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	Term 1	Term 2	Term 3	Periodical Test	SLAS	

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SURA'S

CHEMISTRY

11th Standard

VOLUME - I & II

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- Govt. Model Question Paper, Sura's Model Question Paper, Quarterly Common Examination - 2019, Half Yearly Examination - 2019 Question Papers are given.

SURA PUBLICATIONS
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CHEMISTRY

Volume I

01 Basic Concepts Of Chemistry And Chemical Calculations

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  - ✶ Chemical Classification of matter
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- Balancing of redox reactions
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Government Exam Questions and Answers

PART - I

Choose the Correct Answer 1 MARK

1. The equivalent mass of a divalent metal element is 10 g eq^{-1}. The molar mass of its anhydrous oxide is *[Govt. MQP-2018]*

(a) 46 g (b) 36 g
(c) 52 g (d) none of these

[Ans. (c) 52 g]

Hint: Atomic mass of divalent metal is equal to 2 multiple of atomic mass of metal + 2 multiple of atomic mass of oxygen

2. Match the list I with List II correctly by using the code given below the list. *[QY. 2018]*

List I (no. of moles)		List II (Amount)	
A	0.1 mole	1	4480 mL of CO_2
B	0.2 mole	2	200 mg of hydrogen gas
C	0.25 mole	3	9 mL of water
D	0.5 mole	4	1. 51 × 10^{23} molecules of oxygen

	A	B	C	D
(a)	2	3	4	1
(b)	4	3	1	2
(c)	3	1	4	2
(d)	2	1	4	3

[Ans. (b) 2 1 4 3]

Hint: Number of moles is equal to Mass/ Molar mass
Number of moles is equal to Volume/ molar volume

3. The oxidation number of chromium in dichromate lion is *[QY-2018]*

(a) +4 (b) +6 (c)+5 (d) 0

[Ans. (b) +6]

4. The empirical formula of glucose is : *[HY. 2019]*

(a) CH_2O (b) CHO
(c) CH_2O_2 (d) CH_3O_2

[Ans. (a) CH_2O]

5. The oxidation number of carbon in CH_2F_2 is ____. *[June 2019]*

(a) +4 (b) –4 (c) 0 (d) +2

[Ans. (c) 0]

PART - II

Answer the Questions 2 MARK

1. Write the electronic concept of oxidation and reduction reactions. *[QY. & HY. 2018]*

Ans. The process can be explained on the basis of electrons. The reaction involving loss of electron is termed oxidation

$Fe^{2+} \rightarrow Fe^{3+} + e^-$ (loss of electron-oxidation).

The reaction involving gain of electron is termed reduction.

$Cu^{2+} + 2e^- \rightarrow Cu$ (gain of electron-reduction)

2. How many moles of hydrogen is required to produce 10 moles of ammonia ? *[HY-2018]*

Ans. $N_2(g) + 3\ H_2(g) \longrightarrow 2\ NH_3(g)$

To produce 2 moles of ammonia, 3 moles of hydrogen are required

To produce 10 moles of ammonia

$$= \frac{3 \text{ moles of } H_2}{\cancel{2 \text{ moles of } NH_3}} \times \overset{5}{\cancel{10 \text{ moles of } NH_3}}$$

= 15 moles of hydrogen are required.

3. Calculate oxidation number of oxygen in H_2O_2. *[Mar. 2019]*

Ans. hydrogen peroxide (H_2O_2)

$2 (+1) + 2x = 0; \Rightarrow 2x = -2 ; \Rightarrow x = -1$

4. What is combination reaction? Give example. *[HY. 2019]*

Ans. When two or more substance combine to form a single substance, the reactions are combination reactions.

$$A + B \longrightarrow C$$

$$Ex - 2Mg + O_2 \longrightarrow 2MgO$$

5. Calculate the oxidation states of oxygen in H_2O_2 and KO_2. *[QY. 2019]*

Ans. Hydrogen peroxide (H_2O_2) is –1.

$2 (+1) + 2x = 0; \Rightarrow 2x = -2 ; \Rightarrow x = -1$

Super oxides such as KO_2 is = –1/2

$+1 + 2x = 0; \Rightarrow 2x = -1 ; \Rightarrow x = -1/2$.

NUMERICAL PROBLEMS

1. Calculate the number of atoms in each of the following.
(i) 52 g of He and (ii) 52 moles of He.

Ans. **(i)** 1 mol of He ≡ 4g ≡ 6.022×10^{23} He atoms
(ie) 4g of He contains 6.022×10^{23} He atoms

$$\therefore \text{ 52g of He contains } = \frac{6.023\times10^{23}\times52}{4}$$
$$= 7.83\times10^{24}$$

52g of He contains 7.83×10^{24} He atoms.

(ii) 1 mol of He contains 6.023×10^{23} He atoms

$$\therefore \text{ 52 moles of He contains } = \frac{6.023\times10^{23}\times52}{1}$$
$$= 3.132\times10^{25}$$

52 moles of He contains 3.132×10^{25} He atoms.

2. Calculate the mass of the following :
(i) 1 atom of silver (ii) 1 molecule of benzene
(iii) 1 molecule of water.

Ans. **(i)** Molecular mass of silver (Ag) = 107.87 u
Molar mass of Ag = 107.87 g mol^{-1}

$$\therefore \text{ Mass of 1 atom of Ag } = \frac{\text{Molar mass}}{\text{Avogadro's number}}$$
$$= \frac{107.87 \text{ g mol}^{-1}}{6.023\times10^{23} \text{ mol}^{-1}}$$
$$= 17.91 \times 10^{-23} \text{ g.}$$

Mass of 1 atom of Ag = 17.91×10^{-23} g.

(ii) Molecular mass of benzene (C_6H_6) =
(6 × 12.01 u) + (6 × 1u) = 78.06 u
Molar mass of benzene = 78.06 g mol^{-1}
Then, mass of 1 molecule of benzene

$$= \frac{\text{Molar mass of benzene}}{\text{Avogadro's number}}$$
$$= \frac{78.06 \text{ g mol}^{-1}}{6.023\times10^{23} \text{ mol}^{-1}} = 12.96 \times 10^{-23} \text{ g}$$

Mass of 1 molecule of benzene = 12.94×10^{-23} g.

(iii) Molecular mass of water = (2 × 1u) + (1 × 16u)
= 18 u
Molar mass of water = 18 g mol^{-1}
Mass of 1 molecule of water

$$= \frac{\text{Molar mass of water}}{\text{Avogadro's number}}$$
$$= \frac{18 \text{g mol}^{-1}}{6.023\times10^{23} \text{ mol}^{-1}} = 2.99 \times 10\text{–}23 \text{ g}$$

Mass of 1 molecule of water = 2.99×10^{-23} g.

3. One million silver atoms weigh 1.79×10^{-16} g. Calculate the atomic mass of silver.

Ans. No. of silver atoms = 1 million = 1×10^6
Mass of one million Ag atoms = 1.79×10^{-16} g
Mass of 6.023×10^{23} atoms of silver

$$= \frac{1.79\times10^{-16}\text{g}}{1\times10^{6}} \times 6.023\times10^{23}$$
$$= 107.8 \text{ g.}$$

Atomic mass of silver = 6.023×10^{23} atoms of Ag
∴ The atomic mass of Ag = 107.8 g.

4. How much mass (in gram units) is represented by the following?
(i) 0.2 mol of NH_3 (ii) 3.0 mol of CO_2
(iii) 5.14 mol of H_5IO_6

Ans. **(a)** Molar mass of NH_3 = (1×14 + 3×1) = 17g mol^{-1}
Mass of 0.2 mol of NH_3 = 0.2 mol × 17g mol^{-1}
= 3.4 g

(b) Molar mass of CO_2 = (1×12 + 2×16)
= 44 g mol^{-1}
Mass of 3 moles of CO_2 = 3 mol × 44g mol^{-1}
= 132 g

(c) Molar mass of H_5IO_6 = (5×1 + 1×127 + 6×16)
= 228 g mol^{-1}
Mass of 5.14 mol of H_5IO_6 = 5.14 mol × 228g mol^{-1}
= 1171.9 g.

5. What mass of N_2 will be required to produce 34g of NH_3 by the reaction, $N_2 + 3H_2 \longrightarrow 2NH_3$.

Ans. The reaction is

N_2	+	$3H_2$	⟶	$2NH_3$
1 mol		3 mol		2 mol
2 × 14				2(1×14 + 3×1)
28g				= 34g

Thus, to produce 34.0 g ammonia, 28g of N_2 is required.

6. Calculate the Formula Weights of the following compounds.
(a) NO_2 (b) Glucose ($C_6H_{12}O_6$) (c) NaOH
(d) $Mg(OH)_2$

02 Quantum Mechanical Model of Atom

CHAPTER SNAPSHOT

Introduction to various atom models
- Thomson model of atom
- Rutherford's atomic model
- Bohr's atomic model

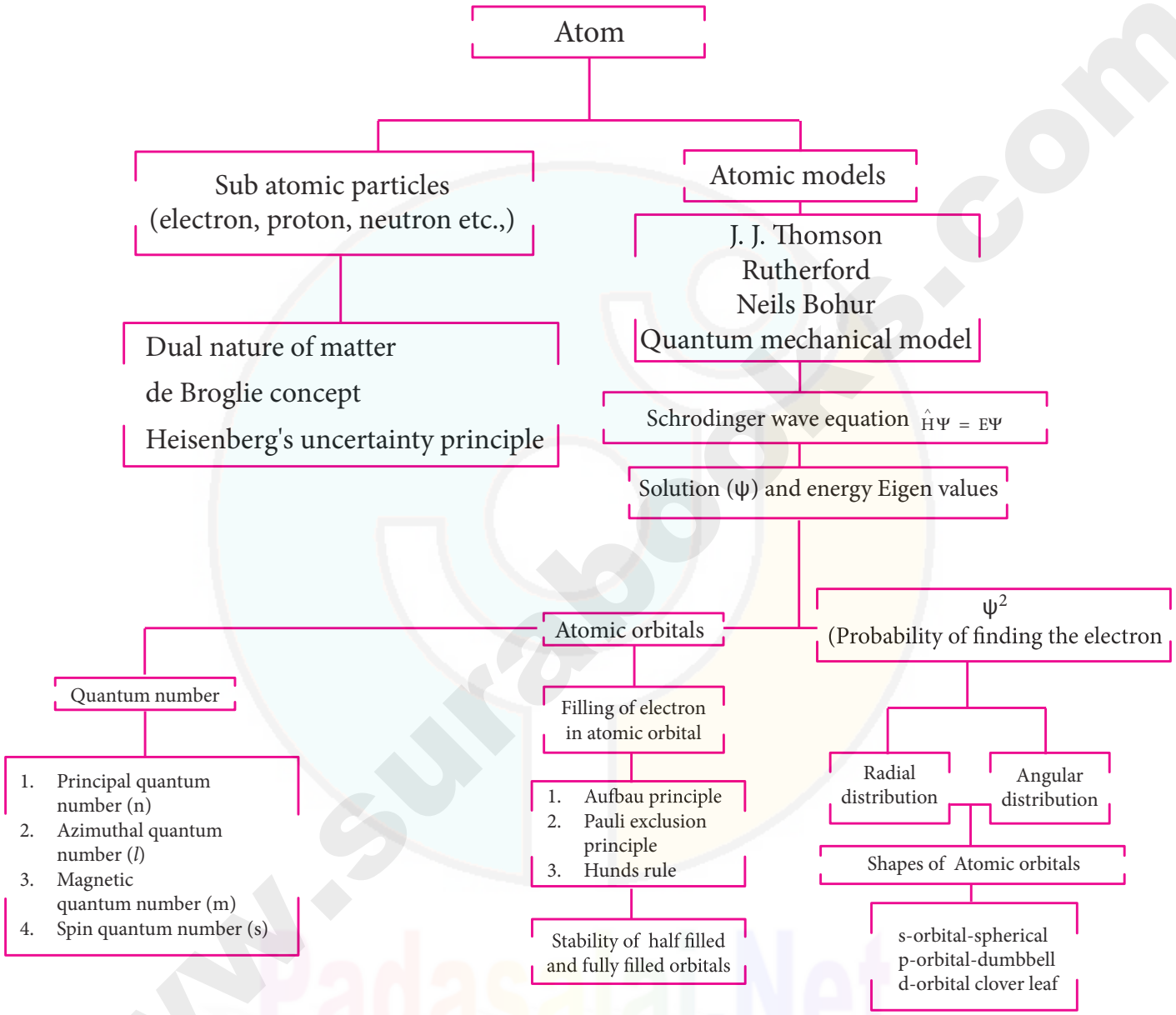
Dual Behaviour of matter
- de-Broglie equation
- Heisenberg's uncertainty principle

Quantum mechanical model of atom
- Schrodinger wave equation

Quantum numbers
- Principal quantum number
- Azimuthal quantum number
- Magnetic quantum number
- Spin quantum number

Atomic orbitals
- Shapes of atomic orbitals
- Energies of orbitals
- Filling of orbitals in atom
- Electronic configuration of atom
- Stability of completely filled and half filled orbitals

CONCEPT MAP



$$\frac{h}{4\pi} = \frac{6.626\times10^{-34}}{4\times3.14}\,kgm^2s^{-1}$$

$$\frac{h}{4\pi} = 5.28\times10^{-35}$$

$$\Delta x.\Delta p \geq 5.28\times10^{-35}$$

$$\Delta x.m.\Delta v \geq 5.28\times10^{-35}$$

$$\Rightarrow \Delta x \geq \frac{5.28\times10^{-35}\,kgm^2s^{-1}}{9.1\times10^{-31}\,kg\times5.7\times10^{5}\,ms^{-1}}$$

$$\Rightarrow \Delta x \geq 1.017\times10^{-10}\,m$$

4. Calculate the orbital angular momentum for d and f orbital. *[June 2019]*

Ans. The formula of the orbital angular momentum is,

$$L = \sqrt{l(l+1)}\,\frac{h}{2\pi}$$

The value of '*l*' for d-orbital = 2

Now put the value of the '*l*' in the above formula, we get the angular momentum.

$$L = \sqrt{2(2+1)}\,\frac{h}{2\pi}$$

$$L = \frac{h\sqrt{6}}{2\pi}$$

Therefore, the angular momentum of electron in d orbital is equal to $\frac{h\sqrt{6}}{2\pi}$

Value of *l* for the electron present in f-sub shell is 3.

Putting the value of $l = 3$ in above equation, we get

$$L = \sqrt{3(3+1)}\,\frac{h}{2\pi}$$

$$L = \frac{\sqrt{3}h}{\pi}$$

The orbital angular momentum of an electron present in f-sub shell is $\frac{\sqrt{3}h}{\pi}$.

