

Chemistry Recapture– 2025

Paper 01

Chemistry I



- This paper consists of **04** pages.
- Answer all the questions.
- Use of calculators is **not allowed**.
- Write your **Index Number** in the space provided in the answer sheet.

Index Number:

Universal gas constant $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$

Planck's constant $h = 6.626 \times 10^{-34} \text{ J s}$

Avogadro constant $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

Velocity of light $c = 3 \times 10^8 \text{ m s}^{-1}$

Structured Essay

1)

- A. You are provided with the following list of terms and scientists which were important in the field of Chemistry. Put them in the appropriate place.

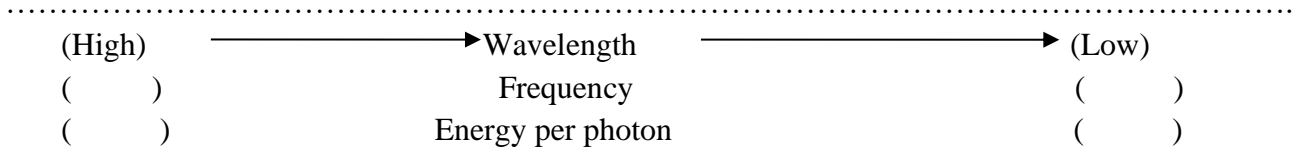
J. J. Thomson, John Dalton, Johannes Hans Wilhelm Geiger, Johnstone G. Stoney, Ernest Marsden, Ernest Rutherford, Sir James Chadwick, Robert Millikan, Cathode rays, α rays, Positive rays, β rays, γ rays

- The golf ball model formulated by
- named the fundamental unit carrying electricity as “electrons”.
- measured the charge of an electron by performing the oil drop experiment.
- Plum pudding model of atomic structure postulated by
- Gold foil experiment carried out by, and
- The neutron discovered by
- It was discovered that these particles, which were derived from various gasses, had precisely the same charge to mass ratio (e/m ratio) -
- The type of gas introduced into the discharge tube and the cathode material determine the characteristics/ nature of these rays. -
- These rays are not affected by an external electric or magnetic field -
- These rays consist of positively charged particles -

B.

- i. On the chart below, arrange the following regions of the electromagnetic spectrum in order of decreasing wavelength. Label the proper ends of frequency line and energy line using “High” and “Low”.

Infrared region, Ultraviolet region, Visible region, and X-ray.

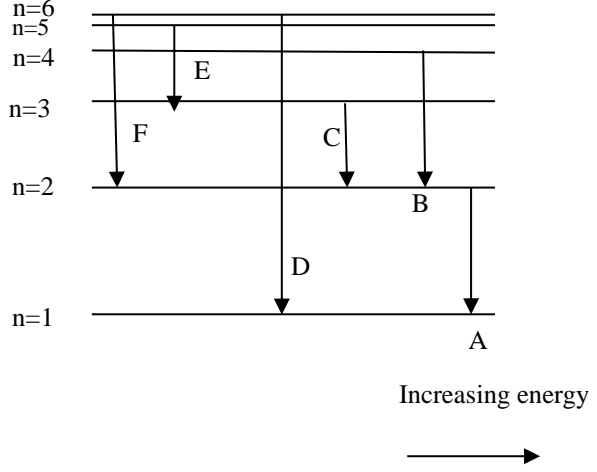


- ii. Typical values for the wavelengths of violet light and red light are 400.0 nm and 700.0 nm respectively. Using these wavelength values, complete the following table.

Color	Frequency	Energy	
		J / photon	kJ/ mol photons
Violet			
Red			

- iii. According to the Bohr model of the Hydrogen atom, the electron can be excited to only certain higher levels above the ground state (n=1). When the excited electron returns to the lower energy levels, it gives energy in the form of radiation. Decide where the electromagnetic spectrum each of the transitions shown at the right will be.

- a. UV spectrum -.....
- b. Visible spectrum-.....
- c. IR spectrum-.....



C. Arrange the following (I) – (V) in the ascending order of the property as given in questions.

I. Atomic radius S, F, Si, Cl

..... < < <

II. First ionization energy of B, C, O, F

..... < < <

III. Electronegativity of Al, Si, C, N

..... < < <

IV. Electron gain enthalpy of F, Cl, Br, I

..... < < <

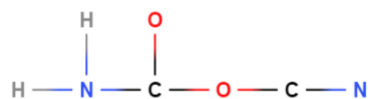
V. Ionic radius of K^+ , Ca^{2+} , S^{2-} , Cl^-

..... < < <

2)

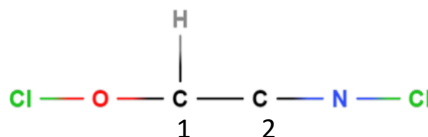
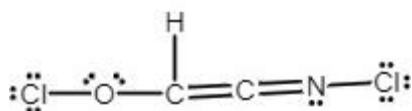
A.

i. Draw the **most acceptable** Lewis dot-dash structure for the skeleton given below.



ii. Draw the resonance structures for the above ion. Indicate the relative stability of the structures you have drawn by writing **stable** or **unstable** under these structures.

- iii. Complete the given table based on the Lewis dot-dash structure given below. The atoms in the skeleton are numbered as follow:



	C ₁	C ₂	N
VSEPR pairs around the atom			
Electron pair geometry around the atom			
Shape around the atom			
Hybridization of the atom			
Oxidation number of the atom			
Bond angle			

- iv. Identify the atomic/hybrid orbitals involved in the formation of σ bonds between the two atoms given below.

C ₁ -H	C ₁	H.....
C ₁ -O	C ₁	O.....
C ₁ -C ₂	C ₁	C ₂
C ₂ -N	C ₂	N.....
N-Cl	N.....	Cl.....

- v. Identify the atomic orbitals involved in the formation of Π bonds between the two atoms given below.

C ₁ -C ₂	C ₁	C ₂
C ₂ -N	C ₂	N.....

B. State whether the following statements are **true** or **false**.

- O₃ is a nonpolar gas.
- The first overlap of two p orbitals is always linear.
- All ionic compounds exist as lattices at room temperature.
- Dative covalent bonds are also formed when metal ions react with ions having lone pairs.

C. State the **main** intermolecular interactions between molecules in each pair shown below.

- I₂ / KI
- NaCl / H₂O
- CH₃CHO / CH₃COCH₃
- Br₂ / C₆H₆