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## DEPARTMENT OF PHYSICS
## QUESTION BANK
Class: - F.Y.B.Sc. Phy.( II )

Physics Principles and Applications

By, Prof. V.R.Pande

## Chap. 1 Physics of Atoms

### Q.(A) Short Answer Question:

1. State postulates of Bohr's theory of hydrogen atom.
2. Give the equation of wavelength in Balmer series of hydrogen atom.
3. Explain: (¡) Balmer series and (¡¡) Paschen series.
4. What are advantages of Bohr's model?
5. What are drawbacks of Bohr's model?
6. Define induced absorption and metastable state.
7. Explain the term: spontaneous emission and stimulated emission.
8. What is population inversion in laser?
9. What is optical pumping?
10. Give application of laser in the field of medicine.
11. Give the characteristics of laser beam.

### Q. (B) long answers the questions:

1. State postulates on Bohrs theory. Obtain expressions for radius and velocity of the electron in an orbit of the hydrogen atom.
2. Deduce the expression for the allowed energies of the hydrogen atoms, giving assumptions made in the derivations
3. Explain laser action using four level energy systems.
4. What is optical pumping? Explain the three level pumping schemes.
5. Describe frank and hertz experiment in detail.

### Q.1(C) Problem

1. Find the wavelength of the spectral line corresponding to transitions in hydrogen atom from n=4 state to n=2 state
2. If the wavelength of first line of the Lymen series is 1215 A°, calculate the wavelength of the second line in Lymen series
3. Calculate the shortest wavelength for the Balmer series, given than $R=1.097\times10^7 m^{-1}$
4. The first line of Balmer series of hydrogen atom has a wavelength of $6563A^0$, calculate the wavelength of the second line of the Balmer series.
5. The series limits wavelength for Balmer series of hydrogen spectrum is $3645A^0$. calculate the values of Rydberg constant.
6. Find the wave number of second line of the Paschen series.
7. Find the liner velocity and angular velocity in the velocity in the first orbit of hydrogen atom. Given: Radius of first Bohr orbit Is $0.52A^0$)

8. Find the relations populations of two state in a ruby laser that produces a light beam of wavelength 6943A$^0$ at 300$^0$K(Given : Boltzmann constant K=8.61×10$^{-5}$eV/k).

## Chap. 2 Lasers and Applications
**Que.1 Short answer question :-**
1. What is population inversion in laser?
2. Define Stimulated emission?
3. What is metastable state ?
4. Give Three use of laser.
5. State any three properties of laser.
6. What is Spontaneous emission ?

**Que.2.long answer question**
1. Explain Three/ four level optical Pumping level scheme of laser.
2. What are the various uses of lasers.
3. Explain characteristics of laser.
4. Discuss with suitable Diagram working of ruby laser.
5. Discuss with suitable Diagram working of He-Ne laser.
6. Explain with suitable Diagram Absorption , Stimulated emission and Spontaneous emission.

**Que.3.Problem.**
1. Find the relative population of two States in Ruby laser that produces a light of wavelength 6943A$^0$ at 300$^0$K
2. The CO2 laser , the energy difference between two levels is 0.117eV Determine the frequency and wavelength of the radiation.
3. The He-Ne laser is capable of lasing at several different IR wavelength, one being 1.15micrometre. Determine the energy difference between upper and lower energy level.

## Chap-3: Physics of molecule

**Que.1 short answer question**
1. What are the criteria for the formation of covalent bond?
2. Define ionic bond. Give its example?
3. Give the principle cause of metallic bond?
4. What are the types of covalent bond?
5. What is hydrogen bond?
6. List the type of forces observed in metallic bond?
7. Give any two properties of covalent bond?
8. Explain polar covalent bond?
9. Explain the formation of a water molecule by shearing of electron?
10. Give the properties of ionic bond?

11. Give the example of molecules in which hydrogen bonds are formed?
12. Draw the diagram of covalent bonds in silicon semiconductor?

## Que.2 long answer Question

1. Explain variation of P.E as a function of a distance between the center of two atoms & hence define the term cohesive force?
2. Explain ionic bonding in NaCl & summaries the properties of ionic bond?
3. Explain concept of covalent bonding &summaries the properties of covalent bond?
4. Explain Van der wall's bonding in molecule with suitable example?
5. Explain hydrogen bonding &discuss the formation of hydrogen bonds in water?
6. What is meant by metallic bonding? Explain the properties of metallic crystal?
7. Explain rotational energy level of diatomic molecule. Draw the rotational energy level diagram?

## Que 3 Problem

1. In rotational energy level of CO molecule, $l = 0$ to $l = 1$ absorption in occurs at frequency $1.15 \times 10^{14}$ Hz. If the reduced mass of the CO molecule is $1.14 \times 10^{-26}$kg find the interatomic distance between C & O atoms
2. Find the frequency of the $L = 3$ to $L = 2$ emission line in the rotational energy level of the NO molecule whose moment of inertia is $1.65 \times 10^{-46}$kg-$m^2$
3. For CO molecule the spacing of vibrational energy is founds to be 0.269 eV . find the force constant K for the Interatomic force (reduced mass of CO is $1.139 \times 10^{-26}$kg)
4. The vibration frequency for a diatomic molecule HF is $1.24 \times 10^{14}$ HZ the mass of hydrogen atom and fluorine atom are $1.67 \times 10^{-26}$kg find i) force constant k for the interatomic forces, ii) the energizing ground state and first excited state.
5. The force constant of vibration in oxygen (O2) molecule is 1180 N/m the mass of an oxygen atom is $2.66 \times 10^{-26}$ kg. Find the energy separation between adjacent vibrational levels of molecule in electron joules and volt.
6. A lithium atom and hydrogen atom have masses $1.17 \times 10^{-26}$ kg and $1.67 \times 10^{-27}$ kg respectively. If the equilibrium separation between two nuclei in LiH molecule is $1.59 \times 10^{-10}$ find the rotational energy levels in $l = 1$ and $l = 3$ states.

## Chap-4: Electromagnetic Wave

## Que.1 Short answer question

1. What is electromagnetic radiation?
2. What do you mean by photon?
3. State plank's hypothesis?
4. What are radio waves?
5. What is the important of hertz experiment?
6. Explain in short principle of
     A) Microwave oven
     B) Solar cell

## Que.2.long answer question

1. Discuss historical perspective of electromagnetic radiation?
2. Discuss Hertz experiment in detail?
3. With diagram discuss the electromagnetic spectrum?
4. Discuss various sources of electromagnetic waves?

## Que.3.Problem

1. .A monogenic radiation beam is having a wavelength 0.5 micrometer. What is the single photon in eV.
2. .An oven uses 2.4 W of electric power. If the oven is plugged into 240 V outlet what electric current is the oven's circuit?$(P = VI)$
3. X-ray machine can operates continuously at a potential of 80 KV & a current of 3mA .what is the power into target?
4. .Calculate the energy of photon of yellow light with a frequency of $5.25 * 10^{-19}$. Give the energy in both joule & electron volt. 1 eV= $1.60 * 10^{-19}$J
5. A microwave radiation has a frequency of 12 gigahertz 1).What would be the energy of photon corresponding to this radiation?2) Calculate the wavelength of radiation (h=$6.626*10^{-34}$ & 1 gigahertz =$10^9$ Hz )

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