightarrow 2Ag(s) + HCOO^-(aq) + 4NH_3(aq) + 2H_2O(l)$

iii. $HCHO(l) + 2Cu^{2+}(aq) + 50H^-(aq) \longrightarrow Cu_2O(s) + HCOO^-(aq) + 3H_2O(I)$

26. Arrange the following sets of molecules in the decreasing order of bond angle. **[3]**

i. SF_6, CCI_4, H_2O, NH_3

ii. CH_4, NH_3, H_2O, BF_3

iii. H_2O, BEH_2, $AICI_3$, BeH_2 H_2S

27. Give the properties of the oxides in a particular period. **[3]**

28. If two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element, are in the whole-number ratio. **[3]**

a. Is this statement true?

b. If yes, according to which law?

c. Give one example related to this law.

Section D

29. **Read the text carefully and answer the questions:** **[4]**

The phenomenon of the existence of two or more compounds possessing the same molecular formula but different properties is known as isomerism. Such compounds are called isomers. Compounds having the same molecular formula but different structures (manners in which atoms are linked) are classified as structural isomers. Structural isomers are classified as chain isomer, position isomer, functional group isomer. Meristematic arises due to different alkyl chains on either side of the functional group in the molecule and stereoisomerism and can be classified as geometrical and optical isomerism. Hyperconjugation is a general stabilising interaction. It involves delocalisation of σ electrons of the C-H bond of an alkyl group directly attached to an atom of an unsaturated system or to an atom with an unshared p orbital. This type of overlap stabilises the carbocation because electron density from the adjacent σ bond helps in dispersing the positive charge.

(a) Why Isopentane, pentane and Neopentane are chain isomers?

OR

The molecular formula C_3H_8O represents which isomer?

(b) What type of isomerism is shown by Methoxypropane and ethoxyethane?

(c) Why hyperconjugation is a permanent effect?

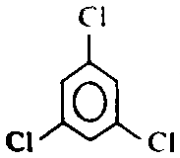
30. **Read the text carefully and answer the questions:** **[4]**

Covalent molecules formed by heteroatoms bound to have some ionic character. The ionic character is due to shifting of the electron pair towards A or B in the molecule AB. Hence, atoms acquire small and equal charge but opposite in sign. Such a bond which has some ionic character is described as a polar covalent bond. Polar covalent molecules can exhibit a dipole moment. The dipole moment is equal to the product of charge

separation, q and the bond length, d for the bond. The unit of dipole moment is Debye. One Debye is equal to 10^{-18} esu cm.

The dipole moment is a vector quantity. It has both magnitude and direction. Hence, the dipole moment of molecules depends upon the relative orientation of the bond dipole, but not the polarity of bonds alone. The symmetrical structure shows a zero dipole moment. Thus, a dipole moment help to predict the geometry of the molecules. Dipole moment values can be used to distinguish between cis- and trans-isomers; ortho-, meta- and para-forms of a substance, etc. The percentage of ionic character of a bond can be calculated by the application of the following formula:

$$\% \text{ ionic character} = \frac{\text{Experimental value dipole moment}}{\text{Theoretical value of dipole moment}} \times 100$$

(a) Out of  and  which compounds have zero dipole moments?

(b) A diatomic molecule has a dipole moment of 1.2D. If the bond length is 1.0×10^{-8}cm, what fraction of charge does exist on each atom?

(c) The dipole moment of NF_3 is very much less that of NH_3. Why?

OR

A covalent molecule, x-y, is found to have a dipole moment of 1.5×10^{-29} cm and a bond length 150 pm. What will be the percentage of ionic character of the bond?

Section E

31. **Attempt any five of the following:** **[5]**

(a) What is Huckel rule? **[1]**

(b) How is alkene produced by vicinal dihalide? **[1]**

(c) Write the general formula for alkynes. **[1]**

(d) Suggest the name of a Lewis acid other than anhydrous aluminium chloride which can be used during ethylation of benzene. **[1]**

(e) Classify the hydrocarbons according to the carbon-carbon bond. **[1]**

(f) What are benzenoids? **[1]**

(g) Write IUPAC name: $CH_3 - CH = CH - CH_2 - CH = CH - \underset{\underset{C_2H_5}{|}}{C}H - CH_2 - CH = CH_2$ **[1]**

32. The pH of milk, black coffee, tomato juice, lemon juice, and egg white are 6.8, 5.0, 4.2, 2.2 and 7.8 respectively. Calculate corresponding hydrogen ion concentration in each. **[5]**

