

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MAY 2013**Second Semester**

Complementary Course – ELECTRIC AND MAGNETIC PHENOMENA THERMODYNAMICS AND
ELEMENTARY SOLID STATE PHYSICS

(For the programme B.Sc. Chemistry, B.Sc. Geology and B.Sc. Chemistry and Water Management)

Time : Three Hours

Maximum Weight : 25

Part A (Objective Type Questions)

Answer all questions.

Weight 1 for each bunch of four questions.

BUNCH I

1. X-rays can be diffracted from the crystals due to :
(a) Random arrangement of atoms. (b) Regular arrangement of atoms.
(c) Colour of crystals. (d) None of these.
2. A reversible heat engine can be 100% efficiency, if the temperature of the sink is :
(a) Less than that of source. (b) Equal to that of source.
(c) 0°C . (d) 0°K .
3. The dielectric constant of water is 80. Its permittivity is :
(a) 80. (b) $80/E_0$.
(c) $80 E_0$. (d) $E_0/80$.
4. The substance having relative permeability less than one is :
(a) Ferromagnetic. (b) Diamagnetic.
(c) Non-magnetic. (d) Paramagnetic.

BUNCH II

- II. 5. Na crystal exhibits :
(a) SC. (b) bec.
(c) fcc. (d) bcp.
6. The gas equation $PV^{\gamma} = \text{a constant}$ is true for :
(a) Isothermal process.
(b) Adiabatic process.
(c) Both isothermal and adiabatic process.
(d) None of these.

Turn over

7. The dielectric constant of a metal is :

- (a) Zero.
- (b) 1.
- (c) Infinity.
- (d) None of these.

8. A magnetic dipole is placed in a non-uniform magnetic field. The dipole experiences :

- (a) Torque only.
- (b) Force only.
- (c) Both force and torque.
- (d) None of these.

BUNCH III

9. X-rays can be deflected by :

- (a) Magnetic field.
- (b) Electric field.
- (c) Electric charges.
- (d) None of these.

10. The entropy of a system in a reversible process :

- (a) Increases.
- (b) Decreases.
- (c) Remains constant.
- (d) None of these.

11. Which is non-polar dielectric?

- (a) Water.
- (b) Ammonia.
- (c) Glass.
- (d) Benzene.

12. Antiferromagnetism is observed in :

- (a) Ni.
- (b) $MnAs$.
- (c) MnO .
- (d) Na.

BUNCH IV

13. In Bhagg's law $2d \sin \theta = n\lambda$ where θ is the angle of :

- (a) Incidence.
- (b) Reflection.
- (c) Glancing.
- (d) None of these.

14. Entropy is maximum in which state :

- (a) Solid.
- (b) Liquid.
- (c) Gas.
- (d) None of these.

15. The paramagnetic property of a material is due to (Classical idea) :

- (a) The change in orbit motion.
- (b) Unpaired spin motions.
- (c) Both (a) and (b).
- (d) None of these.

16. When all the space is filled with a homogeneous linear dielectric the electric field is :

- (a) Reduced by a factor of K . (b) Reduced by a factor of $1/K$.
(c) Increased by a factor of K . (d) Increased by a factor of $1/K$.

(4 × 1 = 4)

Part B (Short Answer Questions)

Answer any five questions.

Weight 1 each.

17. State Gauss's law in dielectrics.
18. Distinguish between Paramagnetism and Ferromagnetism.
19. What is hysteresis?
20. How does a crystal differ from a lattice?
21. What is a cubical crystal system? What are its Bravis Lattices?
22. What are polar and non-polar molecules? Give example.
23. State Zeroth law of thermodynamics.
24. How internal energy of ideal gas differ from a real gas?

(5 × 1 = 5)

Part C (Short Essay/Problems)

Answer any four questions.

Weight 2 each.

25. Calculate the distance between two atoms of a basis of the diamond structure, if the lattice constant of the structure is 5 Å.
26. The initial temperature of a gas is 27° C. Calculate the rise in temperature when the gas is compressed suddenly to 8 times its original volume ($\gamma = 1.5$)
27. An inventor claims to have developed an engine working between 600 K and 300 K capable of having an efficiency of 52%. Comment on his claim.
28. A parallel plate capacitor with air as medium has capacity C . A slab of dielectric constant K and having the same thickness as the separation between the plates is inserted parallel between the plates. Find the new capacitance?
29. Given an iron cylinder of diameter 0.20 cm and length 30 cm is kept parallel to a magnetic field intensity 4800 A/m, then the cylinder acquires a pole strength of 9 Am. Find permeability and the susceptibility of the material of the rod?
28. State and derive Braggs's law.

(4 × 2 = 8)

Turn over

Part D (Essay)*Answer any two questions.**Weight 4 each.*

31. Discuss the carnot cycle with a neat RV diagram. Obtain an expression for the work done in a carnot cycle.
32. Derive Maxwell's thermodynamic relations.
33. What is atomic factor? Evaluate atomic packing factors of simple cubic structure and body centered cubic structure.

 $(2 \times 4 = 8)$