Class XI Session 2025-26
Subject - Chemistry
Sample Question Paper - 6

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. What would be the molarity of NaOH in a solution prepared by dissolving its 4 g in enough water to form 250 mL of the solution? **[1]**

a) 2 M
b) 4 M
c) 0.4M
d) 0.04 M

2. Which of the following elements in an organic compound cannot be detected by Lassaignes test? **[1]**

a) Cl
b) S
c) H
d) N

3. Which of the following relationship is true? **[1]**

a) $C_p = C_v$
b) $C_p > C_v$
c) $C_v > C_p$
d) $C_p = C_v = 0$

4. All the orbitals in the valence shell of the noble gases: **[1]**

a) are completely filled by electrons.
b) not completely filled by electrons and the arrangement is not stable.
c) completely filled by electrons and it is very easy to remove electrons.
d) not completely filled by electrons and it is very easy to alter this stable arrangement by the addition or removal of electrons.

5. In the given reaction, **[1]**

$H_2(g) \rightarrow 2H(g); \Delta H = 435.0 \text{ kJ mol}^{-1}$

The enthalpy change is known as

a) bond dissociation enthalpy

b) enthalpy of atomisation

c) enthalpy of formation

d) enthalpy of atomisation and bond dissociation enthalpy

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. In the ethylene molecule the two carbon atoms have the oxidation number **[1]**

a) -1, -2

b) +2, -2

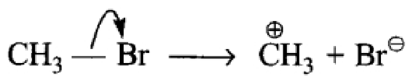
c) -2,-2

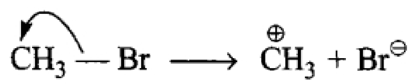
d) -1, -1

8. Covalent bond can undergo fission in two different ways. The correct representation involving heterolytic fission of CH_3-Br is **[1]**

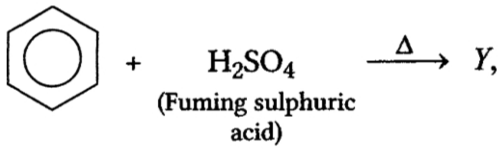
a) 

b) 

c) 

d) 

9. In the reaction, **[1]**



a) $C_6H_5SO_2$

b) C_6H_5CHO

c) $C_6H_5SO_3H$

d) C_6H_5OH

10. The IUPAC name of C_6H_5COCl is: **[1]**

a) Benzene chloro ketone

b) Benzene carbonyl chloride

c) Chloro phenyl ketone

d) Benzoyl chloride

11. $\Delta_f U^{\ominus}$ of formation of CH_4 (g) at certain temperature is –393 $kJmol^{-1}$. The value of $\Delta_f H^{\ominus}$ is **[1]**

a) equal to $\Delta_f U^{\ominus}$

b) $> \Delta_f U^{\ominus}$

c) $< \Delta_f U^{\ominus}$

d) zero

12. The boiling point of isomeric branched chain alkene is: **[1]**

a) same boiling point as straight chain alkenes except for optical isomers.

b) same boiling point as straight chain alkenes.

c) higher boiling point than straight chain alkenes.

d) lower than the boiling point of straight chain alkene.

13. **Assertion (A):** Rinku has two structures naphthalene and aniline. she claims that both are aliphatic compounds. **[1]**
Reason (R): Aromatic compounds are also had hetero atoms in the ring.

a) Both A and R are true and R is the correct

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

correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

14. **Assertion (A):** Fluoride has the lowest and iodide has the highest boiling point. **[1]**

Reason (R): Boiling points of haloalkanes increases with increasing atomic mass.

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):** Atom is electrically neutral. **[1]**

Reason (R): A neutral particle, neutron is present in the nucleus of atom.

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):** Law of conservation of mass hold good for nuclear reaction. **[1]**

Reason (R): Law states that mass can be neither created nor destroyed in a chemical reaction.

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. Calculates the formal charge on each atoms of **[2]**

i. Carbonate ion and

ii. SO_2 molecule

OR

Why are the noble gases poor chemical reactants?