OR

Describe the effect of:

a. addition of H_2

b. addition of CH_3OH

c. removal of CO

d. removal of CH_3OH

On the equilibrium of the reaction: $2H_2(g) + CO(g) \rightleftharpoons CH_3OH(g)$

33. **Answer:** **[5]**

(a) i. 0.3780 g of an organic chlorine compound gave 0.5740 g of silver chloride in Carius **[2.5]**

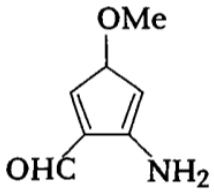
estimation. Calculate the percentage of chlorine present in the compound.

ii. Why does SO_3 act as an electrophile? **[2.5]**

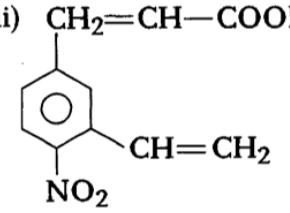
OR

i. Identify the functional groups present in the following compounds. **[2.5]**

(i)



(ii) $CH_2=CH-COOH$



(iii) $CH_3-CH_2-CO-CH_2$

CH_2-COCl

(iv) $CH_2=CH-CH_2-\overset{\overset{O}{\|}}{C}-NH_2$

ii. Discuss the chemistry of Lassaigne's test. **[2.5]**

Solution

Section A

1.

(b) Atomic number

Explanation:

The number of electrons in an atom is equal to its atomic number i.e. number of protons.

2.

(c) heat and its transformations to and from other forms of energy.

Explanation:

Thermodynamics deals with heat and its transformation from one form to another. The branch of physical science that deals with the relations between heat and other forms of energy (such as mechanical, electrical, or chemical energy) and by extension of the relationships between all forms of energy.

3.

(d) *CH_3 - CH_2 - Cl

Explanation:

Cl is most electronegative amongst Cl, Br and I and has more -I (inductive electron withdrawing) effect. So it causes the asterisk marked to have the maximum partial positive charge.

4.

(d) one mole of bonds completely to obtain atoms in the gas phase.

Explanation:

Enthalpy of atomization is the enthalpy change that takes place on breaking one mole of bonds completely of a compound or an element, to obtain atoms in the gas phase.

5.

(d) Period 4, group 6

Explanation:

n = 4 hence, element lies in 4th period.

Group = ns + (n - 1)d = 1 + 5 = 6

6.

(d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

Explanation:

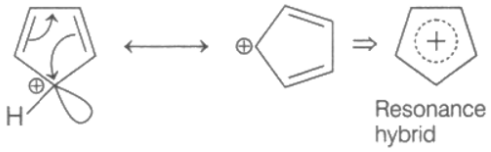
Number of electron (29) = Number of protons (29)

So electronic configuration = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

7. **(a)** 

Explanation:

Aromaticity of a compound can be decided by Huckel's rule. In cyclopentadienyl cation (b), resonance takes place as follows:



Hence,

is an anti-aromatic does not follow Huckel's rule as it has conjugated 4 π-electron ($4n\pi$, n = 1) system. Rest of the species are aromatic as each of them belongs to 6π-electron [$(4n + 2)\ \pi$, n = 1] system.

8.

(c) ultraviolet region

Explanation:

A frequency of $10^{15}\ Hz$ primarily corresponds to the ultraviolet (UV) region of the electromagnetic spectrum. The UV region spans frequencies between $10^{14}\ Hz$ and $10^{17}\ Hz$. While visible light falls within $4 \times 10^{14}\ Hz$ to $7.5 \times 10^{14}\ Hz$, a frequency around $10^{15}\ Hz$ is near the upper limit of visible light and is generally considered to be part of the UV spectrum. Thus, $10^{15}\ Hz$ most accurately belongs to the ultraviolet region.

9.

(b) +8

Explanation:

Oxidation number change = +4-(-4) = +8

10.

(c) 161.44 g/mol

Explanation:

Calculations:

Molar mass of $ZnSO_4$

= [Atomic masses of (Zn + S + 4 * O) atoms]

= [65.38 + 32.065 + (4 $\times$ 15.9994)]

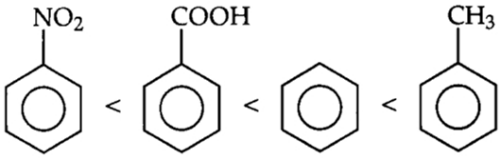
= 161.4426 g/mol

11.