ADDITIONAL QUESTIONS

ADDITIONAL CHOOSE THE CORRECT ANSWER 1 MARK

1. How many neutrons and protons respectively are present in the $_6C^{13}$ nuclei ?
(a) 6, 13 (b) 6, 7 (c) 13,6 (d) 7,6
[Ans. (d) 7,6]

2. Maximum number of electrons in a subshell with l = 3 and n = 4 is
(a) 10 (b) 12 (c) 14 (d) 16
[Ans. (c) 14]

3. The number of neutron(s) present in deuterium is
(a) 0 (b) 1 (c) 2 (d) 3
[Ans. (b) 1]

4. Neutrons was discovered by
(a) Rutherford (b) Chadwick
(c) Bohr (d) Thomson
[Ans. (b) Chadwick]

5. J. J. Thomson's cathode ray experiment revealed that atoms consist of
(a) electrons (b) protons
(c) neutrons (d) photons
[Ans. (a) electrons]

6. In Rutherford's gold foil experiment, a thin gold foil was bombarded with a stream of fast moving
(a) B particles (b) α–particles
(c) γ particles (d) δ particles
[Ans. (b) α–particles]

7. Consider the following statements
1. **λ = h / mv is valid only when the particle travels at speed much less than the speed of light.**
2. **Einstein's mass-energy relationship is $E = mc^2$**
3. **The angular momentum (mvr) of the electron must be equal to an integral multiple of h/4π.**

Which of the following statement(s) given above is/ are correct?
(a) 1 & 3 (b) only 1 (c) 1 & 2 (d) 1, 2 & 3
[Ans. (c) 1 & 2]

8. Almost the entire mass of an atom is concentrated in the _____.
(a) proton (b) electrons
(c) neutrons (d) nucleus
[Ans. (d) nucleus]

03 Periodic Classification Of Elements

CHAPTER SNAPSHOT

Introduction
Guidelines for chemical formula
Definition of elements and chemical formula
Need for classification of elements
- Johann Dobereiner's Classification
- Chancourtois Classification
- Newland's Classification – Law of octaves
- Lothar Meyer's (1830 - 1895) Classification
- Mendeleev's (periodic law) Classification

Modern periodic law
- Moseley's long form of periodic table and its structural features
- Merits of Moseley's long form periodic table
- Anomalies of the long form periodic table

Nomenclature of elements with atomic number greater than 100
Classification of elements based on electronic configuration
Electronic configuration of elements in periods
Electronic configuration of elements in groups
Periodic trends in physical properties
- Periodicity in properties
- Periodic properties
  - Atomic radius
  - Ionic radius
  - Ionization energy
  - Electron gain enthalpy
  - Electronegativity

Periodic trends in chemical properties
Periodicity of oxidation states
Anomalous properties of second period elements
Diagonal relationship

FORMULAE CHART

✷ Pauling Scale:

(i) $E_{A-B} > \sqrt{E_{A-A} \times E_{B-B}}$

where, E_{A-B}, E_{A-A} and E_{B-B} are bond dissociation energies of A–B, A–A, B–B.

(ii) $\Delta = E_{A-B} - \sqrt{E_{A-A} \times E_{B-B}}$

$\Delta = (X_A - X_B)^2$

$0.208\sqrt{\Delta} = X_A - X_B$

where Δ – Difference in electronegativities of A and B

X_A and X_B – electronegativities of A and B

0.208 – conversion factor (k cals $\rightarrow$ eV)

✷ Mulliken's scale:

(i) $\text{Electronegativity} = \frac{\text{I.E} + \text{E.A}}{2}$

where I.E – Ionisation enthalpy

E.A – Electron affinity

(ii) $\text{Electronegativity} = \frac{\text{I.E} + \text{E.A}}{2 \times 2.8 \times 96.48} = \frac{\text{I.E} + \text{E.A}}{540}$

2.8 – Correction factor

96.48 – Conversion factor (kJ mol^{-1} $\rightarrow$ eV)

MUST KNOW DEFINITIONS

Iso electronic ions	:	Ions of different elements having the same number of electrons are called iso electronic ions
Döbereiner Triad	:	Group of three elements called as triads. In triads, the atomic weight of the middle element nearly equal to the arithmetic mean of the atomic weights of the remaining two elements.
A. E. B. de Chancourtois's report	:	A. E. B. de Chancourtois reported a correlation between the properties of the elements and their atomic weights. He said 'the properties of bodies are the properties of numbers' He intended the term numbers to mean the value of atomic weights.

107. **The variation of electron affinity is not as systematic as in the case of _____.**

(a) Ionisation energy (b) Atomic radius
(c) Ionic radius (d) Electronegativity

[Ans. (a) Ionisation energy]

108. **As we move down the group, the electro positive character of elements _____.**

(a) Increases (b) Decreases
(c) Gradutly decreases at regular intervals
(d) Remains same **[Ans. (a) Increases]**

Additional Short Answers

1. **Write the name and deduce the atomic number of the following element**

i. The second alkali metal
ii. The fourth noble gas
iii. The third halogen
iv. The first transition element

Ans. (i) Sodium (Z = 11)
(ii) krypton (Z = 36)
(iii) Bromine (Z = 35)
(iv) Scandium (Z = 21)

2. **Lanthanoids and actinoids are placed in separate rows at the bottom of the periodic table. Explain .**

Ans. Lanthanoids and actinoids are placed in separate rows at the bottom of the periodic table to maintain its structure and to preserve the principle of classification by keeping elements with similar properties in a single column.

3. **Describe in brief Lothar Meyer's classification of elements.**

Ans.
- Lothar Meyer's plotted the physical properties such as atomic volume, melting point and boiling point against atomic weight and obtained a periodically repeated pattern.
- Lothar Meyer observed a change in length of that repeating pattern.
- In 1868, Lothar Meyer had developed a table of the elements that closely resembles the modern periodic table.

4. **State Mendeleev's period law.**

Ans. The mendeleev periodic law states that, "The physical and chemical properties of the elements are periodic functions of their atomic weights.

5. **What are transfermium elements?**

Ans. The elements beyond fermium are called as transfermium elements.

6. **Explain classification of elements based om Newland's law of Octaves.**

Ans. **Newlands's law of Octaves :**

When elements are arranged in increasing order of their atomic weights every eighth element resembles its properties with the first one just like the eight note of a musical table.

Element:	Li	Be	B	C	N	O	F
Atomic Weight:	7	9	11	12	14	16	19

Limitations: Failed for heavier elements beyond calcium.

7. **Justify the given statement with suitable examples "the properties of the elements are a periodic function of their atomic numbers".**

Ans. **(i)** The cause of periodicity in properties is the repetition of similar outer electronic configuration after certain regular intervals.

(ii) **Eg:** Consider elements of group 1s

$_{3}Li - 1s^2\ 2s^1$

$_{11}Na - 1s^2\ 2s^2\ 2p^6\ 3s^1$

- Due to similar outermost electronic configuration they exhibit similar properties.

8. **State the findings of modern periodic law.**

Ans.
- The number of electrons increases by the same number as the increase in the atomic number.
- As the number of electrons increases, the electronic structure of the atom changes.
- Electrons in the outermost shell of an atom (valence electrons) determine the chemical properties of the elements.

9. **What are the demerits of long form periodic table.**

Ans. **(i)** Position of hydrogen is not defined till now.
(ii) Lanthanides and actinides still find place in the bottom of the table.

10. **How many elements can be accommodated in the the long form of the periodic table? Explain.** ***[HOTS]***

Ans. In the present set up of the long form of the periodic table, we have eighteen groups, seven periods (i.e. principal quantum number, n = 7) and four blocks (s, p, d and f-block elements).

Therefore, the maximum number of elements which can be accommodated in the present set up of the long form of the periodic table in accordance with Aufbau principle is

$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 4d^{10}, 5p^6, 6s^2, 4f^{14}, 5d^{10}, 6p^6, 7s^2, 5f^{14}, 6d^{10}, 7p^6 = 118.$

04 HYDROGEN

CHAPTER SNAPSHOT

- Hydrogen – the element
  - Occurrence
  - Position in periodic table
  - Isotopes of hydrogen
- Preparation of hydrogen
  - Laboratory preparation
  - Industrial production
- Properties of hydrogen
- Uses of hydrogen
- Hydrogen – It's compounds
  - Water
    - Hard water
    - Soft water
    - Heavy water
  - Hydrogen peroxide
  - Hydrides
    - Ionic hydride
    - Covalent hydride
    - Metallic hydride
- Hydrogen bonding
  - Intramolecular hydrogen bonding
  - Intermolecular hydrogen bonding

Permanent Hardness	:	Permanent hardness of water is due to the presence of **soluble salts** of magnesium and calcium in the form of chlorides and sulphates in it.
Heavy Water	:	Heavy water (D_2O) is the oxide of heavy hydrogen. One part of heavy water is present in 5000 parts of ordinary water.
Covalent(Molecular) hydrides	:	They are compounds in which hydrogen is attached to another element by sharing of electrons.
Ionic (Saline) hydrides	:	These are hydrides composed of an electropositive metal, generally, an alkali or alkaline-earth metal, except beryllium and magnesium, formed by transfer of electrons from metal to hydrogen atoms.
Metallic (Interstitial) hydrides	:	Metallic hydrides are usually obtained by hydrogenation of metals and alloys in which hydrogen occupies the interstitial sites **(voids)**. Hence, they are called **interstitial hydrides**.

EVALUATION

I. Choose The Best Answer :

1. Which of the following statements about hydrogen is incorrect ? *(NEET 2016)*

(a) Hydrogen ion, H_3O^+ exists freely in solution.
(b) Dihydrogen acts as a reducing agent.
(c) Hydrogen has three isotopes of which tritium is the most common.
(d) Hydrogen never acts as cation in ionic salts.

[Ans. (c) Hydrogen has three isotopes of which tritium is the most common.]

2. Water gas is *[QY. 2018; HY. 2019]*

(a) $H_2O_{(g)}$ (b) $CO + H_2O$
(c) $CO + H_2$ (d) $CO + N_2$

[Ans. (c) $CO + H_2$]

Hint: $C(s) + H_2O \longrightarrow CO + H_2$

3. Which one of the following statements is incorrect with regard to ortho and para dihydrogen ?

(a) They are nuclear spin isomers
(b) Ortho isomer has zero nuclear spin whereas the para isomer has one nuclear spin
(c) The para isomer is favoured at low temperatures
(d) The thermal conductivity of the para isomer is 50% greater than that of the ortho isomer.

[Ans. (b) Ortho isomer has zero nuclear spin whereas the para isomer has one nuclear spin]

4. Ionic hydrides are formed by

(a) halogens
(b) chalcogens
(c) inert gases
(d) group one elements

[Ans. (d) group one elements]

5. Tritium nucleus contains

(a) 1p + 0 n (b) 2 p + 1n
(c) 1p + 2n (d) none of these

[Ans. (c) 1p + 2n]

Hint: ${}_1T^3$

6. Non-stoichiometric hydrides are formed by

(a) palladium, vanadium
(b) carbon, nickel
(c) manganese, lithium
(d) nitrogen, chlorine

[Ans. (a) palladium, vanadium]

7. Assertion : Permanent hardness of water is removed by treatment with washing soda.
Reason : Washing soda reacts with soluble calcium and magnesium chlorides and sulphates in hard water to form insoluble carbonates

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

27. Difference between ortho and para hydrogen.

Ans. **Ortho and para hydrogen :**

	Ortho Hydrogen	Para Hydrogen
1. Definition	Hydrogen molecule in which the protons in the nuclei of both H-atoms are known to spin in same direction is termed as ortho hydrogen.	If the protons in the nuclei of both H-atoms spin in opposite direction, it is termed as para hydrogen.
2. Composition	At room temperature ordinary hydrogen consist of about 75% ortho and 25% para form.	As the temperature is lowered, the equilibrium shifts in favour of para hydrogen. At 25K, there is 99% para and 1% ortho hydrogen
3. Melting Point	Melting point of ortho hydrogen is 13.95 K	Melting point of para hydrogen is 13.83K
4. Boiling Point	Boiling point of ortho hydrogen is 20.39K	Boiling point of para hydrogen 20.26K
5. Vapour Pressure	The vapour pressure of orthohydrogen is lower.	The vapour pressure of liquid para hydrogen is higher than that of ordinary liquid hydrogen.
6. Magnetic Moment	Magnetic moment of ortho is twice than that of a proton	The magnetic moment of para hydrogen is zero since the spins neutralise each other
7. Internal molecular energy	Ortho hydrogen possesses a higher internal molecular energy	Para hydrogen possesses a lower internal molecular energy than ortho form

NUMERICAL PROBLEMS

1. An element (A) belonging to group number 1 and period number 3 react with dihydrogen to form an hydride (B). The element (A) reacts with the universal solvent to give a strong base (C). Identify A, B and C.

Ans. **(i)** An element (A) belonging to group number 1 and period number 3 is **sodium (A)**.

(ii) Sodium reacts with hydrogen to form **sodium hydride (B)**

$$\underset{(A)}{2\,Na} + \underset{(B)}{H_2} \longrightarrow \underset{(C)}{2\,NaH}$$

(iii) Sodium reacts with water to form **sodium hydroxide (C)**.

$$\underset{(A)}{2Na} + 2H_2O \longrightarrow \underset{(C)}{2NaOH} + H_2$$

A	Na	Sodium
B	NaH	Sodium hydride
C	NaOH	Sodium hydroxide

2. Identify the compound (A) which is a universal solvent. Compound A reacts with chlorine gas to give B and C. Compound A dissolves in an ionic compound of silicon to give compound D. Identify A and write the equations involved in the formation of B, C and D.

Ans. **(i)** The universal solvent is **water (A)**.

(ii) Water reacts with chlorine gas to form **hydro chloric acid (B) and hypo chlorous acid (C).**

$$\underset{(A)}{Cl_2 + H_2O} \longrightarrow \underset{(B)}{HCl} + \underset{(C)}{HOCl}$$

(iii) Water reacts with silicon tetra chloride ($SiCl_4$) to give **silicon dioxide (D).**

$$\underset{(A)}{SiCl_4 + 2H_2O} \longrightarrow \underset{(D)}{SiO_2} + \underset{(B)}{4HCl}$$

A	H_2O	Water
B	HCl	Hydro chloric acid
C	HOCl	Hypo chlorous acid
D	SiO_2	Silicon dioxide

✶ ✶ ✶

05 Alkali And Alkaline Earth Metals

CHAPTER SNAPSHOT

- Alkali Metals
  - General characteristics
  - Physical properties
  - Chemical properties
  - Compounds of alkali metals
    - Oxides
    - Hydroxides
    - Halides
    - Salts of oxo acids
  - Biological importance of Na and K
- Alkaline Earth Metals
  - General characteristics
  - Physical properties
  - Chemical properties
  - Compounds of alkaline earth metals
    - Oxides
    - Hydroxides
    - Halides
    - Salts of oxo acids
  - Important compounds of calcium
    - Quick lime
    - Slaked lime
    - Gypsum
    - Plaster of paris
  - Biological importance of Ca and Mg

Additional Long Answers 5 MARK

1. List out the uses of alkali metals.

Ans. **(i)** Lithium metal is used to make useful alloys. For example with lead it is used to make 'white metal' bearings for motor engines, with aluminium to make aircraft parts, and with magnesium to make armour plates. It is used in thermonuclear reactions.

