Progressive Education Society's
Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-411016
(Autonomous)

B.Sc. Blended Program

(A degree of Savitribai Phule Pune University equivalent to the degree of University of Melbourne)

End Semester Examination : April 2025

Program: B.Sc. Blended **Semester:VI** **SET: A**

Program (Specific): B.Sc.Blended(Chemistry) **Course Type: Core Course Theory**
Class: T.Y.B.Sc.Blended **Max.Marks: 50**
Name of the Course: Solid state Chemistry and its Applications
Course Code: CHM601 **Credit: 3** **Time: 2½ hrs**
Paper: I

Note:

1) All questions are compulsory.
2) Figures to the right corner indicate full marks
3) Use of scientific calculators is allowed.
4) Draw diagrams wherever necessary.
5) Use only Black or blue ink/ball/gel pens for writing.

Q1] Select the correct option (Any 10). **[10 x 1M =10 M]**

1) What is SEM?
   a. Standard Electron Magnetism
   b. Standard Enlarge Magnification
   c. Scanning Electron Microscope
   d. Scanning Enlarge Microscope

2) The top to bottom approach is —------.

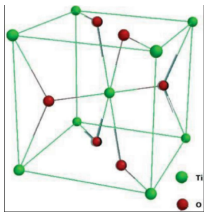
   a. Atoms → Clusters ← Nanoparticles ← Powder ← Bulk
   b. Atoms ← Clusters ← Nanoparticles ← Powder ← Bulk
   c. Atoms → Clusters → Nanoparticles → Powder → Bulk
   d. Atoms ← Clusters → Nanoparticles → Powder ← Bulk

3) The atom at its position is misplaced in —--- defect.
   a. Frankel
   b. Schottky
   c. impurity
   d. extrinsic

4) In Bragg's equation $n\lambda = 2d \sin \Theta$; the incident wavelength is represented by ——-.

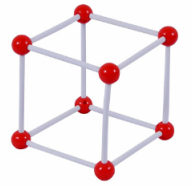
a. n
b. d
c. Θ
d. λ

5) What is the type of the following crystal system?



a. FCC
b. BCC
c. rutile
d. wurtzite

6) How many atoms are there in the given unit cell of the crystal?



a. 1
b. 2
c. 4
d. 8

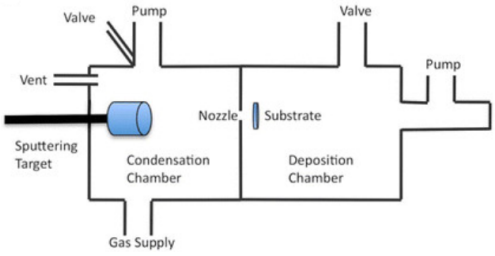
7) The semiconductor with some impurity are ——-----semiconductors.

a. intrinsic
b. extrinsic
c. super
d. non reactive

8) Semiconductor nanoparticles are known as ——---.

a. quantum dots
b. non metallic
c. non ductile
d. transparent

9) Identify the method of nanoparticle synthesis.



a. Inert gas condensation
b. Ball mill
c. Laser pyrolysis
d. Electric discharge

10) Which among the following is not used to analyze nanoparticles?
   a. SEM
   b. TEM
   c. EDAX
   d. polarimetry

11) Noble metals show strong—-------.
   a. insulation
   b. plasmonic resonance
   c. light
   d. heat

12) The bulk materials are fast and high in —------ .
   a. absorption and adsorption
   b. Transmittance
   c. speed
   d. liquid Materials

Q2] Answer in brief. (Any 10) **[10 x 2M = 20 M]**

1) Compare the structures of C60 and C240. Show that they are fullerenes.
2) Draw schematic diagram of Transmission Electron microscopy.
3) Compare the rutile and wurtzite crystal types.
4) What are perovskites? Discuss its applications.
5) Write a note on non stoichiometric compounds.
6) What are semiconductor nanoparticles? Name its applications.
7) How are nanoparticles analyzed using scanning microscopy?
8) Explain the electrochemical method of synthesis of nanoparticles.
9) Discuss the application of nanoparticles in environmental studies.
10) Discuss how the optical property of nanoparticles changes with size.
11) Discuss the use of carbon nanotubes as a smoke sensor.
12) What are biosensors? Explain its functioning.

Q3] Solve the following.

a) Identify the crystal structure from the following data for NaCl crystal. [10M]
Use graph paper for plotting the necessary graph.

2 theta	27.36	31.69	45.43	53.85	56.45	66.20	73.04

Given: Wavelength = 1.54 A^{o}
Molecular weight of NaCl(m) = 58.44 amu ; Avogadro number (N) = 6.022 x 10^{23} mol^{-1}
Write the results in the following format

Sr no	Details	Results
1	Crystal type	
2	Lattice constant	
3	Number of Molecules per unit cell	
4	Density of the crystal	

b) Solve the following (Any 2). [2 x 5M = 10M]

1) Discuss the band theory of solids in detail.

2) Discuss the synthesis of nanoparticles by chemical method.

3) What is the Born Haber cycle? Construct Born Haber Cycle from the following reactions.

$$Mg_{(s)} + Cl_{2(g)} \rightarrow MgCl_{2(s)}$$
$$Mg_{(s)} \rightarrow Mg_{(g)}$$
$$\tfrac{1}{2} Cl_{2(g)} \rightarrow 2Cl_{(g)}$$
$$Mg_{(g)} \rightarrow Mg^{+}_{(g)} + e^{-}$$
$$Mg^{+}_{(g)} \rightarrow Mg^{2+}_{(g)} + e^{-}$$
$$Cl + e^{-} \rightarrow Cl^{-}$$
$$Mg^{2+}(g) + 2Cl^{-}_{(g)} \rightarrow MgCl_{2(s)}$$

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