(b) Toluene

Explanation:

Presence of electron releasing group like -R, -OH etc. increases the electron density at ortho and para position and thus makes the benzene ring more reactive towards electrophile. On the other hand, electron withdrawing groups like -COOH, $-NO_2$ etc. reduces electron density and thus reduces the reactivity of benzene towards electrophile. Thus, order of the given compounds towards electrophilic nitration is:



12.

(d) zero

Explanation:

By definition, the enthalpy of formation of elements in their standard state is taken as zero. Therefore, The enthalpies of all elements in their standard states is zero irrespective of the element.

13.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation:

Benzoic acid dissolves in hot water but naphthalene does not therefore, hot water is used for separation of benzoic acid from water.

14. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

15.

(c) A is true but R is false.

Explanation:

The threshold frequency is the minimum frequency required for the emission of electrons from the metal surface.

16. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

According to law of conservation of mass, in a chemical reaction total mass of the products is equal to the mass of the reactants.

Section B

17. For the reaction, $\frac{1}{2}H_2(g) + \frac{1}{2}I_2(g) \rightleftharpoons HI(g)$

$K_c = \frac{[HI]}{[H_2]^{1/2}[I_2]^{1/2}} = 5$

Thus for the reaction, 2HI(g) $\rightleftharpoons$ H_2(g) + I_2(g)

$K_{c_1} = \frac{[H_2][I_2]}{[HI]^2}$ = $(\frac{1}{K_c})^2$= $(\frac{1}{5})^2$ = $(\frac{1}{25})$ = 0.04

18. Since,

the number of atoms in 1 mol of ^{12}C atoms = 6.022 $\times$ 10^{23} atoms = Atomic mass of carbon - 12 in gms. = 12 g

Thus, 6.0022 $\times$ 10^{23} atoms of ^{12}C have mass = 12 g

$\therefore$ 1 atom of ^{12}C will have mass = $\frac{12}{6.022\times10^{23}}g$

= 1.9927 $\times$ 10^{-23} g

19. Unsaturated hydrocarbon compounds undergo addition reactions because they contain carbon-carbon double or triple bonds. By addition reactions, these unstable π-bonds get broken and makes stable saturated hydrocarbons.

OR

For the given compound, the number of π-electrons is 8.

By Huckel's rule,

$\Rightarrow 4n + 2 = 8$

$\Rightarrow 4n = 6$

$\Rightarrow n = 3/2$

For a compound to be aromatic, the value of n must be an integer (n = 0, 1, 2…).

This is not true for the given compound as it is a fraction. Hence, it is not aromatic in nature.

20. H_2^+ = one

H_2 = two

O_2^+ = 15

21. The element lies in Group 1 and 4^{th} Period of the modern periodic table.

Section C

22. 1. 1s, 2s and 3s orbitals in Mg atom are not degenerate because these have different values of n i.e 1, 2 and 3 respectively.
    2. $2p_x$, $2p_y$ and $2p_z$ orbitals in C atom are degenerate because these belong to the same subshell and n=2 for each orbital.
    3. 3s, $3p_x$ and 3d orbitals in H atom are degenerate.The 3 in each of these orbitals is its "principal" quantum number. It seems that these three different designations, s, p, and d, as describing the different shapes of their orbitals while they all have the same energy when there is only one electron at the "3" level, such as in the hydrogen atom where there is only one electron.

23. Answer:

(i) We have q = – w = p_{ex} (10 – 2) = 0(8) = 0 No work is done; no heat is absorbed.

(ii) For an adiabatic process,

$\Delta H = 0$

(iii) Reaction:

$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$

As gas is formed, the sign of ΔS is positive.

24. Suppose q is the quantity of heat from the reaction mixture and C_v is the heat capacity of the calorimeter, then the quantity of heat absorbed by the calorimeter.

$q = Cv \times \Delta T$

Quantity of heat from the reaction will have the same magnitude but opposite sign because the heat lost by the system (reaction mixture) is equal to the heat gained by the calorimeter.