(ii) Lithium is also used to make electrochemical cells.

(iii) Lithium carbonate is used in medicines

(iv) Sodium is used to make Na/Pb alloy.

(v) Liquid sodium metal is used as a coolant in fast breeder nuclear reactors.

(vi) Potassium chloride is used as a fertilizer. Potassium hydroxide is used in the manufacture of soft soap. It is also used as an excellent absorbent of carbon dioxide.

(vii) Caesium is used in devising photoelectric cells.

2. How are peroxides and superoxides formed by alkali metals? ***[HOTS]***

Ans. **(i)** The fact that a **small cation can stabilize a small anion** and a large **cation can stabilize a large anion** explains the formation and stability of these oxides.

(ii) The Na^+ ion is a **larger cation** and has a **weak positive field** around it and thus **can stabilize a bigger peroxide ion**, O_2^{2-} **or** $[-O-O-]^{2-}$ which is also surrounded by a weak negative field.

(iii) Similarly, the other ions **K^+, Rb^+, Cs^+** are still larger, having **very weak positive field**.

(iv) Thus these ions **can stabilize a bigger superoxide O^{2-} anion** and form **super oxides**.

3. The hydrides of alkali metals behave as strong reducing agents - Justify the statement.

Ans. **(i)** All alkali metals react with hydrogen at **about 673K (lithium at 1073K)** to form the corresponding **hydrides**, which are ionic in nature.

(ii) **Reactivity** of alkali metals with hydrogen **increases from Li to Cs**.

$$2M + H_2 \longrightarrow 2M^+H^- \ (M = Li, Na, K, Rb, Cs)$$

(iii) **Ionic character** of the hydrides **increases from Li to Cs**.

(iv) The decrease in ionization enthalpy down the group permits easy availability of electrons to hydrogen, forming H^+ ion.

(v) The hydrides behave as **strong reducing agents** and their reducing nature increases down the group.

4. When does the blue coloured ammonia solution (of alkali metals) changes to bronze colour?

Ans. **(i)** Alkali metals dissolve in liquid ammonia to give deep blue solutions that are conducting in nature.

(ii) The blue colour of the solution is due to the **ammoniated electron** which absorbs energy in the visible region of light and thus imparts blue colour to the solution.

(iii) The solutions are **paramagnetic** and on standing slowly **liberate hydrogen** resulting in the formation of **amide**.

(iv) In **concentrated solution**, the blue colour changes to **bronze colour** and become **diamagnetic**.

5. Illustrate the role of sodium and potassium in biological fluid.

Ans. **(i)** Monovalent sodium and potassium ions are found in large proportions in biological fluids.

(ii) **maintenance of ion balance and nerve impulse conduction**.

(iii) **Sodium–potassium pump** play an important role in **transmitting nerve signals**.

(iv) **Sodium ions** are found primarily on the outside of cells, being located in **blood plasma** and in the **interstitial fluid** which surrounds the cells.

(v) These ions participate in the transmission of nerve signals, in **regulating the flow of water** across cell membranes and in the **transport of sugars and amino acids** into cells.

(vi) Sodium and potassium, although so **similar chemically, differ quantitatively** in their ability to penetrate cell membranes, in their transport mechanisms and in their efficiency to activate enzymes.

(viii) Thus, **potassium ions** are the most abundant cations within **cell fluids**, where they activate many enzymes, participate in the oxidation of glucose to produce ATP and, with sodium, are responsible for the transmission of nerve signals.

6. How is sodium hydroxide prepared commercially from brine solution?

Ans. **(i)** Sodium hydroxide is prepared commercially by the electrolysis of brine solution in Castner-Kellner cell .

(ii) Cathode- mercury
anode - carbon

(iii) Sodium metal is discharged at the cathode and combines with mercury to form sodium amalgam.

06 GASEOUS STATE

CHAPTER SNAPSHOT

Introduction
The Gas Laws
- Boyle's Law
- Charles Law
- Gay-Lussac's Law
- Avogadro's hypothesis

Ideal gas equation
Dalton's law of partial pressures
- Graham' s law of diffusion

Deviation from ideal gas behaviour
- Compression factor Z
- Van der Waal's equation
- Andrews's isotherm
- Derivation of critical constants from Van der Waal's constant
- Liquefaction of gases
- Linde's method
- Claude's process
- Adiabatic process

FORMULAE TO REMEMBER

- Boyle's law : $P \propto \frac{1}{V}$ (at constant T and n)
- Charles's law : $V \propto T$ (at constant P)
- Avogadro's law : $V \propto n$ (at constant P and T)
- Gay-Lussac's law : $P \propto T$ (at constant V)
- Dalton's law : $P_{Total} = p_1 + p_2 + p_3 \ldots\ldots$ (at constant T and V)
- Graham's law of diffusion $\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$
- Ideal gas equation: $PV = nRT$
- Vanderwaal's equation of state $\left[P + \frac{a}{V^2}\right](V - b) = RT$ (when n = 1)
- Critical Temperature $T_c = \frac{8a}{27Rb}$
- Critical Pressure $P_c = \frac{a}{27b^2}$
- Critical Volume $V_c = 3b$
- Inversion Temperature $T_i = \frac{2a}{Rb}$
- Vanderwaal's constants

  $a = 3V_c^2P_c$

  $b = \frac{V_c}{3}$
- Compressibility factor:

  $Z = \frac{PV}{nRT}$

53. A combustible gas is stored in a metal tank at a pressure of 2.98 atm at 25°C. The tank can withstand a maximum pressure of 12 atm after which it will explode. The building in which the tank has been stored catches fire. Now predict whether the tank will blow up first or start melting? (Melting point of the metal = 1100 K).

Ans. Pressure of the gas in the tank at its melting point

$T_1 = 298$ K ; $P_1 = 2.98$ atm; $T_2 = 1100$ K; $P_2 = ?$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\Rightarrow \quad P_2 = \frac{P_1}{T_1} \times T_2$$

$$P_2 = \frac{2.98 \text{ atm}}{298 \text{ K}} \times 1100 \text{ K} = 11 \text{ atm.}$$

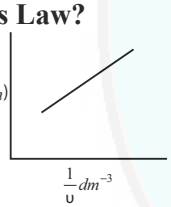
At 1100 K the pressure of the gas inside the tank will become 11 atm. Given that tank can withstand a maximum pressure of 12 atm, the tank will start melting first.

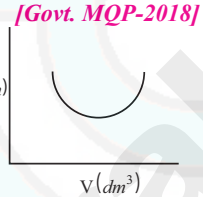
Government Exam Questions and Answers

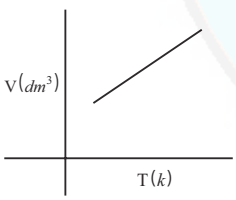
PART - I

Choose the Correct Answer — 1 MARK

1. Which of the following correctly represents Boyle's Law? *[Govt. MQP-2018]*

(a) 

(b) 

(c) 

(d) All of these

[Ans. (a)]

2. What is the density of oxygen gas at 227°C and 4 atm pressure (R = 0.082 L atom K^{-1} mol^{-1}) *[Govt. MQP-2018]*

(a) 3.12 g/L (b) 3.41 g/L

(c) 2.81 g/L (d) none of these

[Ans. (a) 3.12 g/L]

Hint: Density is equal to pm/RT

3. 56 g nitrogen and 96 g of oxygen are mixed isothermally and the mixture exerts a total pressure of 10 atm. The partial pressure of nitrogen and oxygen are respectively. *[QY-2018]*

(a) 4, 6 (b) 8, 2 (c) 6, 4 (d) 2, 8

[Ans. (a) 4, 6]

Hint: According to Raoult's law
P_a is equal to mole fraction of the component. A multiple by vapour pressure

PART - II

Answer the Questions — 2 MARK

1. Distinguish real and ideal gases. *[HY-2018]*

Ans. **Ideal gas :**

1) Obeys gas laws under all condition of P and T.
2) Obeys ideal gas equation

Real gas :

1) Obeys only at low P and high T.
2) Does not obey ideal gas equation.

2. Give the expressions of critical constants. *[HY-2018]*

Ans. The critical constants can be calculated using the values of van der waals constant of a gas and vice versa.

$$a = 3V_C^2 P_C \text{ and } b = \frac{V_C}{3}.$$

3. What is the density of N_2 gas at 227°C and 5.00 atm pressure? (R = 0.082 L atm K^{-1} mol^{-1}) *[QY. 2019]*

Ans. Density $= \frac{\text{Mass}}{\text{Volume}}$

$$= \frac{m}{\left(\frac{nRT}{P}\right)} = \left(\frac{m}{n}\right)\frac{P}{RT}$$

$$= \text{Molar mass} \times \frac{P}{RT}$$

$$= \frac{28 \text{ g mol}^{-1} \times 5 \text{ atm}}{0.082 \text{ L atm K}^{-1} \text{ mol}^{-1} \times 500 \text{K}}$$

$$= 3.41 \text{ g L}^{-1}.$$

(v) Below the Boyle point, the real gases first show a decrease for Z, reaches a minimum and then increase with the increase in pressure.

(vi) Hence, the compressibility factor Z can be rewritten as

$$Z = \frac{PV_{real}}{nRT} \quad (a)$$

$$V_{ideal} = \frac{nRT}{P} \quad (b)$$

Substituting (b) in (a)

$$Z = \frac{V_{real}}{V_{ideal}}$$

(vi) Where V_{real} is the molar volume of the real gas and V_{ideal} is the molar volume of it when it behaves ideal.

5. Using Dalton's law how will you determine the pressure of a dry gas.

Ans. The pressure of dry vapor can be calculated using Dalton's law.

$$P_{dry\ gas\ collected} = p_{total} - p_{water\ vapour}$$

$p_{water\ vapour}$ is generally referred as aqueous tension and its values are available for air at various temperatures.

Let us understand Dalton's law by solving this problem. A mixture of gases contains 4.76 mole of Ne, 0.74 mole of Ar and 2.5 mole of Xe. Calculate the partial pressure of gases, if the total pressure is 2 atm. at a fixed temperature.

6. How will you calculate the partial pressure in terms of mole fraction?

Ans. **Partial pressure in terms of mole fraction :** For a mixture containing three gases 1, 2 and 3 with partial pressures p_1, p_2 and p_3 in a container with volume V, the total pressure P_{total} will be give by

$$P_{total} = p_1 + p_2 + p_3 \quad .....(1)$$

Assuming that the gases behave ideally,

$$p_1 = n_1 \frac{RT}{V} \; ; p_2 = n_2 \frac{RT}{V} \; ; p_3 = n_3 \frac{RT}{V}$$

$$P_{total} = n_1 \frac{RT}{V} + n_2 \frac{RT}{V} + n_3 \frac{RT}{V}$$

$$= (n_1 + n_2 + n_3) \frac{RT}{V}$$

$$P_{total} = n_{Total} \left(\frac{RT}{V}\right) \quad .....(2)$$

The partial pressure can also be expressed as $\left(\frac{RT}{V}\right)$ can expressed as $\frac{p_1}{n_1}$ or $\frac{p_2}{n_2}$ or $\frac{p_3}{n_3}$ or in general $\frac{P_i}{n_i}$

Therefore

$$P_{total} = n_{total} \frac{P_i}{n_i} = \frac{n_{Total}}{n_1} p_i$$

$$\Rightarrow \quad p_i = \frac{n_i}{n_{Total}} P_{Total} = x_i P_{Total} \quad .....(3)$$

where x^i is the mole fraction of the i^{th} component.

NUMERICAL PROBLEMS

1. Find the pressure of 5 mole Cl_2 gas filled in a 2 litre vessel at 27 °C temperature.

Given : n = 5; V = 2 litre; T = 27 + 273 = 300 K

Sol : $P = \frac{nRT}{V}$ [∵PV = nRT]

$$P = \frac{5 \times 8.314 \times 300}{2} = 62.355 \text{ bar}$$

∴ The pressure of Cl_2 gas will be 62.355 bar.

2. Find the moles of O_2 gas having pressure 250 bar in 500 ml vessel at 350 K temperature.

Given : P = 250 bar; T = 350 K; V = 500 ml = 0.5 litre.

Sol : $n = \frac{PV}{RT}$ [∵ PV = nRT]

$$= \frac{250 \times 0.5}{8.314 \times 10^{-2} \times 350} = 4.296 \text{ mol}$$

∴ n = 4.296 mol.

3. Find the pressure of neon gas having density 0.9 gm lit^{-1} at 350 K temperature.

Given : Density (d) = 0.9 gm lit^{-1}

T = 350 K

Mass of neon (M) = 20 gm mol^{-1}

Sol : $P = \frac{dRT}{M} \quad \left(\because n = \frac{d}{M}\right)$

$$= \frac{0.9 \times 8.314 \times 10^{-2} \times 350}{20} = 1.309 \text{ bar}$$

Pressure of neon = 1.309 bar

07 THERMODYNAMICS

CHAPTER SNAPSHOT

Introduction:

System

- Homogeneous and heterogeneous systems
- Surroundings
- Boundary

Types of systems

- Isolated system
- Closed system
- Open system

Properties of the system

- Extensive properties
- Intensive properties

Thermodynamic processes

- Reversible process
- Irreversible Process
- Adiabatic process
- Isothermal process
- Isobaric process
- Isochoric process
- Cyclic process
- State functions
- Path Functions

Internal Energy (U)

Heat (q)

Work(w)

Zeroth Law of Thermodynamics

First Law of Thermodynamics

Enthalpy (H)

- Relation between enthalpy `H' and internal energy `U'
- Enthalpy Changes for different types of reactions and phase transitions
- Standard heat of formation
- Molar heat capacities
- Calculation of ΔU and ΔH
- Energy changes during transitions or phase changes
- Hess's law of constant heat summation
  - Born haber's cycle
- Second Law of thermodynamics - Various statements

Entropy (S)

- Entropy change accompanying change of phase

Gibbs free energy (G)

- Relationship between standard free energy change (ΔG°) and equilibrium constant(K_{eq})

Statement of the third law

$\Delta^\circ H_f$ = heat of formation of sodium chloride
$= -411.3$ kJ mol^{-1}
$\Delta^\circ H_1$ = heat of sublimation of $Na_{(S)} = 108.7$ kJ mol^{-1}
$\Delta^\circ H_2$ = ionisation energy of $Na_{(g)} = 495.0$ kJ mol^{-1}
$\Delta^\circ H_3$ = dissociation energy of $Cl_{2(g)} = 244$ kJ mol^{-1}
$\Delta^\circ H_4$ = Electron affinity of $Cl_{(g)} = -349.0$ kJ mol^{-1}
U = Lattice energy of NaCl

$$\Delta^\circ H_f = \Delta^\circ H_1 + \Delta^\circ H_2 + \tfrac{1}{2}\Delta^\circ H_3 + \Delta^\circ H_4 + \Delta^\circ H_5$$
$$\therefore \Delta^\circ H_5 = (\Delta^\circ H_f) - (\Delta^\circ H_1 + \Delta^\circ H_2 + 1/2\ \Delta^\circ H_3 + \Delta^\circ H_4)$$
$$\Rightarrow \Delta^\circ H_5 = (-411.3) - (108.7 + 495.0 + 122 - 349)$$
$$\Delta^\circ H_5 = (-411.3) - (376.7)$$
$$\therefore \Delta^\circ H_5 = -788 \text{ kJ mol}^{-1}.$$

This negative sign in lattice energy indicates that the energy is released when sodium is formed from its constituent gaseous ions Na^+ and Cl^-.

