

*Mansoura University
Faculty of Engineering
Prod. & Mech. Design Eng. Dept.*

Biomaterials (PDE 393)
Biomedical Department (Level 300)
Mid-Term Exam (Spring 2018)

<i>Level</i>	<i>: 300</i>	<i>Group No.</i>	<i>: -----</i>
<i>Student name</i>	<i>: -----</i>	<i>Student ID</i>	<i>: -----</i>
<i>Day</i>	<i>: Thursday</i>	<i>Date</i>	<i>: 5/4/2018</i>
<i>Time allowed</i>	<i>: One hour</i>	<i>Examiner</i>	<i>: Dr. T. A. Enab</i>

Question No.	Marks	
	Number	Written
First		
Second		
Third		
Fourth		
Fifth		
Total		

Signature : Associate Prof. Dr. Tawakol Ahmed ENAB

Question 1:

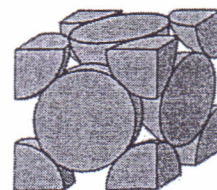
(10 Marks, each point 1 mark)

a) Fill in the spaces the correct answer :

1. is, on the basis of these structure-property correlations, designing or engineering the structure of a material to produce a pre-determined set of properties.
2. is a measure of how willing atoms are to accept electrons.
3. In bonds electrons are shared between the molecules, to saturate the valency.
4. encompasses the organization of atoms or molecules relative to one another, and may be viewed using some type of microscope.
5. The is the smallest structural unit or building block that can describe the crystal structure.

b) Choose the right answer :

1. What type(s) of electron subshell(s) does an M shell contain?
☐ A. s ☐ B. p ☐ C. d ☐ D. f
☐ E. s and p ☐ F. s, p and d ☐ G. All of the above
2. What is the maximum number of electrons that an K shell may contain
☐ A. 32 ☐ B. 18 ☐ C. 8 ☐ D. 2
3. What is the predominant type of bonding for ceramic materials?
☐ A. Ionic ☐ B. Covalent ☐ C. Metallic
☐ D. Secondary ☐ E. Both A and B ☐ F. Both B and D
4. The drawing represents the unit cell for which crystal structure?
☐ A. Simple cubic ☐ B. Face-centered cubic
☐ C. Body-centered cubic ☐ D. Hexagonal close-packed
5. Which crystal system(s) listed below has (have) the following relationship for the unit cell edge lengths? $a = b \neq c$
☐ A. Cubic ☐ B. Hexagonal ☐ C. Triclinic
☐ D. Monoclinic ☐ E. Rhombohedral ☐ F. Orthorhombic
☐ G. Tetragonal ☐ H. Both C, D and F ☐ I. Both B and G



Question 2:

(10 Marks)

(a) What are the four components involved in the design, production, and utilization of materials, and briefly describe the interrelationships between these components. (4 Marks)

(4 Marks)

(b) Compare between the SCC, BCC, FCC and HCP unit cells?

(6 Marks)

Question 3:

(10 Marks)

(a) Zirconium has an HCP crystal structure and a density of 6.51 g/cm^3 . (Note : the atomic mass of $A_{\text{Zr}} = 91.22 \text{ g/mol}$).

(4 Marks)

- i. What is the volume of its unit cell in cubic meters?
- ii. If the c/a ratio is 1.593, compute the values of c and a?

(b) On the basis of ionic radii, what crystal structure would you predict for FeO where the ionic radius of Fe^{2+} and O^{2-} are 0.077 nm and 0.140 nm respectively? Then calculate the density of FeO, given that the atomic weight for Fe^{2+} is 55.85 g/mol and for O^{2-} is 16 g/mol.

(6 Marks)

Question 4:

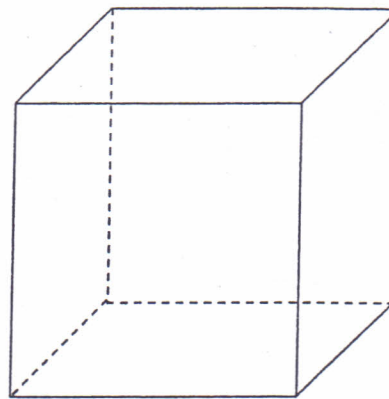
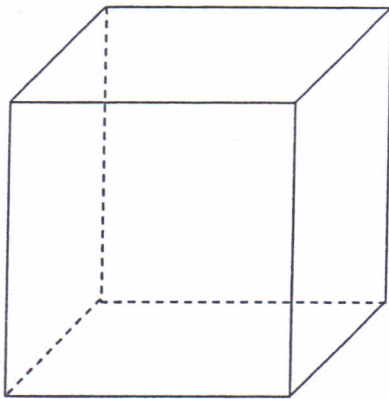
(10 Marks)

(a) Sketch the following direction and plane within a cubic unit cell.

(6 Marks)

i) $[2\bar{3}1]$

ii) $(\bar{3}02)$



(b) Surgical Sutures are normally classified into different types, briefly with short notes discuss these types?

(4 Marks)