$q = - C_v \times \Delta T = - 20.7\ kJ/K \times (299 - 298)\ K$

$= - 20.7\ kJ$

(Here, the negative sign indicates the exothermic nature of the reaction). Thus, ΔU for the combustion of the 1g of graphite = $-20.7\ kJ\ K^{-1}$

For combustion of 1 mol of graphite,

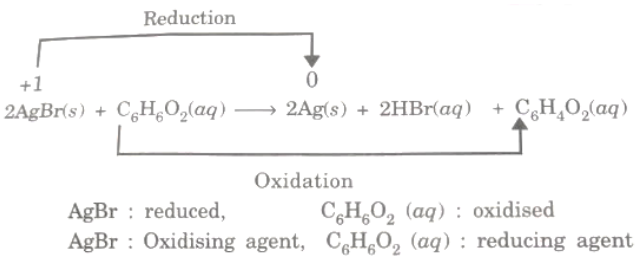
$= \frac{12.0 g\ mol^{-1} \times (-20.7 kJ)}{1g}$

$= - 2.48 \times 10^2\ kJ\ mol^{-1}$

Since $\Delta n_g = 0$

$\Delta H = \Delta U = - 2.48 \times 10^2\ kJ\ mol^{-1}$

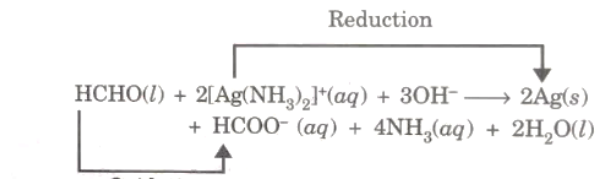
25. i.



AgBr : reduced, $C_6H_6O_2$ (aq) : oxidised

AgBr : Oxidising agent, $C_6H_6O_2$ (aq) : reducing agent

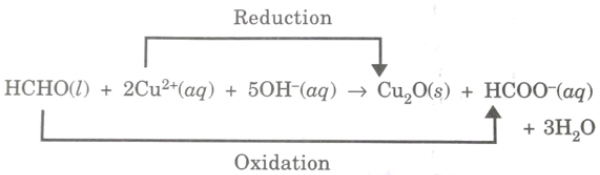
ii.



$[Ag(NH_3)_2]^+$ (aq) : reduced, HCHO(l) : oxidised

$[Ag(NH_3)_2]^+$ (aq) : oxidising agent, HCHO(l) : reducing agent

iii.



Cu^{2+} (aq) : reduced, HCHO(l) : oxidised

Cu^{2+} (aq) : oxidising agent, HCHO(l) : reducing agent

Reduction

26. i. $\underset{Tetrahedral}{CCI_4(109.5^\circ)}, \underset{Pyramidal}{NH_3\ (107^\circ)}, \underset{Angular}{H_2O(104.5^\circ)}, \underset{Octahedral}{SF_6\ (90^\circ)}$

ii. $\underset{Planar}{BF_3(120^\circ)}, \underset{Tetrahedral}{CH_4(109.5^\circ)}, \underset{Pyramidal}{NH_3(107^\circ)}, \underset{Angular}{H_2O\ (104.5^\circ)}$

iii. $\underset{Linear}{BeH_2(180^\circ)}, \underset{Planar}{AICI_3(120^\circ)}, \underset{Angular}{H_2O(104.5^\circ)}, \underset{Angular\ but\ S\ is\ less\ electronegative\ Than\ O}{H_2S(100^\circ)},$

27. Elements on extremes ends of a period easily combines with oxygen to form oxides. The elements present on the extreme left of a period are metals and formed basic oxides (e.g. Na_2O, MgO, CaO, K_2O etc.) with ionic nature whereas the element present on extreme right are non- metals formed the most acidic oxides (e.g. Cl_2O_7 , CO_2, SO_2, N_2O_3 etc.). The non-metallic oxides are covalent in nature. Oxides of middle elements of a period are however amphoteric in nature (eg. Al_2O_3) or neutral (eg. CO).

28. a. Yes, the statement is true.

b. According to the law of multiple proportions.

c. $\underset{2\ g}{H_2} + \underset{16\ g}{O_2} \rightarrow \underset{18\ g}{H_2O}$

$\underset{2\ g}{H_2} + \underset{32\ g}{O_2} \rightarrow \underset{34\ g}{H_2O}$

Here, masses of oxygen, (i.e., 16 g in H_2O and 32 g in H_2O_2) which combine with a fixed mass of hydrogen (2g) are in the simple ratio i.e., 16: 32 or 1: 2.