18. What factors does the equilibrium constant of a reaction depend? **[2]**

19. Write the IUPAC name of the compound from its given structure. **[2]**

$\underset{6}{C}H \equiv \underset{5}{C} - \underset{4}{C}H = \underset{3}{C}H - \underset{2}{C}H = \underset{1}{C}H_2$

20. Calculate the pH of a buffer solution containing 0.1 mole of acetic acid and 0.15 mole of sodium acetate. Ionisation constant for acetic acid is 1.75×10^{-5}. **[2]**

21. Complete the following: **[2]**

$(CH_3COO)_2\,Pb + Na_2S \longrightarrow$

Section C

22. 7-bromo-1, 3, 5-cycloheptatriene exists as an ion whereas 5-bromo-1, 3-cyclopentadiene does not form an ion even in presence of Ag^+. Explain. **[3]**

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

(a) Arrange X-rays, cosmic rays and radio waves according to frequency. **[1]**

(b) What is an isotope? **[1]**

(c) Which series of lines of the hydrogen spectrum lie in the visible region? **[1]**

24. Predict in which of the following, entropy increases/decreases **[3]**

i. A liquid crystallizes into a solid.

ii. The temperature of a crystallize solid is raised from 0 K to 115 K

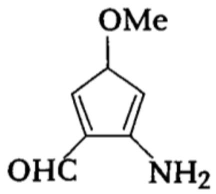
iii. $2NaHCO_3(s) \longrightarrow Na_2CO_3\ (s) + CO_2\ (g) + H_2O\ (g)$

iv. $H_2(g) \longrightarrow 2H\ (g)$

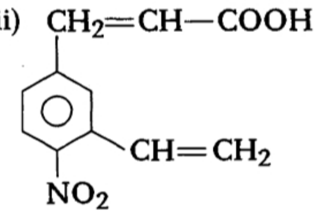
25. What are the oxidation number of the underlined $H_2\underline{S}_4O_6$ element and how do you rationalise your results? **[3]**

26. Identify the functional groups present in the following compounds. **[3]**

(i)



(ii)



(iii) $CH_3—CH_2—CO—CH_2—CH_2—COCl$

(iv) $CH_2{=}CH—CH_2—C(=O)—NH_2$

27. Justify the following statements. **[3]**

i. Reaction with negative Gibb's energy always has an equilibrium constant greater than 1.

ii. Many thermodynamically feasible reactions do not occur under ordinary conditions.

iii. At low temperatures, enthalpy change dominates the ΔG expression and at high temperatures, it is the entropy that dominates the value of ΔG.

28. The pH of 0.005 M codeine ($C_{18}H_{21}NO_3$) solution is 9.95. Calculate the ionization constant and pK_b. **[3]**

Section D

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

The relative stability of alkenes can be determined by comparing their heats of hydrogenation. The lower heat of hydrogenation indicates the more stable alkene. The three main factors determining the relative stability of alkenes are

i. the number of substituents attached to the double-bond carbon atoms,

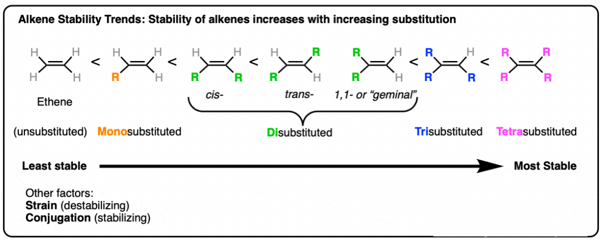
ii. hyperconjugation, and

iii. the stereochemistry of the double bond.

The number of substituents across the double bond: An alkene with two smaller substituents is more stable than its isomer having one large substituent. For example, 2-butene is more stable compared to 1-butene. The highly substituted alkenes have a higher ratio of sp^2-sp^3 bonds, which are lower in energy and are stronger as compared to the sp^3-sp^3 bonds. Thus, a tetrasubstituted alkene is more stable than a tri-, di-, or monosubstituted alkene.

Hyperconjugation: Hyperconjugation is a stabilizing interaction of the delocalized electron density between the carbon-carbon π bond and the adjacent carbon-hydrogen σ bonds on the substituent. Thus, a higher number of alkyl substituents across the double bond suggests greater hyperconjugation, resulting in a more stable alkene.

