

C80034

(Pages : 3)

Name.....45.....

Reg. No.....

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH/APRIL 2015

(U.G.-CCSS)

Core Course—Physics

PH 6B 17—SOLID STATE PHYSICS, SPECTROSCOPY AND LASER PHYSICS

Time : Three Hours

Maximum : 30 Weightage

Section I

Answer all questions.

Each question carries $\frac{1}{4}$ weightage.

- Solids that have no periodic structure are called :
 - Amorphous.
 - Liquid crystals.
 - Simple cubic.
 - None of the above.
- An example of a hexagonal system is :
 - NaCl.
 - CuSO₄.
 - Quartz.
 - NiSO₄.
- Planes with equal intercepts on a and b axes and parallel to c axes are designated by :
 - [0 0 1].
 - [0 1 0].
 - [0 1 1].
 - [1 1 0].
- Bragg's reflection can occur only for wavelength :
 - $\lambda \leq 2d$.
 - $\lambda \geq 2d$.
 - $\lambda \geq \frac{d}{\sqrt{2}}$.
 - $\lambda \leq \frac{d}{\sqrt{2}}$.
- SQUIDS are used to detect :
 - Radiation from human body.
 - Small magnetic fields in a human brain.
 - Small electric fields in a human brain.
 - Heart beat.
- Molecular absorption takes place :
 - At a single frequency.
 - Over a spread of frequencies.
 - At a discrete energy level.
 - None of the above.

Turn over

7. When all the three principal moments of inertia of a molecule are equal, it is called ?
(a) Symmetric top. (b) Linear molecule.
(c) Spherical top. (d) Asymmetric top.
8. Raman lines are strongly _____.
9. The method of producing population inversion is called _____.
10. At the lowest vibrational level, the vibrational energy is :
(a) Continuous. (b) Infinity.
(c) Zero. (d) Non zero.
11. The three dimensional high speed photography method developed using lasers is called _____.
12. In Born oppenheimer approximation, we consider that a diatomic molecule can execute :
(a) Rotations alone.
(b) Vibrations alone.
(c) Rotations and Vibrations independently.
(d) None of the above.

(12 × ¼ = 3 weight)

Section II

Answer all questions.

Each question carries 1 weightage.

13. What is a unit cell ?
14. Explain Bravais lattice in two dimensions.
15. Copper has an fcc structure with lattice constant $a = 3.61 \text{ \AA}$. Calculate the radius of the copper atom.
16. What is a body centered cubic crystal ?
17. How can super conductivity be destroyed ?
18. What is centrifugal distortion ?
19. What is Raman resonance spectroscopy ?
20. Give the principle of working of a maser.
21. Why don't homonuclear diatomic molecules show vibrational spectra ?

(9 × 1 = 9 weight)

Section III

Answer any five questions.

Each question carries 2 weightage.

22. What is miller indices ? Explain the rules to find the miller indices of a plane.

23. What do you understand by space lattice ? Enumerate the crystal systems.
24. Distinguish between type I and type II superconductors.
25. The moment of inertia of the Co molecule is 1.46×10^{-46} kg-m². Calculate the energy in eV.
26. Explain the effect of anharmonicity on the vibrational spectra of diatomic molecules.
27. The lines in the pure rotational 341 Mu spectrum of HCl are spaced at 20.8×10^3 per metre. Calculate the moment of inertia and internuclear distance. Mass of chlorine = 58.5×10^{-27} kg and mass of proton = 1.67×10^{-27} kg.
28. What are Einstein's coefficients ? Give the relation between them.

(5 × 2 = 10 weightage)

Section IV

Answer any two questions.

Each question carries 4 weightage.

29. What is Raman effect ? Explain theoretically the observed characteristics of the Raman spectra of a diatomic molecule. Bring out the similarity in infra red and Raman spectra.
30. What is super conductivity ? Explain Meissner effect of superconductivity. Give two important applications of superconductivity. The critical temperature of a superconductor when no magnetic field is present is T_c . Find the temperature at which the critical field becomes half its value of OK.
31. Derive expressions for the energy and frequency of diatomic molecule. Show the vibrational energy levels graphically.

(2 × 4 = 8 weightage)