KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2016/2017 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE

COURSE CODE: SCH 343E

COURSE TITLE: CRYSTALLOGRAPHY

DATE: 22ND SEPTEMBER 2017**TIME: 11:30 Am – 1:30Pm**

INSTRUCTIONS TO CANDIDATES

Answer QUESTION 1 and any other TWO questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

a) Define the following terms: **[3 marks]**
   - i. SpaceLattice
   - ii. Primitive Unit Cell
   - iii. Fourier synthesis

b) Using a diagram illustrate the difference between a face centered and body centered cubic crystal structure   **[2 marks]**

c) State Bragg's law and explain each of the four main terms   **[4 marks]**

d) Define structure factorand state how it can be used to determine the intensity of the (hkl) reflection   **[3 marks]**

e) Calculate the separations of the planes {121}, {221}, and {244} in a crystal in which the cubic unit cell has side 523 pm.   **[6 marks]**

f) Find the Miller indices of the planes that intersect the crystallographic axes at the distances (1a, 3b, −c) and (2a, 3b, 4c).**[4 marks]**

g) Equivalent lattice points within the unit cell of a Bravais lattice have identical surroundings. What points within a body-centred cubic unit cell are equivalent to the point (1/2, 0, 1/2)?**[4 marks]**

h) Use a diagram to illustrate the process for generation of x-ray radiation   **[4 marks]**

QUESTION TWO (20 MARKS)

a) The glancing angle of a Bragg reflection from a set of crystal planes separated by 128.2 pm is 19.76°. Calculate the wavelength of the X-rays.   **[4 marks]**

b) What are the values of 2θ of the first three diffraction lines of fcc gold {atomic radius 144 pm) when the X-ray wavelength is 154 pm?**[8 marks]**

c) A first-order reflection from the {111} planes of a cubic crystal was observed at a glancing angle of 11.2° when Cu(Kα) X-rays of wavelength 154 pm were used. What is the length of the side of the unit cell?**[8 marks]**

QUESTION THREE (20 MARKS)

a) Explain how planes of lattice points are labelled.   **[4 marks]**

b) Explain the main differences in the operation between neuron and electron diffraction   **[10 marks]**

c) Explain what is meant by systematic absence and how they arise   **[6 marks]**

QUESTION FOUR (20 MARKS)

a) Explain how X-ray crystallography was used to elucidate the details of biological macromolecules **[10 marks]**

b) Using a diagram to highlight the key components, discuss the operation of x-ray diffractometer **[10 marks]**

QUESTION FIVE(20 MARKS)

a) Unit cells are classified into seven crystal systems according to the rotational symmetry they possess. Name the seven crystal systems and for each draw the structure **[14 marks]**

b) Given that the notation (hkl) denotes an individual plane, sketch the following planes (010), (001) and (100)w**[6 marks]**

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