Stereochemistry: The spatial arrangement of the substituents also contributes to the stability of alkenes. The cis-isomer exhibits steric strain because of the crowding of the substituents on the same side of the double bond and therefore is less stable compared to the trans isomer.



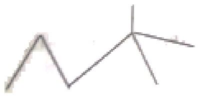
i. Arrange the following alkenes in the decreasing order of stability: (1)

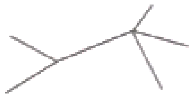
i. CH_3
 |
$CH_3C = CHCH_3$

ii. CH_3
 |
$CH_3CHCH = CH_2$

iii. CH_3
 |
$CH_3 = CCH_2CH_3$

ii. Arrange the following in decreasing order of their release of energy on combustion: (1)

i. 

ii. 

iii. 

iv. 

iii. Arrange the following set of compounds in order of their decreasing relative reactivity with an electrophile, E^+. (2)

chlorobenzene, 2,4 -dinitrochlorobenzene, p -nitrochloro benzene

OR

Arrange the following set of compounds in order of their decreasing relative reactivity with an electrophile, E^+. (2)

toluene, p-H_3C-C_6H_4-CH_3, p-H_3C-C_6H_4-NO_2, p-O_2N-C_6 H_4-NO_2

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

In 1830, Michael Faraday showed that if electricity is passed through a solution of an electrolyte, chemical reactions occurred at the electrodes, which resulted in the liberation and deposition of matter at the electrodes. In the mid-1850s Faraday began to study electrical discharge in partially evacuated tubes, known as cathode ray discharge tubes. When sufficiently high voltage is applied across the electrodes, current starts flowing through a stream of particles moving in the tube from the negative electrode to the positive electrode. These were called cathode rays or cathode ray particles. J.J. Thomson measured the ratio of electrical charge (e) to the mass of the electron (m_e) by using a cathode ray tube and applying electrical and magnetic fields perpendicular to each other as well as to the path of electrons. Positively charged particle was characterised in 1919. Later, a need was felt for the presence of electrically neutral particles as one of the constituents of the atom.

i. What is the value of charge to mass ratio (e/m) of electrons? (1)

ii. How is it concluded that electrons are a universal constituent of all matter? (1)

iii. Which fundamental property of an atom is not understood if we assume that an atom consists of a nucleus containing protons only and an extranuclear part containing an equal number of electrons? (2)

OR

Calculate the total no. of electrons present in one mole of methane. (2)

Section E

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

(a) Can we have a diatomic molecule with its ground state molecular orbitals full with electrons? Give a reason for your answer. **[1]**

(b) Compare the relative stability of the following species and indicate their magnetic properties; O_2, O_2^+, O_2^- (superoxide), O_2^{2-} (peroxide). **[1]**

(c) Why KHF_2 exists but $KHCl_2$ does not? **[1]**

(d) Discuss the shape of the following molecules based on VSEPR theory: BCI_3, $SiCI_4$. **[1]**

(e) BH_4^- and NH_4^+ are isolobal. Explain. **[1]**

(f) What is the valence bond approach for the formation of a covalent bond? **[1]**

(g) Define hybridization. **[1]**

32. Discuss the factors affecting electron gain enthalpy and the trend in its variation in the periodic table. **[5]**

OR

i. Give the characteristics of Mendeleev's periodic table

ii. In what manner is the long form of periodic table better than Mendeleev's periodic table? Explain with examples.

33. A solution is prepared by adding 2 g of a substance A to 18 g of water. Calculate the mass percent of the solute. Also define volume percentage and parts per million (ppm). **[5]**

OR

An organic substance containing carbon, hydrogen and oxygen gave the percentage composition as C = 40.687%, H = 5.085%.

The vapour density of the compound is 59. Calculate the molecular formula of the compound.

Solution

Section A

1.