52. List the characteristics of Gibbs free energy.

[HY. 2019]

Ans. **(i)** Free energy is defined as G = H – TS. 'G' is a state function.

(ii) G- Extensive property; ΔG - intensive property. When mass remains constant between initial and final states of system.

(iii) 'G' has a single value for the thermodynamic state of the system.

(iv) G and ΔG values correspond to the system only.

Process	Spontaneous	Equilibrium	Non-spontaneous
ΔG	–Ve	Zero	+Ve

(v) Gibbs free energy and the net work done by the system:

For any system at constant pressure and temperature

$$\Delta G = \Delta H - T\Delta S \quad \text{.....(1)}$$

We know that,

$$\Delta H = \Delta U + P\Delta V$$
$$\therefore \Delta G = \Delta U + P\Delta V - T\Delta S$$

from first law of thermodynamics

$$\Delta U = q + w$$

from second law of thermodynamics

$$\Delta S = \frac{q}{T} \quad \Delta G = q + w + P\Delta V - T\left(\frac{q}{T}\right)$$
$$\Delta G = w + P\Delta V$$
$$-\Delta G = -w - P\Delta V \quad \text{.....(2)}$$

But $-P\Delta V$ represents the work done due to expansion against a constant external pressure.

53. Calculate the work done when 2 moles of an ideal gas expands reversibly and isothermally from a volume of 500 ml to a volume of 2 L at 25°C and normal pressure.

Ans. n = 2 moles
V_i = 500 ml = 0.5 lit
V_f = 2 lit
T = 25°C = 298 K

$$w = -2.303\ nRT\log\left(\frac{V_f}{V_i}\right)$$
$$w = -2.303 \times 2 \times 8.314 \times 298 \times \log\left(\frac{2}{0.5}\right)$$
$$w = -2.303 \times 2 \times 8.314 \times 298 \times \log(4)$$
$$w = -2.303 \times 2 \times 8.314 \times 298 \times 0.6021$$
$$w = -6871 \text{ J}$$
$$w = -6.871 \text{ KJ}.$$

54. In a constant volume calorimeter, 3.5 g of a gas with molecular weight 28 was burnt in excess oxygen at 298 K. The temperature of the calorimeter was found to increase from 298 K to 298.45 K due to the combustion process. Given that the calorimeter constant is 2.5 kJ K^{-1}. Calculate the enthalpy of combustion of the gas in kJ mol^{-1}.

Ans.
T_i = 298 K
T_f = 298.45 K
k = 2.5 kJ K^{-1}
m = 3.5g
M_m = 28
heat evolved = k ΔT
= k ($T_f - T_i$)
= 2.5 KJ K^{-1} (298.45 − 298)K
= 1.125kJ

$$\Delta H_c = \frac{1.125}{3.5} \times 28 \text{ KJ mol}^{-1}$$
$$\Delta H_c = 9 \text{ kJ mol}^{-1}.$$

55. Calculate the entropy change in the system, and surroundings, and the total entropy change in the universe during a process in which 245 J of heat flow out of the system at 77°C to the surrounding at 33°C.

Ans. T_{sys} = 77°C = (77 + 273) = 350 K
T_{surr} = 33°C = (33 + 273) = 306 K
q = 245 J

$$\Delta S_{sys} = \frac{q}{T_{sys}} = \frac{-245}{350} = -0.7 \text{ JK}^{-1}$$

$$\Delta S_{surr} = \frac{q}{T_{sys}} = \frac{+245}{306} = +0.8 \text{JK}^{-1}$$

7. Distinguish between reversible and irreversible process.

Ans.

S.No	REVERSIBLE PROCESS	IRREVERSIBLE PROCESS
1.	It takes place in both forward and backward directions.	It takes place in one direction only.
2.	The driving force for reversible process is small.	There is a definite driving force required.
3.	Work done in a reversible process is greater.	Work done in a irreversible process is always lower.

NUMERICAL PROBLEMS

1. The entropy change in the conversion of water to ice at 272 k for the system is −22.88 Jk^{-1} mol^{-1} and that of surrounding is + 24.85 Jk^{-1} mol^{-1}. State whether the process is spontaneous or not?

Sol : $\Delta S_{univ} = \Delta S_{sys} + \Delta S_{surr}$

$= -22.88 + (+24.85)$

$= 1.97\ JK^{-1}\ mol^{-1}$

$\therefore \Delta S_{univ} > 0$ at 272 K

$\therefore$ The process freezing of water is spontaneous.

2. Calculate the standard entropy of formation ΔS_f° of $CO_{2(g)}$. Given the standard entropies of $CO_{2(g)}$, $C_{(s)}$, $O_{2(g)}$ as 218.8, 8.740 and 205.60 Jk^{-1} respectively.

Ans. $C + O_2 \longrightarrow CO_2 \qquad \Delta S_f^\circ = ?$

$\Delta S_f^\circ, CO_2 = \Sigma S^\circ_{compound} - \Sigma S^\circ_{elements}$

$= 218.8 - (8.74 + 205.60)$

$\Delta S_f^\circ, CO_2 = 4.46\ Jk^{-1}$

3. The standard heat of formation of $H_2O_{(l)}$ from its elements H_2 and O_2 is −290.83 kJ mol^{-1} and the standard entropy change for the same reaction is −330 JK^{-1} at 25°C. Will the reaction be spontaneous at 25°C.

Given: $\Delta H^\circ = -290.83$ kJ mol^{-1}

$= -290830$ J mol^{-1}

$\Delta S^\circ = -330\ JK^{-1}$

$T = 25°C = 298$ K

Sol : $\boxed{\Delta G^o = \Delta H^o - T\Delta S^o}$

$= -290830 - 298\ (-330)$

$= -290830 + 98340 = -192490$

$\Delta G^\circ = -192490$ J mol^{-1}

Since ΔG° is negative, the reaction is spontaneous.

4. ΔH and ΔS for the reaction

$Ag_2O_{(s)} \longrightarrow 2Ag_{(s)} + \frac{1}{2}O_{2(g)}$ **are 30.56 kJ mol^{-1} and 66.0 Jk^{-1} mol^{-1} respectively. Calculate the temperature at which the free energy for this reaction will be zero. What will be the direction of reaction at this temperature and at temperature below this and why?**

Given: $\Delta H = 30.56$ kJ $mol^{-1} = 30560$ J mol^{-1}

$\Delta S = 66.0\ JK^{-1}\ mol^{-1}$

$\Delta G = 0$

Sol : $\Delta G = \Delta H - T\Delta S$

$$\boxed{T = \frac{\Delta H - \Delta G}{\Delta S}} = \frac{30560 - 0}{66} = 463$$

$T = 463$ K.

At 463 K, the reaction is at equilibrium

At T < 463 K, ΔG will have positive value hence backward reaction is favoured.

5. The heat of combustion of solid naphthalene ($C_{10}H_{10}$) at constant volume was −4984 kJ mol^{-1} at 298 K. Calculate the value of enthalpy change.

Given:

$C_{10}H_{8(s)} + 12O_{2(g)} \longrightarrow 10CO_{2(g)} + 4H_2O_{(l)};$

$\Delta U = -4984$ kJ mol^{-1}

$\Delta U = -4984$ kJ mol^{-1}, $R = 8.314\ JK^{-1}\ mol^{-1}$

$T = 298$ K

Sol :

$\Delta n = 10 - 12 = -2$ mol

$\boxed{\Delta H = \Delta U + RT\ (\Delta n)}$

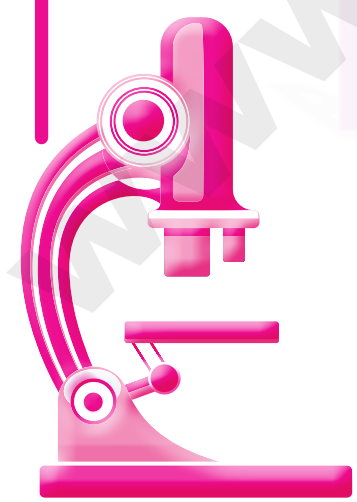
$= -4984 \times 10^3\ J + 8.314\ Jk^{-1}\ mol^{-1} \times 298k \times (-2)$ mol.

$= -4984000\ J - 4955.144\ J = -4988955.144\ J$

$\Delta H = -4988.955$ kJ

CHEMISTRY

Volume II



08 Physical And Chemical Equilibrium

CHAPTER SNAPSHOT

- Equilibrium state
- Types of Equilibrium
  - ✶ Physical Equilibrium
    - ✶ Solid ⟶ Liquid
    - ✶ Liquid ⟶ Vapour
    - ✶ Solid ⟶ Vapour
    - ✶ Dissolution of solid or gas in liquid
  - ✶ Chemical Equilibrium
    - ✶ Homogeneous equilibrium
    - ✶ Heterogeneous equilibrium
- Law of mass action
- Equilibrium constant
- Relationship between K_p and K_c
- Application of equilibrium constant
  - ✶ Predicting the extent of a reaction
  - ✶ Predicting the direction of a reaction
- Factors affecting equilibrium
- Le-Chatelier's principle
  - ✶ Effect of concentration change
  - ✶ Effect of temperature change
  - ✶ Effect of pressure change
  - ✶ Effect of inert gas addition
  - ✶ Effect of catalyst.

EVALUATION

I. Choose The Best Answer :

If K_b and K_f for a reversible reactions are 0.8×10^{-5} and 1.6×10^{-4} respectively, the value of the equilibrium constant is, *[June 2019]*

(a) 20 (b) 0.2×10^{-1} (c) 0.05
(d) none of these **[Ans. (a) 20]**

Hint: Equilibrium constant, K_C is equal to K_b/K_f

1. At a given temperature and pressure, the equilibrium constant values for the equilibria

$$3A_2 + B_2 + 2C \overset{K_1}{\rightleftharpoons} 2A_3BC \text{ and}$$

$$A_3BC \overset{K_2}{\rightleftharpoons} \frac{3}{2}[A_2] + \frac{1}{2}B_2 + C$$

The relation between K_1 and K_2 is

(a) $K_1 = \frac{1}{\sqrt{K_2}}$ (b) $K_2 = K_1^{-1/2}$

(c) $K_1^2 = 2K_2$ (d) $\frac{K_1}{2} = K_2$

[Ans. (b) $K_2 = K_1^{-1/2}$]

2. The equilibrium constant for a reaction at room temperature is K_1 and that at 700 K is K_2. If $K_1 > K_2$, then

(a) The forward reaction is exothermic
(b) The forward reaction is endothermic
(c) The reaction does not attain equilibrium
(d) The reverse reaction is exothermic
[Ans. (a) The forward reaction is exothermic]

3. The formation of ammonia from $N_{2(g)}$ and $H_{2(g)}$ is a reversible reaction

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

What is the effect of increase of temperature on this equilibrium reaction

(a) equilibrium is unaltered
(b) formation of ammonia is favoured
(c) equilibrium is shifted to the left
(d) reaction rate does not change
[Ans. (c) Equilibrium is shifted to the left]

4. Solubility of carbon dioxide gas in cold water can be increased by

(a) increase in pressure (b) decrease in pressure
(c) increase in volume (d) none of these
[Ans. (a) increase in pressure]

Hint: It is because due to increase in intra molecular force of attraction. Solubility of carbon dioxide gas in cold water is increased.

5. Which one of the following is incorrect statement ?

(a) for a system at equilibrium, Q is always less than the equilibrium constant.
(b) equilibrium can be attained from either side of the reaction.
(c) presence of catalyst affects both the forward reaction and reverse reaction to the same extent.
(d) equilibrium constant varied with temperature.
[Ans. (a) For a system at equilibrium, Q is always less than the equilibrium constant.]

6. K_1 and K_2 are the equilibrium constants for the reactions respectively.

$$N_{2(g)} + O_{2(g)} \overset{K_1}{\rightleftharpoons} 2NO_{(g)}$$

$$2NO_{(g)} + O_{2(g)} \overset{K_2}{\rightleftharpoons} 2NO_{2(g)}$$

What is the equilibrium constant for the reaction $NO_{2(g)} \rightleftharpoons \frac{1}{2}N_{2(g)} + O_{2(g)}$

(a) $\frac{1}{\sqrt{K_1K_2}}$ (b) $(K_1 = K_2)^{1/2}$

(c) $\frac{1}{2K_1K_2}$ (d) $\left(\frac{1}{K_1K_2}\right)^{3/2}$

[Ans. (a) $\frac{1}{\sqrt{K_1K_2}}$]

7. In the equilibrium,

$$2A(g) \rightleftharpoons 2B(g) + C_2(g)$$

the equilibrium concentrations of A, B and C_2 at 400 K are 1×10^{-4} M, 2.0×10^{-3} M, 1.5×10^{-4} M respectively. The value of K_C for the equilibrium at 400 K is

(a) 0.06 (b) 0.09 (c) 0.62 (d) 3×10^{-2}
[Ans. (a) 0.06]

Hint: Law of mass action formula.

