

Roll No.

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**C.B.S. (Eighth Semester)
EXAMINATION, May - June, 2022
CHEMISTRY OF MATERIALS**

(C-801)

Time : Three Hours]

[Maximum Marks:40

(Section-A)

(½ mark each)

(Multiple Choice Questions)

Note: Attempt all question:

1. What is the maximum proportion of volume available in FCC arrangement of spheres?
(A) 10%
(B) 20%
(C) 26%
(D) 30%

P.T.O.

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2. The number of atoms per unit area of the plane [0 1 0] of a simple cubic crystal is :

(A) $4r^2$

(B) $4r$

(C) $\frac{1}{4r^2}$

(D) $\frac{1}{4r}$

3. The primitive translation vectors of the fcc lattice are :

$$\hat{a}_1 = \frac{a}{2}(\hat{i} + \hat{j}); \hat{a}_2 = \frac{a}{2}(\hat{i} + \hat{k}); \hat{a}_3 = \frac{a}{2}(\hat{i} + \hat{j})$$

The volume of the primitive cell of reciprocal lattice is :

(A) $4\left(\frac{\pi}{a}\right)^3$

(B) $4\left(\frac{3\pi}{a}\right)^3$

(C) $4\left(\frac{\pi}{2a}\right)^3$

(D) $4\left(\frac{2\pi}{a}\right)^3$

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4. When a cation leaves its normal position in the crystal and moves to some interstitial space, the defect in the crystal is known as :
- (A) Non-stoichiometric defect
 - (B) Schottky defect
 - (C) Stoichiometric defect
 - (D) Frenkel defect
5. As per band theory the forbidden gap of semiconductor is-
- (A) $> 5.0\text{eV}$
 - (B) $\geq 5.0\text{eV}$
 - (C) $< 3.0\text{eV}$
 - (D) $\geq 3.0\text{eV}$
6. n-type of semiconductors are formed by the doping of-
- (A) P
 - (B) As
 - (C) Both (A) and (B)
 - (D) None of the above

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7. In the Hall Effect, the electric field is in x direction and the velocity is in y direction. What is the direction of the magnetic field?
- (A) X
 - (B) Y
 - (C) Z
 - (D) None of the above
8. Type-II superconductors are :
- (A) Lu, NbTi
 - (B) V_3Si , PbMoS
 - (C) Zr, Cd
 - (D) None of the above
9. Above the temperature, in which antiferromagnetic materials become paramagnetic
- (A) Curie temperature
 - (B) Neel temperature
 - (C) Triple point
 - (D) None

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10. Which of the following mechanical properties is/are important in structural applications of metals?
- (A) Tensile strength
 - (B) Yield strength
 - (C) Ductility and Elasticity
 - (D) Tensile strength, Yield strength, Ductility and Fracture toughness
11. Which of the following optical properties cannot be measured by spectrophotometer?
- (A) Gloss
 - (B) Haze
 - (C) Optical distortion
 - (D) Yellowness Index
12. Which of the following tests is used to measure tensile strength of plastics?
- (A) Blocking
 - (B) WVTR
 - (C) Creep Test
 - (D) OTR

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13. What is the aim of thin film deposition?
- (A) To maintain surface uniformity
 - (B) To reduce the amount of light absorbing materials
 - (C) To decrease the weight and bulkiness of the materials
 - (D) All of these
14. Which of these techniques require an external current source for the deposition of metallic ions on the substrate?
- (A) Electroless plating
 - (B) Chemical bath deposition
 - (C) Electroplating
 - (D) Dip coating
15. Size of crystals in nanocrystalline materials is:
- (A) 1-100 nm
 - (B) 10-1000 nm
 - (C) > 1000 nm
 - (D) $1-10^0 \text{ \AA}$

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16. Thin-film photovoltaic cell (TFPV) is :
- (A) First generation solar cell
 - (B) Second generation solar cell
 - (C) Third generation solar cell
 - (D) None of the above
17. Which of the following is an example of liquid crystals
- (A) Sodium benzoate
 - (B) Silver oxide
 - (C) Benzene
 - (D) Potassium chloride
18. Which of the following statement about allotropes of carbon is incorrect?
- (A) Diamond is more dense than graphite
 - (B) Diamond is metastable
 - (C) Graphite is an electrical conductor but the conductivity is direction dependent
 - (D) Fullerenes and amorphous carbon are molecular solids

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19. Superconductors are derived from the compounds of
- (A) p-block elements
 - (B) Lanthanides
 - (C) Transition elements Actinides
 - (D) Transition elements
20. Pitch is measured in case of liquid crystals.
- (A) Smectic
 - (B) Nematic
 - (C) Cholesteric
 - (D) Polymer dispersed

(Section-B)

(0.75 mark each)

(Very Short Answer Type Questions)

Note: Attempt all question:

1. A crystal plane cuts intercepts of $a/2$, and $3c/2$ along x, y, z directions, directions. Determine the Miller indices of the plane.

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2. How many point groups in 2D and 3D structure?
3. What are type-I superconductors?
4. What do you mean by superconductors?
5. Explain n-type semiconductors.
6. What are color centers in solids?
7. What are the raw materials for production of iron and steel?
8. How many types of deposition schemes commonly used to transfer Langmuir film onto solid substrate to form Langmuir-Blodgett (LB) film? Write their name.
9. What are rectifiers?
10. Which type of materials is used for Grease resistance technique?

(Section-C)

(1.25 mark each)

(Short Answer Type Questions)

Note: Attempt all question:

1. What do you mean by Primitive cell and non-primitive cell? What do you mean by Bravais lattice?

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2. Write about normal and inverse spinels with example.
3. Differentiate the intrinsic and extrinsic semiconductors.
4. Describe the Meissner effect.
5. Write a note on hysteresis.
6. Explain Raman scattering in crystals.
7. Write about killed, semi-killed and rimmed steel.
8. What is zone melting?
9. Write about capacitors.
10. How can doped fullerenes act as superconductors? Explain.

(Section-D)

(2 marks each)

(Long Answer Type Questions)

Note: Attempt all question:

1. What do you mean by reciprocal lattice? What do you mean by primitive vectors in direct space lattice and reciprocal lattice? Write down the expression for lattice translational vectors in real space and reciprocal space?

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OR

Prove the volume of a Bravais lattice primitive cell is $V = [a^1 \cdot (a^2 \times a^3)]$ where the a_i are three primitive vectors. And the volume of the primitive cell of the reciprocal cell is $(2\pi)^3 / V$

2. Describe the hall effect with its application.

OR

Describe the basic concepts of BCS theory.

3. Write about preparation and characterization of high T_c materials.

OR

Write a note on classification of magnetic materials.

4. What are nanocrystalline materials? Give their preparation procedure and applications.

OR

Explain about Langmuir-Blodgett Film.

5. What are liquid crystals? Write about its structure, chemical composition and optical properties.

[12]

OR

Write about nonlinear optical materials. Give their applications.