(c) 0.4M

Explanation:

Given that 250 ml of solution contains 4 g NaOH

∴ Number of moles of NaOH in 250 ml of the prepared solution = (4/40)

= 0.1 moles

& number of moles of NaOH per litre of this solution

= 0.4 moles

Since Molarity (M)= number of moles of solute present in 1 Litre of the solution,

Therefore, the Molarity of NaOH solution is 0.4 M.

2.

(c) H

Explanation:

H

3.

(b) $C_p > C_v$

Explanation:

We know, $C_p - C_v = R$

Hence, $C_p > C_v$

4. **(a)** are completely filled by electrons.

Explanation:

These elements are called noble elements because they contain ns^2, np^6 valence shell electronic configuration. A complete octet in the outermost shell makes these elements chemically stable, and therefore they do not easily react with other elements to form compounds.

5.

(b) enthalpy of atomisation

Explanation:

$H_2(g) \rightarrow 2H(g)$; $\Delta_a H^o = 435$ kJ mol^{-1}

H-atoms are formed by breaking H - H bond in dihydrogen. The enthalpy change in this process is known as enthalpy of atomisation, $\Delta_a H^o$.

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

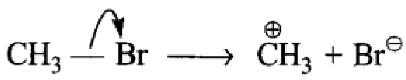
7.

(c) -2,-2

Explanation:

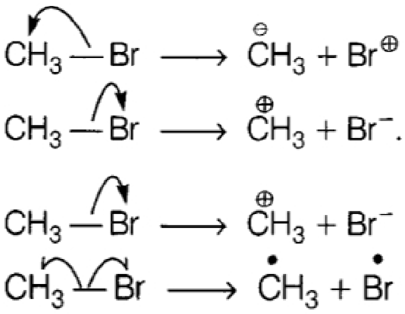
In general carbon molecule have 4 valence electrons and in ethylene molecule ($H_2C = CH_2$) each carbon atom is surrounded by 6 valence electron so by calculating its oxidation number we will get 4 - 6= -2. so, thats why carbon have -2,-2 oxidation number.

8.

(c) 

Explanation:

Arrow denotes the direction of movement of electrons



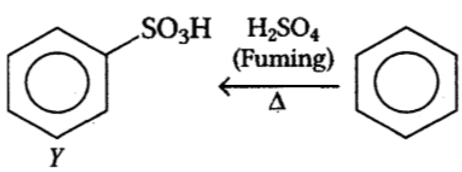
(homolytic)

Since, Br is more electronegative than carbon, hence heterolytic fission occurs in such a way that $-CH_3$ gets the positive charge and Br gets the negative charge.

9.

(c) $C_6H_5SO_3H$

Explanation:



10.

(d) Benzoyl chloride

Explanation:

Carboxylic acids are named as oyl chlorides.

11.

(c) $<\Delta_f U^\ominus$

Explanation:

The combustion of metahne is given as follows: $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

Since $\Delta_f H^\circ = \Delta_f U^\circ + \Delta n_g RT$ and $\triangle_f U^\circ$ = - 393 kJmol^{-1}, $\triangle_f H^\circ$ = (-393) + $\triangle n_g RT$

(Here, $\triangle n_g < 0) \Rightarrow \Delta_f H^\circ < \Delta_f U^\circ$

12.

(d) lower than the boiling point of straight chain alkene.

Explanation:

As the surface area decreases with branching, the boiling point also decreases.

13.

(d) A is false but R is true.

Explanation:

Aromatic compounds are special types of compounds. These include benzene and other related ring compounds (benzenoid). Like alicyclic compounds, aromatic compounds may also have heteroatom in the ring. Such compounds are called heterocyclic aromatic compounds. example aniline, naphthalene.

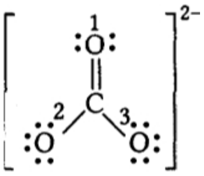
14. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
For a given halogen the boiling point rises with increasing atomic mass of the halogen, so that fluoride has the lowest boiling point and iodide has the highest boiling point.

15.
(b) Both A and R are true but R is not the correct explanation of A.
Explanation:
Atom is electrically neutral because the number of protons (positively charged particle) is equal to the number of electrons (negatively charged particle).