Government Exam Questions and Answers

PART - I

Choose the Correct Answer 1 MARK

1. When Δn_g is negative in chemical equilibrium reaction then : *[Mar. 2019]*

(a) $K_p < K_c$ (b) $K_p = 1/K_c$

(c) $K_p = K_c (RT)^{-ve}$ (d) $K_p > K_c$

[Ans. (a) $K_p < K_c$]

PART - II

Answer the Questions 2 MARK

1. Derive K_C - value for dissociation of PCl_5. *[HY. 2019]*

Ans. $K_c = \dfrac{[PC1_3][C1_2]}{[PC1_5]}$

2. Write the Balance chemical equation for the

$$Kc = \frac{[CaO_{(s)}]\,[CO_{2(g)}]}{[CaCO_{(s)}]}$$

Ans. $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

PART - III

Answer the Questions 3 MARK

1. Write Kp and Kc for the following reactions :

$2H_2O_{(g)} + 2Cl_{2(g)} \rightleftharpoons 4HCl_{(g)} + O_{2(g)}$ *[HY. 2019]*

Ans. $K_c = \dfrac{[HCl]^4[O_2]}{[H_2O]^2[Cl_2]^2}$, $K_p = \dfrac{P_{HCl}{}^4 \times P_{O_2}}{P_{H_2O}{}^2 \times P_{Cl_2}}$

2. Find out the Δng values and write the K_c and K_p relation for the equilibrium reactions

(i) Decomposition of ammonia

(ii) Formation of NO *[HY-2018]*

Ans. (i) $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$

$\Delta ng = 4 - 2 = 2$

$K_p = K_c (RT)^{\Delta ng}$

$K_p = K_c (RT)^2$, $K_p > K_c$

(ii) $N_2 + O_2 \rightleftharpoons 2NO$

$\Delta ng = 2 - 2 = 0$

$K_p = K_c (RT)^{\Delta ng}$

$K_p = K_c (RT)^0$, $K_p = K_c$

PART - IV

Answer All the Questions 5 MARK

1. Why is chemical equilibrium considered dynamic in nature? *[HY. 2019]*

Ans. Equilibrium in chemical processes. You may have learnt about reversible reactions. However, this equilibrium is said to be dynamic in nature. This is because it consists of a forward reaction where the reactants react to give products and reverse reaction where the products can react to give back the original reactants.

ADDITIONAL QUESTIONS

Choose the Correct Answers 1 MARK

1. The K_c for given reaction will be

$A_{2(g)} + 2B_{(g)} \rightleftharpoons C_{(g)} + 2D_{(g)}$

(a) $K_c = \dfrac{[C][D]^2}{[A_2][B]^2}$ (b) $K_c = \dfrac{[C]}{[A_2][B]^2}$

(c) $K_c = \dfrac{[A_2][B]^2}{[C][D]^2}$ (d) $K_c = \dfrac{[A_2][B]^2}{[C]}$

[Ans. (b)]

2. For which of the following reaction, the degree of dissociation (α) and equilibrium constant (K_p) are related as $K_p = \dfrac{4\alpha^2 P}{(1-\alpha^2)}$?

(a) $N_2O_{4(g)} \rightleftharpoons 2NO_2(g)$

(b) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI(g)$

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

(d) $PCl_{3(g)} + Cl_{2(g)} \rightleftharpoons PCl_{5(g)}$

[Ans. (a) $N_2O_{4(g)} \rightleftharpoons 2NO_2(g)$]

09 SOLUTIONS

CHAPTER SNAPSHOT

- Types of solutions
- Expressing concentration of solutions
- Solubility of the solutes
- Henry's law
- Vapour pressure of liquid
- Vapour pressure of liquid solutions
  - ✶ Vapour pressure of binary solution of liquid in liquids
  - ✶ Vapour pressure of binary solution of solids in liquids
- Ideal and non-ideal solutions
  - ✶ Ideal solutions
  - ✶ Non-ideal solutions
- Positive deviation from Rauolt's law
- Negative deviation from Rauolt's law
- Colligative properties
  - ✶ Relative lowering of vapour pressure (P)
  - ✶ Elevation of boiling point
  - ✶ Depression in freezing point
  - ✶ Osmosis and osmotic pressure
  - ✶ Isotonic solutions
  - ✶ Reverse osmosis (RO)
  - ✶ Abnormal molar mass

PART - IV

ANSWER ALL THE QUESTIONS 5 MARK

1. Define the term solubility and what are the factors that influences solubility? *[HY. 2019]*

Ans. **Solubility :** Solubility of a solute is the maximum amount of solute that can be dissolved in a specific amount of solvent at a specified temperature.

Factors influencing the solubility :

(i) Nature of solute and solvent

(ii) Effect of temperature

(a) Solid solute in liquid solvent

(b) Gaseous solute in liquid solvent

(iii) Effect of pressure.

2. What is the mass of glucose ($C_6H_{12}O_6$) in it one litre solution which is isotonic with 6 g L^{-1} of urea (NH_2CONH_2)? *[June 2019]*

Ans. Osmotic pressure of urea solution (π_1) = CRT

$$= \frac{W_2}{M_2 V} RT$$

$$= \frac{6}{60 \times 1} \times RT$$

Osmotic pressure of glucose solution

$$(\pi_2) = \frac{W_2}{180 \times 1} \times RT$$

For isotonic solution,

$\pi_1 = \pi_2$

$$\frac{6}{60} RT = \frac{W_2}{180} RT$$

$$\Rightarrow \quad W_2 = \frac{6}{60} \times 180$$

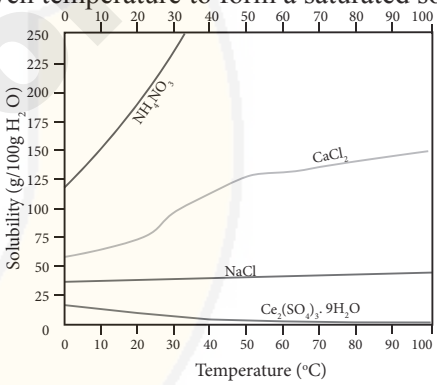
$$W_2 = 18g$$

3. Write a note on solubility of solute and brief out the formation of a saturated solution with an example. (OR)
Draw and explain the graph obtained by plotting solubility versus temperature for calcium chloride. *[June 2019]*

Ans. **(i)** Solubility of a solute is the maximum amount of solute that can be dissolved in a specic amount of solvent at a specied temperature.

(ii) When maximum amount of solute is dissolved in a solvent, any more addition of solute will result in precipitation at a given temperature and pressure. Such a solution is called as a saturated solution.

(iii) The solubility of a substance at a given temperature is dened as the amount of the solute that can be dissolved in 100 g of the solvent at a given temperature to form a saturated solution.



ADDITIONAL QUESTIONS

CHOOSE THE CORRECT ANSWERS 1 MARK

1. The example of solid solution is

(a) glucose in water (b) copper in gold

(c) camphor in nitrogen (d) oxygen in nitrogen

[Ans. (b) copper in gold]

2. In a binary solution

(a) solvent may be liquid (b) solvent may be solid

(c) solute may be gas (d) any of these

[Ans. (d) any of these]

3. The blocking of capillaires due to sudden release of bubbles of N_2 gas in blood is known as

(a) bends (b) blends

(c) mends (d) all of these

[Ans. (a) bends]

4. Which of the following gas should have maximum value for k_H?

(a) He (b) H_2 (c) N_2 (d) CO_2

[Ans. (a) He]

NUMERICAL PROBLEMS

1. A solution contains 510g of sulphuric acid per litre at 25°C. Calculate the normality and molarity of the solution.

Sol : Normality = $\frac{\text{Number of gram equivalents of solute}}{\text{Volume of solution is litres}}$

Gram equivalent = $\frac{\text{Mass}}{\text{Eq.mass}}$

Equivalent mass of H_2SO_4 = $\frac{\text{Molar mass}}{\text{Basicity}}$

= $\frac{98}{2} = 49$

Equivalencs of H_2SO_4 = $\frac{510g}{49} = 10.408$

Normality = $\frac{10.408}{1}$ = **10.40 N**

(ii) Molarity = $\frac{\text{No.of moles of solute}}{\text{Volume of solution in litre}}$

No.of moles = $\frac{\text{Mass}}{\text{Molecular mass}}$

= $\frac{510}{98} = 5.20$ moles

Molarity = $\frac{\text{No.of moles of solute}}{\text{Vol.of solution in 1 lit}}$

= $\frac{5.20}{1} =$ **5.20 M**

2. A solution is prepared by dissolving 30g of urea in 120g of water. Calculate the molality of the solution. (Molar mass of urea : 60)

Sol : Molality = $\frac{\text{No.of moles of solute}}{\text{Mass of solvent in kg}}$

No.of. moles = $\frac{\text{Mass}}{\text{Molecular mass}}$

= $\frac{30}{60} = 0.5$ moles

Mass of solvent in kg = $\frac{120}{1000} = 0.12$ kg

Molality = $\frac{\text{No.of moles of solute}}{\text{Mass of solvent in kg}}$

= $\frac{0.5}{0.12} =$ **4.166m**

3. A sample of 56g of ethanol is dissolved in 36g of water. Calculate the mole fraction of ethyl alcohol.

Sol : Mole fraction of solute

= $\frac{\text{Moles of the component}}{\text{Total number of moles of all the component in the solution}}$

No.of moles = $\frac{\text{Mass}}{\text{Molecular mass}}$

No.of moles of ethanol = $\frac{56}{46} = 1.28$ moles

No.of moles of water = $\frac{36}{18} = 2$ moles

No.of mole fraction of ethyl/alcohol = $\frac{1.28}{(1.28+2)}$

= $\frac{1.28}{3.28} =$ **0.39**

4. What is the mass percentage of each component in a mixture containing 22g of methanol in 112g of benzene?

Sol : Mass of solution = Mass of methanol + mass of benzene

= 134g

Mass percentage of methanol = $\frac{22}{134} \times 100 =$ **16.42%**

Mass percentage of benzene = $\frac{112}{134} \times 100 =$ **83.58%**

5. Calculate the volume of 1.5N H_2SO_4 is completely neturalized by 35.8 mL of

(a) 2.5N NaOH (b) 2.5M NaOH

(c) 2.5N $Ba(OH)_2$ (d) 2.5M $Ba(OH)_2$

Sol : (a) $V_1N_1 = V_2N_2$

Volume of $H_2SO_4(V_1)$ = x ml

Normality of $H_2SO_4(N_1)$ = 1.5 N

Volume of $NaOH(V_2)$ = 35.8 mL

Normality of $NaOH(N_2)$ = 2.5 N

According to volumetric law

$V_1N_1 = V_2N_2$

10 CHEMICAL BONDING

CHAPTER SNAPSHOT

- Kossel – Lewis approach to chemical bonding
- Octet rule
- Ionic bond
- Co-ordinate bond – Bonding in metals
- Bond parameters
  - ✶ Bond angle
  - ✶ Bond length
  - ✶ Bond enthalpy
  - ✶ Bond order
  - ✶ Resonance
  - ✶ Polarity of bonds
- Valence share electron pair repulsion theory
- Shapes of covalent molecules.
- Valence bond theory.
- Hybridisation
  - ✶ σ – bond formation
  - ✶ π – bond formation
- Molecular orbital theory
  - ✶ Bonding in homonuclear diatomic molecules
  - ✶ Bonding in heteronuclear diatomic molecules
- Hydrogen bonding
  - ✶ Intermolecular hydrogen bonding
  - ✶ Intramolecular hydrogen bonding

FORMULAE TO REMEMBER

- Dipole moment (μ) = Charge (Q) × Distance of separation (r)
- According to Linear combination of Atomic Orbitals,
  - $\Psi_{MO} = \Psi_A \pm \Psi_B$
  - $\Psi_{bonding} = \Psi_A + \Psi_B$
  - $\Psi_{antibonding} = \Psi_A - \Psi_B$
- Bond order = $\frac{1}{2} = (N_b - N_a)$

MUST KNOW DEFINITIONS

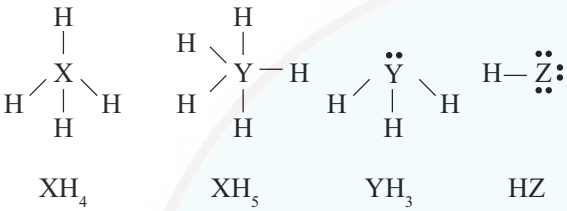
Octet rule	:	The atoms transfer or share electrons so that all atoms involved in chemical bonding obtain 8 electrons in their outer shell (valence shell).
Chemical bond	:	The strong force of binding between two or many atoms is referred to as a chemical bond.
Ionic bond	:	The electrostatic attraction force existing between the cation and anion produced by the electron transfer from one atom to other is known as ionic bond.
Co-ordinate bond	:	The bond formed between the donor and acceptor atoms is called co-ordinate or co-ordinate covalent bond.
Covalent bond	:	A chemical bond formed when two atoms mutually share a pair of electron is called covalent bond.
Single covalent bond	:	When two atoms share one electron pair they are said to be joined by a single covalent bond.
Double covalent bond	:	If two atoms share two pairs of electrons, the covalent bond between them is called a double bond.
Triple bond	:	When combining atoms share three electron pairs a triple bond is formed.
Lattice Enthalpy	:	The lattice enthalpy of an ionic solid is defined as the energy required to completely separate one mole of a solid ionic compound into gaseous constituent ions.
Bond length	:	Bond length is defined as the distance between the nuclei of two covalenty bonded atoms in a molecule.
Bond angle	:	It is defined as the angle between the orbitals containing bonding electron pairs around the central atom in a molecule/complex ion
Bond enthalpy	:	It is defined as the amount of energy required to break one mole of a particular bonds in molecules in their state. The unit of bond enthalpy is kJ mol^{-1}.

CREATIVE QUESTIONS (HOTS)

2 MARKS

1. (i) X, Y and Z elements have 4, 5 and 7 valence electrons. Draw the structure of XH_4, YH_5 YH_3 and H-Z.
(ii) Which of these compounds possess highest dipole moment?

Ans. (i)



XH_4 XH_5 YH_3 HZ

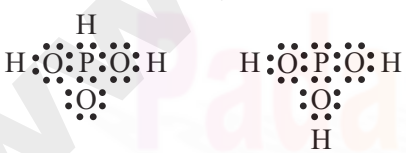
(ii) The compound with more number of electrons on the valence shell, ∴ is considered to be the most electronegative element.
∴ HZ is the most electronegative element which has highest dipole moment.

2. On the basis of VSEPR theory predict the shape of the Ozone.

Ans. The resonating structure of ozone are:

The central *o*-atom is considered to have two bond pairs and one lone pair of electrons (ie) it is of AB_2E type.
Hence it is a **bent molecule**.

3. H_3PO_3 can be represented by structures I and II shown below, can these two structures be taken as the canonical forms of the resonance hybrid representing H_3PO_3? If not, give reasons for the same.



- The two structures I and II of H_3PO_3 cannot be taken as canonical forms, because canonical forms differ only in the arrangement of electrons.
- But in I and II the position of the H-atom has been changed.
- Hence I and Ii are not considered to be canonical or resonance forms.

4. Predict the geometry of BF_3, SF_6, SO_2 and NH_3

Ans.

Molecule	Geometry
BF_3	Triagonal Planar
SF_6	Octahedral
SO_2	Bent
NH_3	Tetrahedral

5. How may lone pairs and bond pairs are present in SO_4^{2-} and H_3O^+?

Ans. SO_4^{2-} contains 6 bond pairs and 10 lone pairs
H_3O^+ contains 3 bond pairs and 1 lone pair

6. Calculate the number of bond pairs and lone pairs in ICl_4^-.

Ans. No. of valence electrons in I = 7
Out of 7, 4 electrons are bonded to four Cl^- atoms.
∴ It has 4 – bond pairs
No. of lone pairs = Valence electrons – Bond pairs
= 7 – 4 = 3
No. of lone pair = 3 + 1 (charge on C*l*) = 4 electrons or 2 lone pairs

7. Does H_2O and H_2S possess same bond angle? Explain

Ans.

