



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA
SECOND SEMESTER EXAMINATIONS, MAY 2019

COURSE NO: MC/RN 168 EL 270

COURSE NAME: Basic Material Science

CLASS: MC/RN I

TIME: 2 hours

Name: _____ Index Number: _____

SECTION A (20 marks)

Answer all questions in this section on the objectives sheet in the first hour

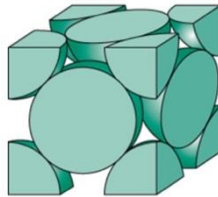
1. The tiny block formed by the arrangement of small group of atoms is called
 - a. Unit cell
 - b. Crystal
 - c. Space lattice
 - d. Atomic packing factor
2. According to Bravais there are _____ possible types of space lattices in the seven basic crystal systems
 - a. 7
 - b. 14
 - c. 20
 - d. 24
3. The coordination number of simple centered cubic structure is
 - a. two
 - b. six
 - c. four
 - d. eight
4. The coordination number of face centered cubic structure is
 - a. four
 - b. eight
 - c. six
 - d. twelve
5. Atomic packing factor of a simple cube is approximately
 - a. 0.4
 - b. 0.42
 - c. 0.52
 - d. 0.8
6. the total number of atoms in a face centred cube is

14. The structure of common glass is
- a. Amorphous
 - b. Fully Crystalline
 - c. Partially Crystalline
 - d. None of the above
15. A polymer which once produced cannot be softened and worked at elevated temperatures which chemical or structural decomposition is known as
- a. Copolymer
 - b. Condensation polymer
 - c. Thermosetting polymer
 - d. Thermoplastic polymer
16. Stainless steels owe their resistance to corrosion to the presence of
- a. Chromium
 - b. Manganese
 - c. Carbon
 - d. Sulphur
17. Developing new materials by moving atoms and molecules to form new structures at the atomic level is termed as the _____ in material development
- a. Bottom-up approach
 - b. Top-down approach
 - c. General approach
 - d. Methodical approach
18. Materials that can sense changes in their environment and respond to these changes in predetermined manner-traits that are found in living organisms/bodies are termed
- a. Nanomaterials
 - b. Smart materials
 - c. Biomaterials
 - d. Metals
19. These are materials used as replacements for diseased or damaged body parts
- a. Nano materials
 - b. Smart Materials
 - c. Biomaterials
 - d. Composite materials
20. Which crystal system has equal axial lengths and angles
- a. Tetragonal
 - b. Hexagonal
 - c. Cubic
 - d. Monoclinic

SECTION B (40 marks)

Answer two questions (Question 1 is compulsory)

1. a) Define the following terms **(4 marks)**
- | | |
|--------------|---------------------------|
| i. Unit cell | iii. Coordination number |
| ii. Lattice | iv. Atomic packing factor |
- b) Distinguish between primary and secondary bonding in materials **(6 marks)**
- c) Explain closet packing in crystalline solids. **(4 marks)**
- d) Explain point defects in ionic crystals **(6 marks)**
- e) For the unit cell below show that the packing factor is 0.74. Where the cubic edge length is a and the radius of the sphere is r . **(6 marks)**



2. a) List the conditions required for substitutional solid solutions to form **(4 marks)**
- b) Distinguish between self and impurity diffusion **(6 marks)**
- c) What are the differences between steady and non-steady state diffusion **(6 marks)**
- d) Explain activation energy in terms of diffusion and list three factor that influences it. **(4 marks)**
3. a) Why is it important to have standards for conducting test works (Explain using ASTM standards)? **(4 marks)**
- b) A metallurgical manager has been given grinding media (steel ball) samples for testing from the Procurement department. Explain the types of tests that can be

undertaken to ensure the best supplier is selected and recommend one of the tests for hardness. **(9 marks)**

- c) With the help of a strain-stress graph and short notes show the main portions of the graph and where brittle and ductile materials fail. **(5 marks)**
- d) Write short notes on accelerated aging testing and fatigue testing. **(4 marks)**

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