16.
(d) A is false but R is true.
Explanation:
Law of conservation of mass does not hold good for nuclear reaction due to mass defect.

Section B

17. i. Lewis structure of CO_3^{2-} ion is



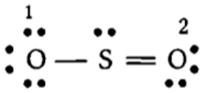
The formal charge on

a. the carbon atom = V - L - $\frac{1}{2}$S
= 4 - 0 - $\frac{1}{2}$(8) = 0

b. the oxygen atom marked as (1) = V - L - $\frac{1}{2}$S

c. the oxygen atom marked as (2) and (3) = V - L - $\frac{1}{2}$S
= 6 - 6 - $\frac{1}{2}$ (2) = -1

ii. Lewis structure of SO_2 ion is



The formal charge on

a. the sulphur atom = V - L - $\frac{1}{2}$S
= 6 - 2 - $\frac{1}{2}$ (6) = +1

b. the oxygen atom marked as (1) = V - L - $\frac{1}{2}$S
= 6 -6 - $\frac{1}{2}$ (2) = -1

c. the oxygen atom marked as (2) = V - L - $\frac{1}{2}$S
= 6 - 4 - $\frac{1}{2}$ (4) = 0

OR

The noble gases are the chemical elements in group 18 of the periodic table. They are the most stable element in their respective period as they have the maximum number of valence electrons their outer shell can hold and hence they have a stable electronic configuration. Therefore, they rarely react with other elements and hence are poor chemical reactants.

18. The equilibrium constant of a reaction depends on

i. Temperature i.e. the constant depends on the sign of ΔH
ii. Stoichiometry of the reaction i.e. how the reaction is represented.

19. The two C=C (double bond) functional groups are present at carbon atoms 1 and 3, while the C≡C (triple bond) functional group is present at carbon 5. These groups are indicated by suffixes ‘diene’ and ‘yne’ respectively. The longest chain containing the functional groups has 6 carbon atoms; hence the parent hydrocarbon is hexane. The name of the compound, therefore, is Hexa-1,3- dien-5-yne.

20. We have, Henderson's equation

$pH = pK_a + \log \frac{[Salt]}{[Acid]}$

$pH = -\log K_a + \log \frac{[Sodium\ acetate]}{[Acetic\ acid]}$

$pH = -\log (1.75 \times 10^{-5}) + \log \frac{0.15}{0.10}$

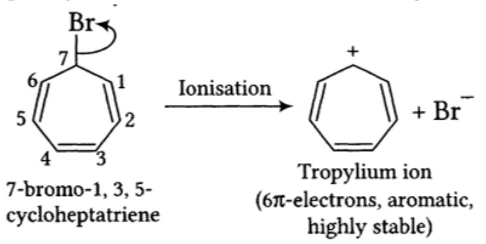
or, $pH = -\log 1.75 - \log 10^{-5} + \log 1.5$

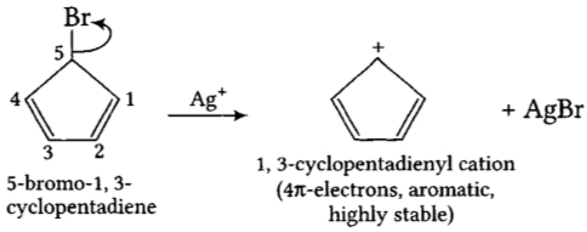
$= -0.243 + 5 + 0.176 = 4.933$

21. $(CH_3COO)_2Pb + Na_2S \longrightarrow PbS + 2CH_3COONa$

Section C

22. 7-bromo-1, 3, 5-cycloheptatriene, on ionisation, gives tropylium ion. Since, tropylium ion contains 6π-electrons which are completely delocalised, therefore, according to Huckel rule, it is aromatic and hence stable due to which it is easily formed.





In contrast, 5-bromo-1,3-cyclopentadiene, on ionisation, will give 1, 3-cyclopentadienyl cation which contains 4π-electrons and it is anti-aromatic.

Being anti-aromatic, it is highly unstable and hence is not formed even in the presence of Ag^+ ion which facilitates ionisation.