The bond angle of HSH is 92.2° and that of H_2O is 104.5°
The higher bond angle in water molecule is due to the higher electronegativity of oxygen (in H_2O) than sulphur (in H_2S).

8. Arrange the bonds in order of increasing ionic character in the molecules; L*i*F, K_2O, N_2, SO_2 and C*l*F_3

Ans. Ionic character α Lattice energy α $\frac{1}{\text{size of ion}}$ α Charge on ion.
A non-polar molecule like N_2 has almost negligible ionic character.
∴ The order of ionic character is $N_2 < SO_2 < ClF_3 < K_2O <$ L*i*F

9. Explain the equal bond lengths of C—O bonds in CO_3^{2-} ion.

Ans. According to experimental observations, the C—O bonds in CO_3^{2-} equivalent.

11 FUNDAMENTALS OF ORGANIC CHEMISTRY

CHAPTER SNAPSHOT

- Introduction to organic chemistry
- Classification of organic compounds
  - Open chain compounds
  - Closed chain compounds
    - Hetero cyclic compounds
    - Homo cyclic compounds
    - Alicyclic compounds
    - Aromatic compounds
      - Benzenoid compounds
      - Non-benzenoid compounds
- Nomenclature of organic compounds
- Isomerism
  - Structural isomerism
    - Chain isomerism
    - Position isomerism
    - Functional isomerism
    - Metamerism
  - Stereoisomerism
    - Geometrical isomerism
    - Optical isomerism
- Detection and estimation of elements in organic compounds
  - Carbon and Hydrogen
  - Nitrogen
  - Sulphur
  - Halogen
  - Phosphorus
- Purification of organic compounds
  - Crystallisation
  - Sublimation
  - Distillation
    - Fractional distillation
    - Steam distillation
    - Azeotropic distillation
- Distillation under reduced pressure
- Differential extraction
- Chromatography
  - Adsorption chromatography
    - Column chromatography
    - Thin layer chromatography
  - Partition chromatography
    - Paper chromatography

49. 0.32 g of an organic compound, after heating with fuming nitric acid and barium nitrate crystals is a sealed tube game 0.466 g of barium sulphate. Determine the percentage of sulphur in the compound.

Ans. Mass of solution substance taken = 0.32 g
Mass of $BaSO_4$ formed = 0.466g
Molecular mass of $BaSO_4$ = 137 + 32 + 64 = 233
Then mass of 0.466 g of $BaSO_4$ = $\frac{0.466 \times 32}{233}$ g

Percentage of S in compound = $\frac{0.466 \times 32 \times 100}{233 \times 0.32} = 20\%$

50. 0.24g of an organic compound gave 0.287 g of silver chloride in the carius method. Calculate the percentage of chlorine in the compound.

Ans. Weight of the organic substance = 0.24 g
Weight of AgCl is = 0.287 g
143.5 g of AgCl contains 35.5 g of chlorine
0.287 g of AgCl contains $\frac{35.5}{143.5} \times \frac{0.287}{0.284}$

% of chlorine is $\frac{35.5}{143.5} \times \frac{0.287}{0.284} \times 100 = 24.56$

51. In the estimation of nitrogen present in an organic compound by Dumas method 0.35 g yielded 20.7 mL of nitrogen at 150 C and 760 mm pressure. Calculate the percentage of nitrogen in the compound.

Sol. Weight of the organic compound = 0.359

Volume = 20.7 ml
Temperature T = 15 + 273
= 288 K
Pressure P = 760 mm

Percentage of N = $\frac{28 \times v}{22400} \times \frac{100}{w}$

= $\frac{28 \times 20.7}{22400} \times \frac{100}{0359} = 7.208$

Percentage of N = 7.208 %

★★★

Government Exam Questions and Answers

PART - I

Choose the Correct Answer — 1 MARK

1. In the hydrocarbon $CH_2 = C = CH_2$ the state of hybridisation of carbon 1, 2, 3 is respectively *[HY. 2018]*

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

[Ans. (a) sp, sp^2, sp^3]

Hint: single bond contains sp^3 hybridisation, double bond contains sp^2 hybridisation, and triple bond contains sp hybridisation.

2. Many of the organic compounds are inflammable because of its : *[Mar. 2019]*

(a) Vander Waal's force (b) Co-ordinate nature
(c) Covalent nature (d) Ionic nature

[Ans. (c) Covalent nature]

3. The simplest Ketone is : *[HY. 2019]*

(a) $CH_3 - CH_2 - CO - CH_3$
(b) $CH_3 - CO - CH_3$
(c) $CH_3 - O - CH_3$
(d) $CH_3 - COO - CH_3$ **[Ans. (b) CH_3–CO–CH_3]**

PART - II

Answer the Questions — 2 MARK

1. How would you detect the presence of sulphur in an organic compound? *[HY. 2018]*

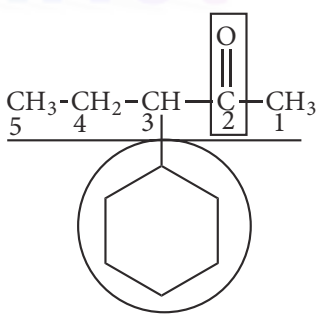
Ans. **Oxidation test:** The organic substances are fused with a mixture of KNO_3 and Na_2CO_3. The sulphur, if present is oxidized to sulphate.

$Na_2CO_3 + S + 3O \longrightarrow Na_2SO_4 + CO_2$

2. Give the structural formulae of the following compounds *[HY. 2018]*

(i) 3-cyclohexylpentan-2-one
(ii) 2-ethylbut-3-enoic acid

Ans. **(i)**



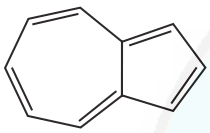
3-cyclohexylpentan-2-one

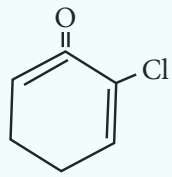
In Text QUestion - Evaluate Yourself

1. Give two examples for each of the following type of organic compounds.
(i) non-benzonoid aromatic,
(ii) aromatic heterocyclic,
(iii) alicyclic and
(iv) aliphatic open chain.

Ans. **(i) non - benzonoid aromatic compounds :**

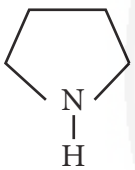
1. Azulene 2. Chorotroplone

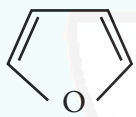




(ii) Aromatic heterocyclic compounds :

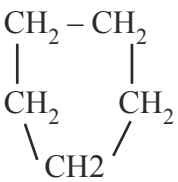
1. Pyroll 2. Furan

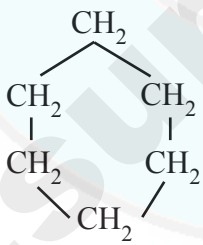




(iii) Alicyclic compounds :

1. Cyclopentane 2. Cyclohexane



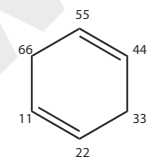


(iv) Aliphatic open chain compound :

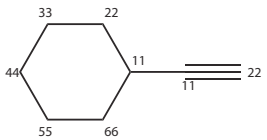
1. $CH_3 – CH_2 – CH_2 – CH_2 – CH_3$ n - pentane
2. $CH_3 – CH_2 – CH_2OH$ 1 - Propanol

2. Write structural formula for the following compounds
(i) Cyclohexa-1, 4-diene
(ii) Ethynyl cyclohexane

Ans.



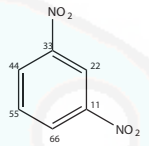
cyclohexa-1,4-diene
(i)



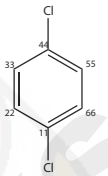
ethynylcyclohexane
(ii)

3. Write structural formula for the following compounds *[Mar. 2019]*
(i) m - dinitrobenzene
(ii) p-dichloro benzene
(iii) 1, 3, 5- Trimethyl benzene

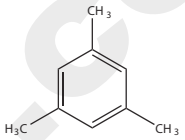
Ans.



1,3-dinitrobenzene
(i)



p-dichloro benzene
(ii)

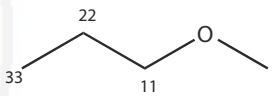


1,3,5-trimethylbenzene
(iii)

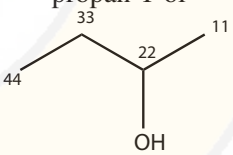
4. Write all the possible isomers of molecular formula $C_4H_{10}O$ and identify the isomerisms found in them.

Ans. $C_4H_{10}O$ isomers

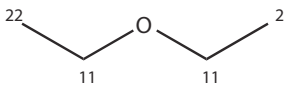
propan-1-ol



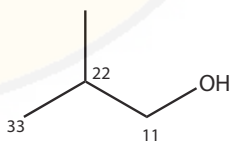
1-methoxypropane



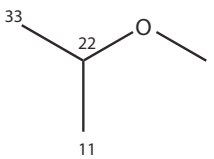
butan-2-ol



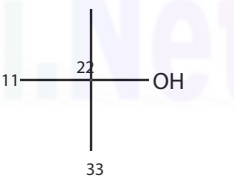
ethoxyethane



2-methylpropan-1-ol



2-methoxypropane



2-methylpropan-2-ol

12 Basic Concepts Of Organic Reactions

CHAPTER SNAPSHOT

- Fundamental concepts in organic reaction mechanism
- Fission of a co-valent bond
  - ✶ Homolytic cleavage
  - ✶ Heterolytic cleavage
- Nucleophiles, electrophiles and free radicals
- Electron movement in organic reactions
- Electron displacement affects in co-valent bonds
  - ✶ Inductive effect
  - ✶ Electrometric effect
  - ✶ Resonance effect
  - ✶ Hyper conjugation
  - ✶ Mesomeric effect
- Types of organic reactions
  - ✶ Substitution reactions (free radical , electrophilic, nucleophilic)
  - ✶ Addition reactions
  - ✶ Elimination reactions
  - ✶ Oxidation reactions
  - ✶ Reduction reactions
  - ✶ Molecular rearrangements
- Functional group inter conversion

Government Exam Questions and Answers

PART - I

Choose the Correct Answer 1 MARK

1. **Statement : Chloro acetic acid is more acidic than acetic acid**
Reason : Chloro group has +1 effect *[HY. 2018]*
(a) Both Assertion, Reason are correct
(b) Assertion is false, Reason is correct
(c) Assertion is correct, Reason is false
(d) Both Assertion and Reason are false
[Ans. (c) Assertion is correct, Reason is false]

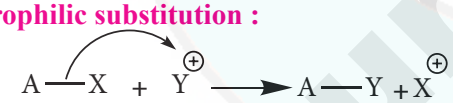
2. **Write the decreasing order of +I effect :** *[HY. 2019]*
(a) $-CH_2CH_3 > -CH_3 > -C(CH_3)_3 > -CH(CH_3)_2$
(b) $-CH_3 > -CH_2CH_3 > -CH(CH_3)_2 > -C(CH_3)_3$
(c) $-C(CH_3)_3 > -CH(CH_3)_2 > -CH_2CH_3 > -CH_3$
(d) $-CH(CH_3)_2 > -CH_2CH_3 > -C(CH_3)_3 > -CH_3$
[Ans. (c) $-C(CH_3)_3 > -CH(CH_3)_2 > -CH_2CH_3 > -CH_3$]

PART - III

Answer the Questions 3 MARK

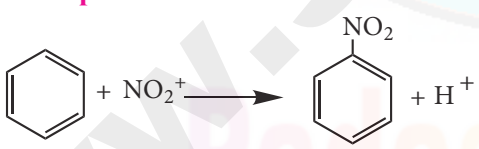
1. **Write the Electrophilic substitution reaction of benzene.** *[HY. 2019]*

Ans. **Electrophilic substitution :**



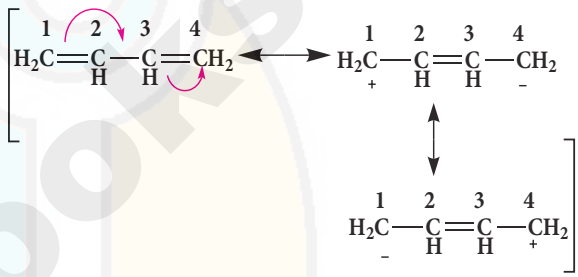
Here Y+ is an electrophile

Example: Nitration of Benzene



2. **The bond length between all the four carbon atoms is same in 1, 3 - butadiene. Explain with reason.** *[June 2019]*

Ans. In 1,3 butadiene, it is expected that the bond between $C^1 - C^2$ and $C^3 - C^4$ should be shorter than that of $C^2 - C^3$, but the observed bond lengths are of same. This property can explained by on the basis of resonance hybrid ,a simple structure in which two π bonds are localised between $C^1 - C^2$ and $C^3 - C^4$. Actually the π electrons are delocalised as shown below.



PART - IV

Answer All the Questions 5 MARK

1. **Explain with example the Positive Mesomeric Effect.** *[Mar. 2019]*

Ans. Positive resonance effect occurs, when the electrons move away from substituent attached to the conjugated system. It occurs, if the electron releasing substituents are attached to the conjugated system.
In such cases, the attached group has a tendency to release electrons through resonance. These electron releasing groups are usually denoted as +R or +M groups.
Examples : –OH, –SH, –OR, –SR, $–NH_2$, –O–

2. **What are Nucleophiles and Electrophiles? Give one example each.** *[Mar. 2019]*

Ans. Nucleophiles are reagents that have high affinity for electro positive centers.
(any two examples)

Types	Examples	Electron rich site
Neutral molecules having unshared pair of electron	Ammonia (NH_3) and amines (RNH_2)	N:
	Water (H_2O), alcohols (ROH) and ethers (R-O-R)	:O:
	Hydrogen sulphide (H_2S) and thiols (RSH)	:S:
Negatively charged nucleophiles	Chlorides (Cl^-), bromides (Br^-) and iodides (I^-)	X^-
	Hydroxide (HO^-), alkoxide (RO^-) and Carboxlate ions ($RCOO^-$)	O^-
	Cyanide (CN^-)	N^-

CREATIVE QUESTIONS (HOTS)

2 MARKS

1. $CH_2=\bar{C}H$ is more basic than $HC\equiv C^-$. Explain why?

