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Reg. No. :

Code No. : 20042 E Sub. Code : AMPH 63

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2025.

Sixth Semester

Physics – Core

SOLID STATE PHYSICS

(For those who joined in July 2020 only)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. If the atomic radius of aluminium (FCC) is r , what is the unit cell volume?

- (a) $(2r/\sqrt{2})^3$ (b) $(4r/\sqrt{2})^3$
(c) $(2r/\sqrt{3})^3$ (d) $(4r/\sqrt{3})^3$

2. Co-ordination number for an ideal BCC metallic crystal is _____.

- (a) 8
(b) 6
(c) 12
(d) Varies for different metal

3. Madelung's constant for NaCl is _____.

- (a) 2.487 (b) 1.748
(c) 4.872 (d) 3.872

4. The energy required to separate 1 mole of sodium chloride into gaseous Na^+ and Cl^- ions is _____.

- (a) 226 KJ (b) 386 KJ
(c) 686 KJ (d) 786 KJ

5. Dielectric materials do not have _____.

- (a) Proton (b) Neutron
(c) Bound charge (d) Free electrons

6. In which of the following the magnetic moments align themselves parallel to each other?

- (a) Paramagnetic material
(b) Ferromagnetic material
(c) Ferrimagnetic material
(d) Diamagnetic material

7. In superconductivity, the electrical resistance of the material becomes _____.

- (a) Finite (b) Infinite
(c) Zero (d) All the above

8. The cooper pair is _____.

- (a) two electrons moving in the same direction
(b) two electrons with resultant spin zero
(c) two electrons connected like a boson
(d) two electrons connected through a phonon

9. Graphene is a _____.

- (a) Honeycomb sheet of carbon atoms
(b) Nanoscale cube of random atoms
(c) Invisible plastic membrane
(d) Graphite in a 6B pencil

10. A fullerene is any molecule composed entirely of the carbon not in the form of hollow _____.

- (a) Sphere (b) Tube
(c) Ellipsoid (d) Cuboid

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PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Derive Bragg's law of diffraction.

Or

(b) Explain the seven classes of crystals.

12. (a) Deduce the energy of NaCl molecule.

Or

(b) Explain the variation of interatomic force with inter atomic spacing.

13. (a) Explain antiferromagnetism with example.

Or

(b) Derive the expression for electronic and ionic polarization.

14. (a) Describe Meissner effect and persistent current in a superconductor.

Or

(b) Write the applications of AC and DC Josephson effect.

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15. (a) Write the properties and application of carbon nano tubes.

Or

- (b) Explain the synthesis of nanoparticles by electro deposition method.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 600 words.

16. (a) Describe the characteristics of hexagonal close packed structure.

Or

- (b) Define miller indices. Write the procedure for finding miller indices with example.

17. (a) Define cohesive energy. Find the cohesive energy of ionic solids and apply it to NaCl.

Or

- (b) Explain the different types of bond in crystals.

18. (a) Define internal field and hence derive Clausius Mossotti relation.

Or

- (b) Explain Langevin's theory of para magnetism.

19. (a) Derive London equations in superconductors.

Or

- (b) Explain high temperature super conductors.

20. (a) Explain the ball milling method of preparing nano particles.

Or

- (b) Describe chemical vapour deposition method of preparation of nano partocles.