23. Answer:

(i) Cosmic rays > X-rays > radio waves.

(ii) Atoms of the same element having same atomic number but different mass number are called isotopes. e.g. Hydrogen exist in three isotopes i.e. ${}_1^1H, {}_1^2H$ and ${}_1^3H$. Here ${}_1^3H$ is radioactive.

(iii) **Balmer series:** The Balmer series or Balmer lines in atomic physics, is the designation of one of a set of six named series describing the spectral line emissions of the hydrogen atom. The Balmer series is calculated using the Balmer formula, an empirical equation discovered by Johann Balmer in 1885

24. i. After freezing, the molecules attain an ordered state and therefore, entropy decreases.

ii. At 0K the constituent particles are in static form therefore entropy is minimum. If the temperature is raised to 115 K, these begin to move and oscillate about their equilibrium positions in the lattice and system becomes more disordered, therefore entropy increases.

iii. Reactant, $NaHCO_3$ is solid and it has low entropy. Among products there are one solid and two gases. Therefore, the products represent a condition of higher entropy.

iv. Here one molecule gives two atoms i.e., number of particles increases leading to more disordered state. Two moles of H atoms have higher entropy than one mole of dihydrogen molecule.

25. In $H_2S_4O_6$, let the oxidation number of S be x.

$\overset{+1}{H_2}\overset{x}{S_4}\overset{-2}{O_6}$

$2(+1) + 4x + 6(-2) = 0$

$4x = +10$ or $= +\frac{10}{4} = +2.5$

Let us consider the structure of $H_2S_4O_6$

$$H - O - \overset{+5}{\underset{\underset{O}{||}}{\overset{\overset{O}{||}}{S}}} - \overset{0}{S} - \overset{0}{S} - \underset{\underset{O}{||}}{\overset{\overset{O}{||}}{S}}{}^{+5} - OH$$

In $H_2S_4O_6$ the oxidation number of each of two S-atoms which are linked with each of the other by a single bond (in the centre) is zero and each of the remaining two S-atoms both side is +5. Hence, the oxidation number of 4 S-atoms in $H_2S_4O_6$ is +5, 0, 0, and +5 respectively.

26. 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), $-\overset{\overset{O}{||}}{C}-NH_2$ (acitamide).

27. i. We know that, ΔG = - 2.303 RT log K.
Thus, when ΔG° < 0, K > 1.
ii. Under ordinary conditions, the average energy of the reactants may be less than threshold energy. They requires some activation energy to initiate the reaction.
So, many thermodynamically feasible reactions do not occur under ordinary conditions.
iii. We know that, $\Delta G = \Delta H - T\Delta S$.
At low temperature, $T\Delta S$ is small.
Hence, ΔH dominates.
At high temperature, $T\Delta S$ is large.
Hence, ΔS dominates the value of ΔG.

28. Co $d + H_2O \rightleftharpoons Cod\ H^+ + OH^-$
pH = 9.95 ∴ pOH = 14 - 9.5 = 4.05, i.e. -log[OH^-] = 4.05
or log [OH^-] = -4.05 $= \bar{5}.95$ or $[OH^-] = 8.913 \times 10^{-5} M$
$K_b = \frac{[Cod\ H^+]\ [OH^-]}{[Cod]} = \frac{[OH^-]^2}{[Cod]} = \frac{(8.913 \times 10^{-5})^2}{5 \times 10^{-3}} = 1.588 \times 10^{-6}$
Therefore, $pK_b = -\log(1.588 \times 10^{-6}) = 6 - 0.1987 = 5.8$

Section D

29. i. $CH_3C(CH_3)=CHCH_3$ > $CH_3=C(CH_3)CH_2CH_3$ > $CH_3CH(CH_3)CH=CH_3$
ii. Largest the number of carbon atoms having maximum hydrogens (i.e., CH_3 groups), greater is the heat of combustion.
Thus, the increasing order of heat of combustion (iii) < (iv) < (i) < (ii)
iii. Chloro benzene, p-nitrochloro benzene, 2,4-dinitrochloro benzene.