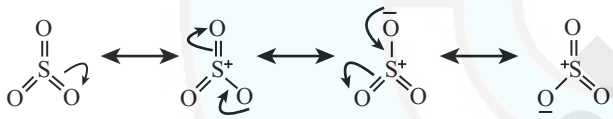
Sol : $CH_2=\overset{sp^2}{C}H^-$ $\qquad$ $HC\equiv\overset{sp}{C}^-$

- Since *sp* carbon is more electronegative than sp^2 carbon.
- ∴ $CH\equiv\bar{C}$ is less interested in donating a pair of electrons than $CH_2=\bar{C}H$.

2. Why does SO_3 act as an electrophile?

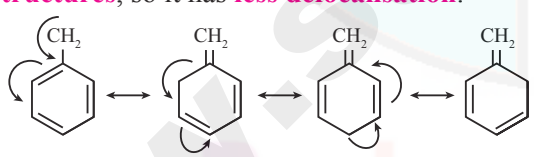
Ans.
- Three highly electronegative oxygen atoms are attached to sulphur atom in SO_3. It makes sulphur **electron defficient**.
- Further, due to **resonance**, sulphur-acquires a positive charge.

  ∴ Resonance and electron defficiency make SO_3 an electrophile.



3. Why is benzylic free radical more stable than allylic free radical?

Ans.
- The benzylic free radical is **resonance stabilised**. It possess more resonance structures.
- Allylic free radical has only **two resonating structures**, so it has **less delocalisation**.



$CH_2=CH-CH_2 \longleftrightarrow H_2C-CH=CH_2$

4. Classify the following reactions in one of the reaction type studied in this unit.

(i) $CH_3CH_2Br + H\bar{S} \longrightarrow CH_3CH_2SH + Br\bar{}$

(ii) $(CH_3)_2C=CH_2 + HCl \longrightarrow (CH_3)_2CCl-CH_3$

(iii) $CH_3-CH_2Br + H\bar{O} \longrightarrow CH_2=CH_2 + H_2O + Br\bar{}$

(iv) $(CH_3)_3C-CH_2OH + HB \longrightarrow (CH_3)_2CBr-CH_2-CH_3 + H_2O$

Ans.
(i) Nucleophilic substitution reaction – $Br\bar{}$ is substituted by $H\bar{S}$

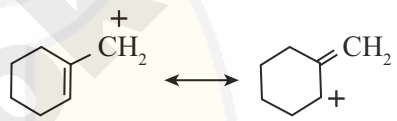
(ii) Electrophilic addition reaction – HCℓ is added to the C=C bond.

(iii) β-elimination reaction – H and B*r* are eliminated from successive carbon atoms.

(iv) Nucleophilic substitution reaction with rearrangement – $\bar{O}H$ us substituted by $Br\bar{}$.

5. Which of the following ions is more stable? Use resonance to explain your answer.

Ans.



(A) (B)

- (A) is more stable than (B).
- Carbocation (A) is more planar and is stabilised by resonance.
- Carbocation (B) is non-planar and does not undergo resonance.
- Double bond inside the ring is more stable than outside the ring.

6. Arrange the following compounds in increasing order of acidity.

(i) $CH_3CH(Br)CH_2COOH$

(ii) $CH_3CH_2CH(Br)COOH$

(iii) $CH_3CH_2C(Br)_2COOH$

(iv) $CH_2BrCH_2CH_2COOH$

[**Hint:** Inductive effect decreases due to polarity].

Ans.
- Br group causes polarity.
- As the distance between B*r* and COOH increases, inductive effect and acidity decreases.
- **Order of acidity: III > II > I > IV**

13 HYDROCARBONS

CHAPTER SNAPSHOT

Hydrocarbons
Introduction and classification

ALIPHATIC - SATURATED HYDROCARBON

Alkanes
- Preparation
- Physical and chemical properties
- Uses
- Conformation of alkanes
  - Saw horse projections
  - Newman projections

ALIPHATIC - UNSATURATED HYDROCARBON

Alkenes
- Preparation
- Physical and chemical properties
  - Markovnikov addition reaction
  - Antimarkovnikov addition reaction
- Isomerism
  - Structural isomerism
    Chain isomerism
    Position isomerism
  - Streoisomerism
    Geometrical isomerism

Alkynes
- Preparation of alkynes
- Physical and chemical properties
- Uses

AROMATIC HYDROCARBON

Aromatic hydrocarbons
- Aromaticity - Huckel's Rule
- Structure of benzene
  - Resonance and stability of benzene
- Preparation of benzene
- Physical properties
- Chemical properties
  - Aromatic electrophilic substitution reaction and mechanism

Directive influence of a functional group is monosubstituted benzene
- Ortho para directing group
- Meta directing group

Carcinogenicity (Toxicity)

5. What do you mean by conformation? Explain about staggered conformation in ethane.

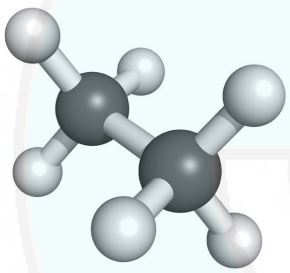
[June 2019]

Ans. **Conformations of ethane :**

The two tetrahedral methyl groups can rotate about the carbon – carbon bond axis yielding several arrangements called conformers. Extreme conformations are staggered and eclipsed conformation. There can be number of other arrangements between staggered and eclipsed forms and their arrangements are known as skew forms.

Staggered conformation of ethane :

In this conformation, the hydrogens of both the carbon atoms are far apart from each other. The repulsion between the atoms is minimum and it is the most stable conformation.



6. An organic compound (A) of molecular formula C_2H_6O, on heating with conc. H_2SO_4 gives compound (B). (B) on treating with cold dilute alkaline $KMnO_4$ gives compound (C). Identify (A), (B) and (C) and explain the reactions.

[June 2019]

Ans. Compund (A) of molecular formula C_2H_6O is C_2H_5OH ethanol

$$\underset{\text{Ethonal (A)}}{C_2H_5OH} \xrightarrow[430-440K]{\text{Conc. } H_2SO_4} \underset{\text{Ethene (B)}}{CH_2 = CH_2}$$

$$\underset{\text{Ethene (B)}}{CH_2 = CH_2} + H_2O + (O) \xrightarrow[273\ K]{\text{Cold dil } KMnO_4} \underset{\text{Ethane 1,2-diol}}{\begin{matrix} CH_2 - CH_2 \\ | \quad\ | \\ OH \quad OH \end{matrix}} + MnO_2$$

A C_2H_5OH - Ethanol

B $CH_2 = CH_2$ - Ethene

C $\begin{matrix} CH_2 - CH_2 \\ | \quad\ | \\ OH \quad OH \end{matrix}$ - Ethane 1,2-diol

ADDITIONAL QUESTIONS

CHOOSE THE CORRECT ANSWERS 1 MARK

1. The difference in potential energy between eclipsed and staggered form of ethane is.

(a) 4 kJ/mol (b) 12.55 kJ/mol
(c) 2 kJ/mol (d) 44 kJ/mol

[Ans. (b) 12.55 kJ/mol]

2. Eclipsed form of ethane has higher energy due to

(a) Torsional strain (b) Steric strain
(c) Angle strain (d) Both (a) & (b)

[Ans. (d) Both (a) & (b)]

3. The angle strain in cyclopentane is

(a) 72° (b) 1°28′
(c) 44′ (d) 108° **[Ans. (c) 44′]**

4. Which one is most stable?

(a) Cyclopropane (b) Cyclobutane
(c) Cyclopentane (d) Cyclohexane

[Ans. (d) Cyclohexane]

5. C- C- C bond angle in benzene is

a) 120° b) 60°
c) 45° d) 135° **[Ans. (a) 120°]**

6. The chair form is _____ stabole than boat form by potential energy _____ kJ/mol.

(a) More, 44 kJ/mol (b) Less, 44 kJ/mol
(c) More, 12.55 kJ/mol (d) Less, 4 kJ/mol

[Ans. (a) More, 44 kJ/mol]

7. Which one is not prepared by winurtz reaction?

(a) C_2H_6 (b) nC_4H_{10}
(c) CH_4
(d) $CH_3-\underset{|}{\overset{CH_3}{CH}}-\underset{|}{\overset{CH_3}{CH}}-CH_3$

[Ans. (c) CH_4]

8. In which alkane isomerization will not occur?

(a) C_2H_6 (b) C_4H_{10}
(c) C_5H_{10} (d) C_6H_{14} **[Ans. (a) C_2H_6]**

14 HALOALKANES AND HALOARENES

CHAPTER SNAPSHOT

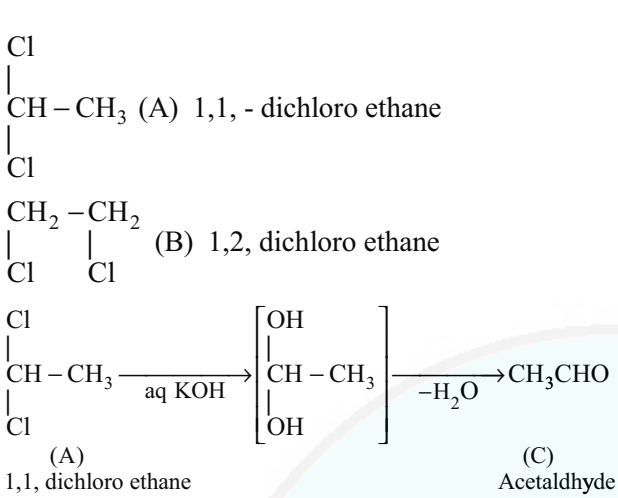
Introduction
Classification
Haloalkanes
- Nomenclature
- Nature of C-X bond
- Methods of preparation
- Physical properties
- Chemical properties
- Uses of halo alkanes

Organo metallic compounds - Grignard reagent
- Preparation of Grignard reagent
- Synthetic uses

Haloarenes
- Nomenclature
- Nature of C –X bond
- Methods of preparation
- Physical properties
- Chemical properties
- Uses of chloro benzene

Poly halogen compounds
Di haloalkanes
- Trihaloalkanes
- Tetra haloalkanes
- Freons
- DDT

Ans.



A		– 1,1 dichloro ethane
B		– 1,2 dichloro ethane
C	CH_3CHO	–Acetaldehyde
D		–Ethyleneglycol

✶ ✶ ✶

Government Exam Questions and Answers

PART - II

Answer the Questions — 2 MARK

1. How is Alkane prepared from Grignard reagent? *[Mar. 2019]*

Ans. $CH_3MgI + HO - H \longrightarrow CH_4 + MgI(OH)$

(or)

$CH_3MgI + C_2H_5OH \xrightarrow{\Delta} CH_4 + MgI(OC_2H_5)$

Ethyl alcohol — methane

2. Explain williamson's synthesis. *[Mar. 2019]*

Ans. Williamson's synthesis : Halo alkanes when boiled with sodium alkoxide gives the corresponding other.

$CH_3 - CH_2Br + CH3\ CH2\ ONa \longrightarrow CH_3 - CH_2 - O - CH2 - CH3 + NaBr$

Bromo ethane — Sodium ethoxide — Diethyl ether

PART - III

Answer the Questions — 3 MARK

1. Convert chlorobenzene to : *[HY. 2019]*
(i) Phenol (ii) Aniline

Ans. Conversion of chloro benzene into phenol & Aniline :

(i) $C_6H_5Cl + NaOH \xrightarrow[300\ atm]{350^\circ c} C_6H_5OH + NaCl$

Chloro benzene — Phenol

(ii) $C_6H_5Cl + 2NH_3 \xrightarrow[50\ atm]{250^\circ c} C_6H_5NH_2 + NH_4Cl$

Chloro benzene — Aniline

(iii) $C_6H_5Cl + COCN \xrightarrow[\text{Phenyl cyanide}]{250^\circ c} C_6H_5CN + CuCl$

Chloro benzene — Phenyl cyanide

PART - IV

Answer All the Questions — 5 MARK

1. Name the reaction used to test primary amine? Write the complete balanced equation for the above reaction. *[HY. 2019]*

Ans. Carbylamine reaction used to test primary amine. Chloroform reacts with aliphatic or aromatic primary amine and alcoholic caustic potash, to give foul smelling alkyl isocyanide (carbylamines)

$CH_3NH_2 + CHCl_3 + 3KOH \longrightarrow CH_3NC + 3KCl + 3H_2O$

Methylamine — Chloroform — Methylisocyanide

2. Among the following compounds, O-dichloro benzene and p-dichloro benzene, which has higher melting point? Explain with reason. *[June 2019]*

Ans. Melting and boiling points :

- The boiling points of monohalo benzene which are all liquids follow the order
  Iodo > Bromo > Chloro
- The boiling points of isomeric dihalobenzene are nearly the same
- The melting point of para isomer is generally higher than the melting points of ortho and meta isomers.

15 ENVIRONMENTAL CHEMISTRY

CHAPTER SNAPSHOT

- Environmental Pollution
- Atmospheric Pollution
- Types of environmental pollution
  - ✶ Air pollution
    - ✶ Gaseous air pollutants
    - ✶ Greenhouse effect and Global warming
    - ✶ Acid Rain
  - ✶ Particulate pollutants
    - a. Viable particulates
    - b. Non-viable particulates
  - ✶ Smog
    - (i) Classical smog or London smog
    - (ii) Photo chemical smog or Los Angel Smog
- Stratospheric pollution
- Water Pollution
- Causes of water pollution
  - ✶ Microbiological (Pathogens)
  - ✶ Organic wastes
  - ✶ Chemical wastes
- Quality of drinking water
- Soil Pollution
  - ✶ Sources of soil pollution
    - ✶ Artificial fertilizers
    - ✶ Pesticides
    - ✶ Industrial wastes
- Strategies to control environmental pollution
- Green Chemistry
  - ✶ Green chemistry in day-to-day life

Government Exam Questions and Answers

PART - I

Choose the Correct Answer 1 MARK

1. _____ cause kidney damage. *[June 2019]*
a) Cadmium, Mercury b) Lead, Cadmium
c) Freon, Fluoride d) Copper, Cadmium
[Ans. (a) Cadmium, Mercury]

PART - II

Answer the Questions 2 MARK

1. Define – Acid rain. *[Mar. 2019]*

Ans. Rain water normally has a pH of 5.6 due to dissolution of atmospheric CO_2 into it. Oxides of sulphur and nitrogen in the atmosphere may be absorbed by droplets of water that make up clouds and get chemically converted into sulphuric acid and nitric acid respectively as a results of pH of rain water drops to the level 5.6, hence it is called acid rain.

PART - IV

Answer All the Questions 5 MARK

1. Write the harmful effects of a acid rain. *[HY. 2019]*

Ans. **Harmful effects of acid rain :** Some harmful effects are discussed below.

(i) Acid rain causes extensive damage to buildings and structural materials of marbles. This attack on marble is termed as Stone leprosy.

$$CaCO_3 + H_2SO_4 \longrightarrow CaSO_4 + H_2O + CO_2\uparrow$$

(ii) Acid rain affects plants and animal life in aquatic ecosystem.
(iii) It is harmful for agriculture, trees and plants as it dissolves and removes the nutrients needed for their growth.
(iv) It corrodes water pipes resulting in the leaching of heavy metals such as iron, lead and copper into the drinking water which have toxic effects.
(v) It causes respiratory ailment in humans and animals.