Section D

29. **Read the text carefully and answer the questions:**

The phenomenon of the existence of two or more compounds possessing the same molecular formula but different properties is known as isomerism. Such compounds are called isomers. Compounds having the same molecular formula but different structures (manners in which atoms are linked) are classified as structural isomers. Structural isomers are classified as chain isomer, position isomer, functional group isomer. Meristematic arises due to different alkyl chains on either side of the functional group in the molecule and stereoisomerism and can be classified as geometrical and optical isomerism. Hyperconjugation is a general stabilising interaction. It involves delocalisation of σ electrons of the C-H bond of an alkyl group directly attached to an atom of an unsaturated system or to an atom with an unshared p orbital. This type of overlap stabilises the carbocation because electron density from the adjacent σ bond helps in dispersing the positive charge.

(i) Isopentane, pentane and Neopentane are chain isomers because they have a similar molecular formula but a different carbon skeleton.

OR

The molecular formula C_3H_8O represents positional isomers because they differ in the position of substituent functional group(OH) on the carbon skeleton.

(ii) Methoxypropane and ethoxyethane are metamers because none of its side are similar to each other.

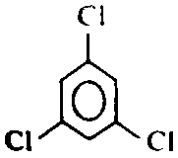
(iii) The σ electrons of C-H bond of the alkyl group enter into partial conjugation with the attached unsaturated system or with the unshared p orbital therefore hyperconjugation is permanent effect.

30. **Read the text carefully and answer the questions:**

Covalent molecules formed by heteroatoms bound to have some ionic character. The ionic character is due to shifting of the electron pair towards A or B in the molecule AB. Hence, atoms acquire small and equal charge but opposite in sign. Such a bond which has some ionic character is described as a polar covalent bond. Polar covalent molecules can exhibit a dipole moment. The dipole moment is equal to the product of charge separation, q and the bond length, d for the bond. The unit of dipole moment is Debye. One Debye is equal to 10^{-18} esu cm.

The dipole moment is a vector quantity. It has both magnitude and direction. Hence, the dipole moment of molecules depends upon the relative orientation of the bond dipole, but not the polarity of bonds alone. The symmetrical structure shows a zero dipole moment. Thus, a dipole moment help to predict the geometry of the molecules. Dipole moment values can be used to distinguish between cis- and trans-isomers; ortho-, meta- and para-forms of a substance, etc. The percentage of ionic character of a bond can be calculated by the application of the following formula:

$$\% \text{ ionic character} = \frac{\text{Experimental value dipole moment}}{\text{Theoretical value of dipole moment}} \times 100$$

(i) Both the molecules have zero dipole moments since both  and  shows symmetrical structure.

(ii) Fraction of electronic charge = $\frac{1.2\times10^{-10}}{4.8\times10^{-10}} = 0.25$

(iii) Because of different direction of moment of N-H and N-F bonds.

OR

% ionic character = $\frac{1.5\times10^{-29}}{2.4\times10^{-29}} \times 100 = 62.5$

Section E

31. Attempt any five of the following:

(i) Huckel rule states that a compound is said to be aromatic if it has (4n + 2) πelectrons delocalized where n = an integer 0, 1, 2, 3, ...

(ii) Alkene are produced from Vicinal dihalide by the process of dehalogenations. Vicinal dihalide on treatment with Zn metal lose a molecule of ZnX_2 to from an alkene.

$CH_2Br\text{-}CH_2Br + Zn \rightarrow CH_2{=}CH_2 + ZnBr_2$.

(iii) General formula of alkynes is C_nH_{2n-2}

(iv) Anhydrous Ferric Chloride $(FeCl_3)$ is another Lewis acid which can be used.

(v) Hydrocarbons are categorized into three categories according to the carbon-carbon bond that exists between them:

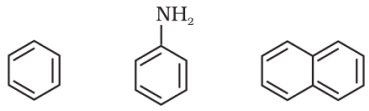
a. Saturated hydrocarbon (In which carbon-carbon single bond are present)

b. Unsaturated hydrocarbon (In which carbon-carbon double and triple bonds are present)

c. Aromatic hydrocarbon (In which alternate single and double bond and (4n+2)π electrons are present)

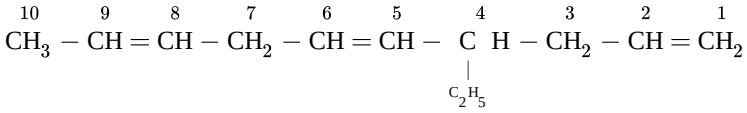
(vi) **Benzenoids:** Aromatic hydrocarbon compound containing benzene ring are known as benzenoids.