OR

p-CH_3-C_6H_4-CH_3 > toluene > p-CH_3-C_6H_4-NO_2-C_6H_4-NO_2

30. i. J.Thomson determined the value of e/m for electron by the study of deflection of electron beam under the simultaneous influence of electric and magnetic field perpendicular to each other, the e/m value is 1.76×10^8 coulomb per gram of electrons.
ii. The charge/mass (e/m) ratio for the particles in the cathode rays (i.e., electron) is found to be the same irrespective of the nature of the cathode or the nature of the gas taken in the discharge tube. This shows that electrons are universal constituents of all matter.
iii. The mass number of atoms and stability of the nucleus cannot be explained.

OR

1
Molecule of methane (CH_4) contains electrons = 6 + 4 = 10
1 Mole, i.e., 6.022×10^{23} molecules will contain electrons = 6.022×10^{24}

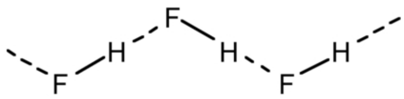
Section E

31. Attempt any five of the following:
(i) We can't have a diatomic molecule with its ground state molecular orbitals full with electrons because bond order becomes zero.
Example: In case of He_2, Be_2, Ne_2, bond order is zero because σ 1s and σ^*1s orbitals are completely filled.
In H_2, σ 1s molecular orbital is full but σ^* 1s is empty. So, bond order is 1.
(ii) O_2^+, O_2 and O_2^- are paramagnetic whereas O_2^{2-} are diamagnetic.

The relative stability of the above species in decreasing order is

$O_2^+ > O_2 > O_2^- > O_2^{2-}$

(iii) Due to the presence of hydrogen bonding in HF, the structure is converted to,



This can dissociate to give HF_2^- ion.

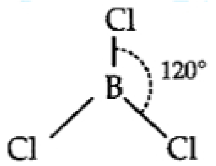
If we add K^+ to HF_2^- ion, we get KHF_2.

Due to the absence of hydrogen bonding in HCl, HCl_2^- ion is not formed.

Hence, $KHCI_2$ does not exist.

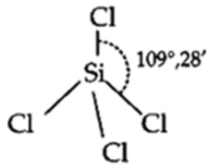
Therefore, KHF_2 exists but $KHCl_2$ does not exist.

(iv) i. BCI_3: Trigonal planar



[No lone pair of electrons on B]

ii. $SiCl_4$: Tetrahedral



[No lone pair of electrons on Si]

(v) Both BH_4^- and NH_4^+ ions have a tetrahedral geometry i.e., they have four lobes of sp^3 hybridised orbitals. So they are called isolobal.

(vi) According to the valence bond theory, a covalent bond is formed due to the overlapping of half-filled atomic orbitals present in the valence shell of the atoms participating in bonding.

(vii) Hybridization is defined as the phenomenon of intermixing of the atomic orbitals of slightly different energies so as to redistribute their energies, resulting in the formation of new set of orbitals of equivalent energies and shape.The new orbitals thus, formed are known as hybrid orbitals.The number of hybrid orbitals are equal to the number of atomic orbitals mixed.

32. **Factors Affecting Electron Gain Enthalpy:**

- **Nuclear charge**: Greater the nuclear charge greater will be electron gain enthalpy.
- **Size of the atom**: It is inversely related to size of the atom as atomic size increases electron gain enthalpy decreases.
- **Electronic configuration**: Elements which have stable electronic configuration of half filled and completely filled valence subshells show less tendency to accept an additional electron. Hence, electron gain enthalpy is less negative.

Trends in variation in the periodic table:

i. **In period**: The electron gain enthalpy increases from left to right in a period as atomic size decreases.
ii. **In group**: The electron gain enthalpy decreases from top to bottom in a group.

OR

The periodic table, generated by Mendeleev's had the following features

i. In this periodic table, there were eight vertical columns, named as groups. These were represented by Roman numerals I to VIII. Each group is divided into sub-groups A and B except the VIII group which had nine elements arranged in three rows as triads i.e. in the group of three.
ii. In this table, there were six horizontal rows, named as periods which were further divided into 12 series.