2. Write notes on the adverse effect caused by ozone depletion. *[June 2019]*

Ans. **Adverse effect of ozone depletion :**
(i) Any change in the equilibrium level of the ozone in the atmosphere will adversely affect life in the biosphere in the following ways.
(ii) Depletion of ozone layer will allow more UV rays to reach the earth surface and layer would cause skin cancer and also decrease the immunity level in human beings.
(iii) UV radiation affects plant proteins which leads to harmful mutation of cells.
(iv) UV radiation affects the growth of phytoplankton, as a result ocean food chain is disturbed and even damages the fish productivity.

ADDITIONAL QUESTIONS

Choose the Correct Answers 1 MARK

1. Which among the following is a green house gas?
(a) CFC (b) CH_4 (c) O_3
(d) All of these **[Ans. (b) All of these]**

Hint: Green House gases are CO_2, CH_4 water vapour, Ozone, CFC gases etc.,

2. Which of the following is responsible for acid rain?
(a) SO_2 (b) NO_2 (c) CO_2
(d) All of these **[Ans. (d) All of these]**

3. Earth is protected from UV rays by
(a) N_2 (b) O_2 (c) SO_3 (d) O_3
[Ans. (d) O_3]

4. _____ **is responsible for global warming.**
(a) CO_2 (b) NO_2
(c) N_2O (d) None of these
[Ans. (a) CO_2]

5. High concentration of lead in human blood damages
(a) Brain (b) Liver
(c) Both (a) & (b) (d) Neither (a) nor (b)
[Ans. (c) Both (a) & (b)]

6. The pH of acid rain is
(a) Equal to 7 (b) Less than 5.6
(c) More than 5.6 (d) Between 7.0 – 9.0
[Ans. (b) Less than 5.6]

CREATIVE QUESTIONS (HOTS)

2 MARKS

1. (i) Name three natural sources of air pollution.
(ii) What compound will be formed when CO combines with blood?

Ans. (i)
- Volcanic eruptions
- Forest fires
- Pollen grains of flowers

(ii) The presence of CO reduces the amount of available haemoglobin of RBC because of formation of carboxyl haemoglobin.

$Hb + CO \longrightarrow HbCO$

2. What is the tolerable limit of fluoride ions in drinking water? What happens if it exceeds 10 ppm?

Ans.
- The tolerable limit of fluoride ions in drinking water is one ppm or 1 mg dm^{-3}
- Higher concentration is harmful to bones and teeth.

3. When does the transport of oxygen to different body cells stop?

Ans. **(i)** Carbon monoxide (CO) combines with haemoglobin (H*b*) of the RBCs about 300 times more readily than oxygen to form **carboxy haemoglobin complex**.

$$Hb + CO \rightleftharpoons HbCO$$

(ii) Thus, Hb will not be able to combine with oxygen to for oxyhaemoglobin complex.

(iii) Hence the transport of oxygen to different body cells does not occur (stops).

4. Why and where do we use freons?

Ans.
- The main reason of ozone layer depletion is due to the release of chlorofluorocarbons (CGCs), also known as freons.
- These compounds are non – reactive, non – flammable, non – toxic organic molecules and therefore used in refrigerators, air – conditioners, in the production of plastic foam and by the electronic industry for cleaning computer parts, etc.

5. Although ozone is heavier than air, it does not settle down near the earth why?

Ans. **(i)** Ozone is thermodynamically unstable and decomposes bask to molecular oxygen before reaching near earth's surface.

(ii) As negligible amount of UV – rays reach near the surface the formation of ozone near the surface of earth is rare.

6. A person consuming metro water suddenly stated consuming well water due to shortage of water supply from municipality. What effect was felt by him? What could be the cause?

Ans.
- He felt laxative effect.
- The laxative effect is observed when the sulphates present in water have concentration greater than 500 ppm. Otherwise at moderate levels it is harmless.

3 MARKS

1. Write the impact of depletion of ozone layer on plants, human and aquatic life.

Ans. **(i) Impact on human:**
Exposure to UV radiation lead to ageing of skin, cataract, sun burn and skin cancer.

(ii) Impact on aquatic life:
Many phytoplanktons are killed and the productivity of fishes are damaged.

(iii) Impact on plant life:
- The plant proteins get easily affected by UV radiation.
- It also increases evaporation of surface water through the stomata of the leaves and decrease the moisture content of the soil.

5 MARKS

1. List out some methods that you suggest to control water pollution in your locality.

Ans. Degradation of water quality by the addition of substances like chemical effluents, metal residues, sewage, oil, detergent, etc. This called water pollution.

Water pollution can be controlled by the following methods :

(i) Industrial waste should not be allowed to get mixed in water bodies such as river, lakes, etc.
(ii) Check the pH of water regularly.
(iii) Excersive usage of fertilizers should be controlled.
(iv) Oil spills must be avoided as much as possible.
(v) Avoid the usage of DDT and malathion at home.
(vi) Waste water should be treated properly.
(vii) Avoid the usage of non – biodegradable detergents for cleaning of clother.

On 21.08.2018, Model Question Paper is released by the Govt. We have given it along with Answer Key

GOVT. MODEL QUESTION PAPER - I

11th STD.

TIME ALLOWED : 2.30 HOURS **CHEMISTRY** MARKS : 70

PART - A

ANSWER ALL THE QUESTIONS: (15 × 1 = 15)

1. Which one of the following is a standard for atomic mass?
   (a) $_6C^{12}$ (b) $_6C^{14}$ (c) $_6C^{13}$ (d) $_6C^{14}$

2. The equivalent mass of a divalent metal element is 10g eq^{-1}. The molar mass of its anhydrous oxide is
   (a) 46 g (b) 36 g
   (c) 52 g (d) none of these

3. Consider the following sets of quantum numbers

	n	l	m	s
(i)	2	1	–1	3/2
(ii)	1	1	1	+1/2
(iii)	1	0	+1	–1/2
(iv)	1	0	0	–1/2

   Which of the following sets of quantum numbers is not possible ?
   (a) (i) and (ii) (b) (ii) and (iv)
   (c) (i), (ii) and (iii) (d) (i), (ii), (iii) and (iv)

4. Based on equation $E = -2.178 \times 10^{-18} \left(\frac{Z^2}{n^2}\right)$ J certain conclusions are written. Which of them is not correct?
   (a) Equation can be used to calculate the energy change when the electron changes orbit.
   (b) For n = 3, the electron has more negative energy than it does for n = 5 which means that the electron is more tightly bound in the smallest allowed orbit.
   (c) The negative sign in the equation simply means that the energy of electron bound to the nucleus is lower it would be if the electrons were at the infinite distance from nucleus.
   (d) Smaller the value of n, the larger is the orbit radius.

5. Which of the following pairs of elements exhibit diagonal relationship?
   (a) Be and Mg (b) Be and Al
   (c) Be and B (d) C and Si

6. The first ionization energy (IE_1) and second ionization energy (IE_2) of elements A, B and C are given below

Element	A	B	C
IE_1 kJ mol^{-1}	2370	522	1680
IE_2 kJ mol^{-1}	5250	7298	3381

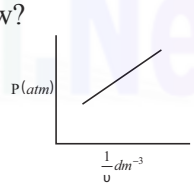
   which one of the above elements is the most reactive metal?
   (a) A (b) B (c) C (d) AandC

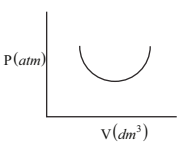
7. Ionic hydrides are formed by
   (a) halogens (b) chalcogens
   (c) alkalimetals (d) inert gases

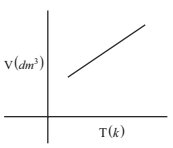
8. Volume strength of 0.5N H_2O_2 is
   (a) 2.8 (b) 8.4 (c) 5.6 (d) 16.8

9. Ionic radius of alkali metals are in the following order
   (a) Li < Na < K < Rb < Cs
   (b) Na < Li < K < Rb < Cs
   (c) Li > Na > K > Rb > Cs
   (d) Na < Li < Rb < K < Cs

10. Which one of the following is true?
    (a) Lithium on direct combination with nitrogen from Li_3N.
    (b) Magnesium on direct combination with nitrogen from Mg_3N.
    (c) Both (a) and (b)
    (d) Lithium and magnesium form bicarbonates.

11. Which of the following correctly represents Boyle's Law?
    (a) 

    (b) 

    (c) 

    (d) All of these

New Pattern of Question Paper :

Total No. of Questions : 38
1 Mark Questions 15 Nos. : 15 Marks
2 Marks Questions 6 Nos.. : 12 Marks
3 Marks Questions 6 Nos.. : 18 Marks
5 Marks Questions 5 Nos.. : 35 Marks
70 Marks

11th STD.

SURA'S MODEL QUESTION PAPER - I

For March 2019 Public Examination

CHEMISTRY

TIME ALLOWED : 2.30 HOURS MARKS : 70

PART - A

ANSWER ALL THE QUESTIONS: **(15 × 1 = 15)**

1. In the third period the first ionization potential is of the order.
   (a) Na > Al > Mg > Si > P
   (b) Na < Al < Mg < Si < P
   (c) Mg > Na > Si > P > Al
   (d) Na< Al < Mg < Si < P
2. The unit of pressure is _____
   (a) Pascal (b) Torr
   (c) Bar (d) all the above
3. Which one of the following binary liquid mixtures exhibits positive deviation from Raoults law ?
   a) Acetone + chloroform
   b) Water + nitric acid
   c) HCl + water
   d) Ethanol + water
4. Match the list I with List II and select the correct answer using. the code given below the lists.

List I		List II	
A	Diamond	**1**	Heterogeneous mixture
B	Aerated drinks	**2**	Element
C	Distilled water	**3**	Homogeneous mixture
D	Sand	**4**	Compound

	A	B	C	D
(a)	2	3	4	1
(b)	4	3	1	2
(c)	3	1	4	2
(d)	2	1	4	3

5. Compounds having boiling points widely apart 40k and above can be purified by ____.
   (a) Crystallisation (b) Sublimating
   (c) Fractional distillation (d) Simple distillation
6. Assertion : Generally alkali and alkaline earth metals form superoxides
   Reason : There is a single bond between O and O in superoxides.
   (a) both assertion and reason are true and reason is the correct explanation of assertion
   (b) both assertion and reason are true but reason is not the correct explanation of assertion
   (c) assertion is true but reason is false
   (d) both assertion and reason are false
7. In a chemical equilibrium, the rate constant for the forward reaction is 2.5×10^2 and the equilibrium constant is 50. The rate constant for the reverse reaction is,
   a) 11.5 b) 5 c) 2×10^2 d) 2×10^{-3}
8. Zeolite used to soften hardness of water is, hydrated
   (a) Sodium aluminium silicate
   (b) Calcium aluminium silicate
   (c) Zinc aluminium borate
   (d) Lithium aluminium hydride
9. **Statement :** Chloro acetic acid is more acidic than acetic acid
   Reason : Chloro group has +1 effect
   (a) Both Assertion, Reason are correct
   (b) Assertion is false, Reason is correct
   (c) Assertion is correct, Reason is false
   (d) Both Assertion and Reason are false
10. The temperature of the system, decreases in an _____
    (a) Isothermal expansion
    (b) Isothermal Compression
    (c) adiabatic expansion
    (d) adiabatic compression
11. Assertion : The spectrum of He^+ is expected to be similar to that of hydrogen
    Reason : He^+ is also one electron system.
    (a) If both assertion and reason are true and reason is the correct explanation of assertion.
    (b) If both assertion and reason are true but reason is not the correct explanation of assertion.
    (c) If assertion is true but reason is false
    (d) If both assertion and reason are false

HALF YEARLY EXAMINATION 2019 - 20

11th STD.

Register Number | | | | | | | |

PART - III
CHEMISTRY

Time allowed : 3.00 Hours | Maximum Marks: 70

Instructions: (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
(2) Use Blue or Black ink to write and underline and pencil to draw diagrams.

PART - I

Note: (1) Answer **all** the questions. **(15 × 1 = 15)**
(2) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

1. The empirical formula of glucose is :
(a) CH_2O (b) CHO
(c) CH_2O_2 (d) CH_3O_2

2. The effective nuclear charge decreases with increase in _____ quantum number.
(a) Principal (b) Azimuthal
(c) Magnetic (d) Spin

3. What would be the IUPAC name for an element with atomic Number 111?
(a) Ununnilium (b) Unununium
(c) Ununbium (d) Ununtrium

4. Water gas is
(a) $H_2O_{(g)}$ (b) $CO + H_2O$
(c) $CO + H_2$ (d) $CO + N_2$

5. Match the flame colours of the alkali and alkaline earth metal salts in the Bunsen Burner :

(p)	Sodium	1	Lilac
(q)	Calcium	2	Yellow
(r)	Barium	3	Brick red
(u)	Potassium	4	Apple green

(a) (p) - (2), (q) - (3), (r) - (4), (s) - (1)
(b) (p) - (3), (q) - (4), (r) - (1), (s) - (2)
(c) (p) - (4), (q) - (1), (r) - (2), (s) - (3)
(d) (p) - (1), (q) - (2), (r) - (3), (s) - (4)

6. Assertion : Critical temperature of CO_2 is 304K, it can be liquefied above 304K.
Reason : For a given mass of gas, volume is to directly proportional to pressure at constant temperature
(a) both assertion and reason are true and reason is the correct explanation of assertion
(b) both assertion and reason are true but reason is not the correct explanation of assertion
(c) assertion is true but reason is false
(d) both assertion and reason are false

7. A process in which the pressure of the system remains constants during its change from initial to final state is know as:
(a) Isochoric process (b) Isothermal process
(c) Cyclic process (d) Isobaric process

8. In a chemical equilibrium, the rate constant for the forward reaction is 2.5×10^2 and the equilibrium constant is 50. The rate constant for the reverse reaction is,
(a) 11.5 (b) 5 (c) 2×10^2 (d) 2×10^{-3}

9. Which one of the following is incorrect for ideal solution ?
(a) $\Delta H_{mix} = 0$ (b) $\Delta U_{mix} = 0$
(c) $\Delta P = P_{observed} - P_{Calculated\ by\ Raoult's\ law} = 0$
(d) $\Delta G_{mix} = 0$

10. Shape of ClF_3 is
(a) Planar triangular (b) Pyramidal
(c) 'T' Shaped (d) none of these

11. The simplest Ketone is :
(a) $CH_3 - CH_2 - CO - CH_3$
(b) $CH_3 - CO - CH_3$
(c) $CH_3 - O - CH_3$
(d) $CH_3 - COO - CH_3$