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Reg. No.................................

Name...

B.Sc. DEGREE (CBCSS) EXAMINATION, MAY 2015

Second Semester

ELECTRIC AND MAGNETIC PHENOMENA, THERMODYNAMICS AND SOLID STATE PHYSICS

(Complementary Physics for B.Sc. Chemistry, B.Sc. Geology and B.Sc. Chemistry and Water Management)

[2013 Admission onwards]

Time : Three Hours

Maximum : 60 Marks

Candidates can use non-programmable scientific calculators.

Part A (Very Short Answer Questions)
Answer all questions briefly.
Each question carries 1 mark.

1. Write the relation between dielectric constant and susceptibility. Explain the symbols.

2. Compare diamagnetism and paramagnetism.

3. What is meant by polarization catastrophe?

4. Define crystal lattice, basis and crystal structure.

5. What do you understand by packing density or packing factor?

6. What are Miller indices? How are they determined?

7. Can we design a heat engine with 100% efficiency? Explain.

8. What is the concept of entropy and disorder?

$(8 \times 1 = 8)$

Part B (Brief Answer Questions)
Answer any six questions.
Each question carries 2 marks.

9. Give the mathematical form of Gauss's law in dielectrics and explain its concept.

10. Explain the different sources of polarizability in dielectrics. How it is exploited?

11. Discuss the temperature dependance of magnetic susceptibility in diamagnetic, paramagnetic and ferromagnetic materials.

12. Explain Hysteresis. Explain any *two* practical applications of the same.

13. What is co-ordination number? Calculate the co-ordination number for simple cubic, *bcc* and *fcc* lattices.

14. What are Bravais lattices and Miller indices in crystallographic notations? Show analytically that the (1 1 1) planes are perpendicular to (1 1 1) direction in a simple cubic crystal.

Turn over

15. For *bcc* lattice, find the number of nearest neighbours, the nearest neighbours' distance and the spacing of (110) planes.

16. What are the different operations involved in a Carnot cycle? What is air standard efficiency? Calculate the same of a Carnot engine.

17. Explain the First and Second laws of thermodynamics. Which leads to internal energy? Explain.

18. In a closed system maintained under adiabatic conditions, entropy increases because of a certain process. Can this process be reversed? Why?

$(6 \times 2 = 12)$

Part C (Problems/Derivations/Short Essays)

Answer any four questions.

Each question carries 4 marks.

19. Calculate the capacitance of a parallel-plate capacitance consisting of two plates of 300 cm^2 and 1.4 mm apart in (i) air ; and (ii) with a mica of relative permittivity 6.

20. A solenoid 20.5 cm long is wound on transformer and has an internal diameter of 10 cm. It is wound to a depth of 2.5 cm with 2500 turns of wire and carries a current of 1 amphere. Find the flux at the centre of the solenoid?

21. If the density of NaCl is 2.163 g/cm^2 and its molecular weight is 58.45, find the spacing between planes parallel to the cubic lattice faces of NaCl crystal. Given Avogadro number is 6.02×10^{23} molecules/g-mole.

22. In a single cubic crystal, find the ratio of (i) Spacing of the (110) and (111) planes ; and (ii) the nearest neighbour distance to the next nearest neighbour distance.

23. 2.5 kg of a gas expands isothermally to 5 times its original volume. If the initial pressure is 15 kg/cm^2 and temperature 500° C. Calculate (a) the original volume ; (b) the final pressure ; and (c) the change in entropy. R = 29.27 mkgf/kg/K.

24. A Carnot engine working as a refrigerator between 260 K and 300 K receives 500 calories of heat from the reservoir at the lower temperature. Calculate the amount of heat required to the reservoir at the higher temperature. Calculate also the amount of work done.

$(4 \times 4 = 16)$

Part D (Long Answer/Essay Questions)

Answer any two questions in detail.

Each question carries 12 marks.

25. What is ferromagnetism? Discuss the magnetic hysteresis curve in ferromagnets. Also discuss the terms retentivity, coercivity using the hysteresis curve.

26. Explain paramagnetism and diamagnetism. Give an account of Langevin's theory of both.

27. What do you understand by space lattice? Describe the seven systems of crystals with neat labelled sketches. Mention and explain with examples the types of lattices in cubic system.

28. Distinguish between isothermal and adiabatic expansion. Derive expressions for the work done by an ideal gas during (a) an isothermal expansion ; and (b) an adiabatic expansion.

$(2 \times 12 = 24)$