Examples for benzenoids are:



Benzene Aniline Naphthalene

(vii)



32. We can calculate the hydrogen ion concentration by applying the formula, pH = –log [H+]

i. pH of milk = 6.8

Since, pH = –log $[H^+]$

$\Rightarrow$ 6.8 = –log $[H^+]$

$\Rightarrow$ log $[H^+]$ = –6.8

By taking antilog of both the sides, we get

$\Rightarrow$ $[H^+]$ = antilog (–6.8)

$\Rightarrow$ $[H^+] = 1.5 \times 19\text{–}7$ M

ii. pH of black coffee = 5.0

Since, pH = –log $[H^+]$

$\Rightarrow$5.0 = –log $[H^+]$

$\Rightarrow$log $[H^+]$ = –5.0

By taking antilog of both the sides, we get

$\Rightarrow$$[H^+]$ = antilog (–5.0)

$\Rightarrow$$[H^+] = 10^{-5}$ M

iii. pH of tomato juice = 4.2

Since, pH = –log $[H^+]$

$\Rightarrow$ 4.2 = –log $[H^+]$

$\Rightarrow$ log $[H^+]$ = –4.2

By taking the antilog of both the sides, we get

$\Rightarrow$ $[H^+]$ = antilog (–4.2)

$\Rightarrow$ $[H^+] = 6.31 \times 10^{-5}$ M

iv. pH of lemon juice = 2.2

Since, pH = –log $[H^+]$

$\Rightarrow$2.2 = –log $[H^+]$

$\Rightarrow$log [H+] = –2.2

By taking the antilog of both the sides, we get

$\Rightarrow [H^+]$ = antilog (–2.2)

$\Rightarrow [H^+] = 6.31 \times 10^{-3}$ M

v. pH of egg white = 7.8

Since, pH = –log $[H^+]$

$\Rightarrow$7.8 = –log $[H^+]$

$\Rightarrow$log $[H^+]$ = –7.8

By taking the antilog of both the sides, we get

$\Rightarrow [H^+]$ = antilog (–7.8)

$\Rightarrow [H^+] = 1.58 \times 10^{-8}$ M

OR

$2H_2(g) + CO(g) \rightleftharpoons CH_3OH$

According to Le-Chatelier's principle:

When any system at equilibrium for a long period of time is subjected to a change in concentration, temperature, volume, or pressure, the system changes to a new equilibrium. This change partly counteracts the applied change.

i. On addition of H_2 (increase in the concentration of reactants), equilibrium will be shifted in the forward direction (more products are formed).

ii. On addition of CH_3OH (increase in concentration or product), equilibrium will be shifted in the backward direction.

iii. On removal of CO , equilibrium will be shifted in the backward direction.

iv. On removal of CH_3OH, Equilibrium will be shifted in the forward direction.

33. Answer:

(i) i. According to the question, 0.3780 g of an organic chlorine compound gave 0.5740 g of silver chloride in Carius estimation.

$$\% \text{ of chlorine} = \frac{35.5}{143.5} \times \frac{\text{mass of AgCl formed}}{\text{mass of substance taken}} \times 100$$

$$= \frac{35.5}{143.5} \times \frac{0.5740}{0.3780} \times 100$$

$$= 37.566\%$$

ii. SO_3 acts as an electrophile because three highly electronegative oxygen atoms are attached to Sulphur atom in SO_3 which makes sulphur atom electron deficient.

OR

i. i. Functional groups are -NH_2 (amino), -OMe (methoxy) and -CHO (aldehydic)

ii. Carbon-carbon double bond, -NO_2 (nitro) and -COOH (carboxylic)

iii. -CO- (keto), -COCl (acylchloride)

iv. $-\overset{|}{C} = \overset{|}{C}-$ ((carbon-carbon double bond), $-\overset{O}{\overset{||}{C}} - NH_2$ (acitamide).

ii. **Lassaigne's test :** Nitrogen, sulphur, halogens and phosphorous present in an organic compound are detected by Lassaigne's test.

First of all compounds are converted to ionic form by fusing the compound with sodium metal.

$$Na + C + N \xrightarrow{\Delta} NaCN$$

$$2Na + S \xrightarrow{A} Na_2S$$

$$Na + X \xrightarrow{A} NaX \text{ [x=cl,Br,I]}$$

Cyanide, sulphide or halide of sodium are extracted from the fused mass by boiling it with distilled water. This extract is known as sodium fusion extract.