**Progressive Education Society's**
**Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16**
**End Semester Examination: October 2024**
**Faculty: Science and Technology**

**Program: B.Sc.** **Semester: I** **SET: A**
**Program (Specific): Chemistry** **Course Type:**
**Class: T.Y.B.Sc** **Max.Marks: 35**
**Name of the Course: Physical Chemistry-I**
**Course Code: 24-CH-501** **Time: 2Hr**
**Paper: I**

**Instructions to the candidate:**

1) ***There are 4 sections in the question paper. Write each section on a separate page.***
2) ***All Sections are compulsory.***
3) ***Figures to the right indicate full marks.***
4) ***Draw a well labeled diagram wherever necessary.***

**SECTION: A**

**Q1) Multiple choice question** **5**

1. The refractive index is the_____
   a) sin r/sin i b) sin i/sin r c) sin i x sin r d) sin i + sin r
2. Which of the molecules is polar?
   a) Benzene b) Dichlorobenzene c) Nitrobenzene d) Methanes
3. Which of the following experimentally verifies the dual nature of matter?
   a) Interference of light b) diffraction of light at single slit c) diffraction of electrons
   d) Formation of the image in the mirror
4. The delayed fluorescence is called as _____
   a) Resonance fluorescence b) phosphorescence
   c) resonance luminescence d) quenching of fluorescence
5. When the light of wavelength $\lambda$ interacts with one mole of reactants, the energy absorbed $\Delta E$ is given by_____
   a) h$\nu$ b) Nh$\nu$ c) hc/$\lambda$ d) N$\lambda$/hc

**Q2) Very short answer questions (Attempt any 4/6)** **4**

1. Dual nature of light.
2. Dipole moment for angle determination.
3. Molar refraction.
4. Phosphorescence.
5. Beer's Law.
6. Black body radiation.

## SECTION: B

**Q3) Short answer questions (Attempt any 4/6)** **8**

1.What is induced polarization in nonpolar molecules?

2. Write the Schrodinger equation for 1D box with the diagram.

3. Why does the value of molar refraction change with the same value in a homologous series?

4. Define Quantum Yield.

5. What is the energy equation for calculating vibrational energy?

6. Write an example of a photolysis reaction.

## SECTION: C

**Q4) Short answer questions (Attempt any 4/6)** **8**

1. Write the uncertainty principle along with the equation.
2. What are Operators? Write the Hamiltonian operator.
3. Explain Induced polarization in non-polar molecules with diagram.
4. Explain the additive nature of Molar refraction.
5. Explain photosynthesis as a photochemical reaction.
6. Write the equation for quantum yield and explain it.

## SECTION: D

**Q5) Solve the following (Any two)** **10**

1. The rotational spectrum of HF has lines 41.9 $cm^{-1}$ apart. Calculate the moment of inertia and bond length in HF.
2. For an electron in 1 D box of length 1 $A^o$, calculate the separation between the two lowest energy levels(n=1 to n=2).
3. What is the Molar absorptivity for 0.05N of $K_2Cr_2O_7$, if the % transmittance of the solution is 60%, path length is 1 cm.