The long form of periodic table is better then Mendeleev's periodic table in the following ways

i. Long form of periodic table removed the anomalies of inversions that existed in the Mendeleev's periodic table, e.g., potassium with atomic number 19 is placed after argon with atomic number 18. Similarly, cobalt with atomic number 27 is placed before nickel with atomic number 28.
ii. In long form table same position is alloted to each isotope of an element as all the isotopes of an element have same atomic number.

iii. Other anomalies of Mendeleev's periodic table like grouping of dissimilar elements together and similar elements separately has also been removed by long form periodic table.

iv. Long form of periodic table also explains the cause of periodicity on the basis of electronic configuration. Further it relates the position o f an element in the periodic table with its electronic configuration.

v. Long form of periodic table provides an easier way to remember all the elements and their properties by just knowing their atomic numbers and electronic configurations.

33. mass percentage of a component = $\frac{\text{Mass of } one\ component}{\text{Mass of solution}} \times 100$

Mass percent of A = $\frac{\text{mass of } A}{\text{mass of solution}} \times 100 = \frac{2\text{g}}{2\text{g of A}+18\text{g of water}} \times 100 = \frac{2\text{g}}{20\text{g}} \times 100 = 10\%$

i. Volume percentage It is defined as the volume of the solute (in ml) present in 100 ml of the solution, e.g. if V_A and V_B are the volumes of solute and solvent A and B respectively in a solution, then

Volume percentage of A $= \frac{\text{volume of } A}{\text{volume of } A + \text{ volume of } B} \times 100$. It can also be expressed as v/V %.

ii. Parts per million When a solute is present in very minute amounts (trace quantities), the concentration is expressed in parts per million, abbreviated as ppm. It is the parts of a component per million parts of the solution. Concentration of A components in terms of ppm = $\frac{\text{mass of component } A}{\text{total mass of solution}} \times 10^6$

For example, suppose a liter of public supply water contains about 3×10^{-3} g of chlorine. The mass percentage of chlorine is = $\frac{3.0\times10^{-3}}{1000} \times 100 = 3 \times 10^{-4}$ (Total volume is 100 mL)

$\therefore$ ppm of chlorine = $\frac{3\times10^{-3}\times10^{6}}{1000} = 3$

Thus, instead of expressing concentrations of chlorine as 3×10^{-4} %, it is better to express as 3 ppm.

OR

Given Percentage of C= 40.687% , Percentage of H = 5.085%.

Therefore, Percentage of O = 100 - (40.687+5.085) = 54.228%.

Step I: To calculate the empirical formula of the compound.

Element	Symbol	Percentage of element	Moles of the element $= \frac{\text{Percentage}}{\text{Atomic mass}}$ (Relative number of moles	Simples molar ratio	Simplest whole number molar ratio
Carbon	C	40.687	$\frac{40.687}{12} = 3.390$	$\frac{3.390}{3.389} = 1$	2
Hydrogen	H	5.085	$\frac{5.0885}{1} = 5.085$	$\frac{5.085}{3.389} = 1.5$	3
Oxygen	O	16	$\frac{54.228}{16} = 3.389$	$\frac{3.389}{3.389} = 1$	2

Since, ration of C : H : O = 2 :3 :2.

$\therefore$ An empirical formula is $C_2H_3O_2$.

Step II: The empirical formula of the compound = $C_2H_3O_2$.

$\therefore$ Empirical formula mass = 2 × C +3 × H + 2× O = $(2 \times 12) + (3 \times 1) + (2 \times 16) = 59$

Step III: To calculate the molecular mass of the salt

The vapour density of the compound = 59 (Given)

Using the relation between vapour density and molecular mass.

Therefore, Molecular mass of compound = 2 × vapour density of compound = 2 × 59 = 118

Step IV: The value of n = $\frac{\text{molecular mass}}{\text{empirical formula mass}} = \frac{118}{59} = 2$

Step V: Calculation of the molecular formula of the salt,

Molecular formula = n × empirical formula = $2 \times C_2H_3O_2 = C_4H_6O_4$

Thus, the molecular formula is $C_4H_6O_4$.