

C 40626

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Name.....

Reg. No.....

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2023

(CBCSS—UG)

Physics/Applied Physics

PHY 6B 11/APH 6B 11—STATISTICAL PHYSICS, SOLID STATE PHYSICS,
SPECTROSCOPY AND PHOTONICS

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in question paper have their usual meanings.***Section A (Short Answer Type)***Answer **all** questions in two **or** three sentences.**Each correct answer carries a maximum of 2 marks.*

1. Explain the terms macrostate and microstate in statistical analysis.
2. Plot the Maxwell molecular speed distribution. Give an expression for the root-mean square speed and explain the terms involved.
3. What do you mean by the co-ordination number of a lattice ? What is the co-ordination number of an fcc lattice ?
4. Draw the atomic positions in the cubic cell of diamond projected on a face.
5. Indicate a (111) direction in a cubic crystal.
6. Give the block diagram of a typical emission spectrometer.
7. Give an expression for the rotational energy levels of a rigid diatomic molecule and explain the terms involved.
8. Explain why the rotational changes about the symmetry axis of symmetric top molecules do not give rise to rotational spectrum.
9. What is Born-Oppenheimer approximation ?
10. Mention the physical meaning of the Einstein's co-efficients.
11. Explain Raman effect.
12. List the properties of laser beams.

(Ceiling 20)

Turn over

Section B (Paragraph/Problem Type)

Answer all questions in a paragraph of about half a page to one page.

Each correct answer carries a maximum of 5 marks.

13. A certain atom with total atomic spin $\frac{1}{2}$ has a magnetic moment μ . A collection of such atoms is placed in a magnetic field of strength B. What is the ratio, at room temperature T, of the number of atoms with their spins aligned along the field to those with their spins aligned opposite to the field ?
14. Explain the reason for a very low value of electronic heat capacity of metals at ordinary temperatures.
15. A monochromatic beam of X ray of $\lambda = 0.7\text{\AA}$ undergoes first order Bragg reflection from the plane (3 0 2) of a cubic crystal at a glancing angle of 35° . Determine the lattice constant .
16. Explain the various regions of the electromagnetic spectrum.
17. Using a suitable energy level diagram, indicate the transitions between the rotational-vibrational energy levels of a diatomic molecule (lowest two rotational levels only required). Show the corresponding spectrum.
18. Write short note on (a) Principle of laser ; and (b) Metastable state.
19. Discuss the construction, energy levels involved in lasing action and emission wavelengths of a He-Ne laser.

(Ceiling 30)

Section C (Essay Type)

Answer in about two pages, any one question.

Answer carries 10 marks.

20. Explain the Einstein theory of heat capacity. Give a typical plot of heat capacity versus temperature.
21. Explain the atomic arrangements in an hcp structure and obtain the corresponding packing fraction.

(1 × 10 = 10 marks)