

**W1-2-60-1-6**

**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2015/2016**

**FOURTH YEAR SECOND SEMESTER EXAMINATION FOR**

**THE DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY**

**SCH 2410: STRUCTURAL CHEMISTRY**

**DATE: DECEMBER 2015 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS**

**QUESTION ONE**

1. i) Draw diagrams to show the packing arrangement for body-centred

and hexagonal close packed cubic lattices. [4 marks]

ii) State which of the above lattices has the highest density. [2 marks]

1. Describe any TWO imperfections that you would expect in a

crystal lattice. [4 marks]

1. Derive the Brags equation and state its importance in crystallography. [6 marks]
2. What are the expected structural and property differences

between metals and ceramics? [6 marks]

1. Draw a schematic diagram of an X-ray tube and outline how it works. [5 marks]
2. Give THREE postulates that affect the stability of an ionic crystal. [3 marks]

**QUESTION TWO**

1. Outline how intrinsic semi-conductors are doped and hence the

origin of p-type and n-type semi-conductors. [8 marks]

1. Explain the working principles of photo-volcanic cells, made by p-type and n-type sandwiches. [6 marks]
2. Light emitting diodes (LEDs) are made of n-type and p-type

sandwitch of semi-conductors. Explain how LEDs function. [6 marks]

**QUESTION THREE**

1. i) Define co-ordination number. [2 marks]

ii) Draw the geometry of ionic crystals with triangular and

octahedral geometry. [4 marks]

1. Calculate the radius ratio of a body-centre crystal lattice. [8 marks]
2. i) For a unit cell with cell edge equal to 564 pm.

Calculate the interplanar distance of the crystal given the

Miller indices (420). [4 marks]

ii) Draw the faces of a crystal described by the Miller indices (100). [2 marks]

**QUESTION FOUR**

1. Compare and contrast the material properties across the periodic

table in terms of:

1. Material classification
2. The bonding type
3. Crystal type formed
4. Hardness
5. Ductility
6. Malleability

[10 marks]

1. What is Jan-Teller distortion? [4 marks]
2. i) What defect is associated with an F-centre in a solid? [2 marks]

ii) State THREE ways of making an F-centre. [4 marks]