

SARDAR PATEL UNIVERSITY

4th Semester B. ScMonday, 11th April 2016

Time: 10:30 AM TO 01:30 PM

Subject Code: US04CPHY02 (PHYSICS)

Course Title: Solid State Physics

C34]

Max Marks: 70

[10]

Que 1

Write correct answer for each of the following MCQs.

- 1 The number of atoms per cell of bcc structure is _____.
 - a) 1
 - b) 6
 - c) 4
 - d) 2
- 2 The regular periodic arrangement of atom/molecule in space is known as _____.
 - a) Crystal
 - b) Basis
 - c) Lattice
 - d) Unit cell
- 3 The relation of angles between axes of tetragonal crystal system is _____.
 - a) $\alpha \neq \beta \neq \gamma \neq 90^\circ$
 - b) $\alpha = \beta = \gamma = 90^\circ$
 - c) $\alpha \neq \beta = \gamma = 90^\circ$
 - d) $\alpha = \beta = \gamma \neq 90^\circ$
- 4 The potential energy of the molecule at the equilibrium spacing between two atoms is _____.
 - a) minimum
 - b) unity
 - c) zero
 - d) infinite
- 5 The _____ element is covalently bonded material.
 - a) copper
 - b) gold
 - c) silicon
 - d) silver
- 6 Energy of phonon is _____.
 - a) h^2v^2
 - b) h^2f
 - c) λf
 - d) $h\nu$
- 7 At higher temperature Debye law of specific heat is reduced to _____ law.
 - a) Dulong-Petit's
 - b) Maxwell's
 - c) Newton's
 - d) Faraday's
- 8 In Einstein model of specific heat of solids he assumed that all atoms of a solid vibrate independently with _____ frequency.
 - a) 0
 - b) constant
 - c) variable
 - d) infinite
- 9 Full form of PVC is _____.
 - a) poly vinyl chloride
 - b) poly vanadium chloride
 - c) poly vinyl carbon
 - d) poly vinyl chromel
- 10 Hydrocarbons with double and triple covalent bonds are termed as _____.
 - a) saturated
 - b) non reactive
 - c) unsaturated
 - d) mono saturated

- Que 2 Write answers of any ten questions in brief. [20]
- 1 Define the terms: Lattice and Basis.
 - 2 What is the closest packed structure?
 - 3 With proper notations, Show the (111) and (100) Planes in the unit cell.
 - 4 What is Madelung constant? Give its value for NaCl structure.
 - 5 Distinguish between primary bonds and secondary bonds.
 - 6 State any two properties of ionic crystal.
 - 7 Write a note on specific heat of solids .
 - 8 Discuss briefly failure of Dulong-Petit's law .
 - 9 Write down assumptions made in deriving expression for thermal conductivity due to electrons.
 - 10 Define relaxation modulus $E_r(t)$ and time dependent creep modulus $E_c(t)$.
 - 11 Explain briefly thermoplastic and thermosetting polymers.
 - 12 Define number average molecular weight and weight average molecular weight. Give their formulae.

- Que 3 [A] What is crystal plane? Write the procedure to determine the Miller indices of a plane with appropriate example. [06]
- [B] Explain the various crystal systems in detail with suitable diagrams. [04]

OR

- Que 3 [C] What are symmetry and symmetry operations? Explain various symmetry operations in detail. [06]
- [D] Define APF. Also prove that the APF for fcc structure is 0.74. [04]
- Que 4 [A] The force between two atoms is given by $F(r) = \frac{A}{r^M} - \frac{B}{r^N}$. Derive the expressions for potential energy and cohesive energy. [06]
- [B] Discuss covalent bond and state its properties. [04]

OR

- Que 4 [C] For the NaCl structure, obtain (i) Madelung constant and (ii) an expression for cohesive energy. [06]
- [D] Explain the Born-Haber cycle for NaCl molecule. [04]

2 | 3

Que 5

Obtain Einstein's formula of specific heat of solids as;

[10]

$$C_v = 3Nk \left(\frac{h\nu}{kT} \right)^2 \cdot \frac{e^{\frac{h\nu}{kT}}}{\left(e^{\frac{h\nu}{kT}} - 1 \right)^2}$$

also show that at higher temperature above expression is reduces to $C_v = 3R$

OR

Que 5

Write down scattering mechanisms responsible for thermal resistance of solids and discuss phonon-phonon interaction including normal (N) process and umklapp (U) process. What is the effect of scattering of phonons by boundary of a specimen or grains on the thermal conductivity of solids?

[10]

Que 6

[A] Briefly explain linear polymer, branched polymer, cross linked polymer and network polymer? Also define copolymer and random copolymer.

[06]

[B] Define following terms: (i) Impact Strength (ii) Fatigue (iii) Tear Strength (iv) Hardness

[04]

OR

Que 6 [C] Discuss stress-strain diagram for brittle, plastic and elastic type of polymers.

[06]

[D] Discuss briefly viscoelastic deformation of polymer with proper strain versus time diagrams.

[04]

=====**Best of Luck**=====

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