



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION
(SCIENCE)
2017/2018 EXAMINATIONS
MAIN
REGULAR

COURSE CODE: SPH 301

COURSE TITLE: Introduction To Solid State Physics

EXAM VENUE: STREAM: (BED SCI)

DATE: EXAM SESSION:

TIME: 2:00HRS

Instructions:

- 1. Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

You may use the following constants

Avogadro's number = 6.023×10^{23}

SECTION A

QUESTION ONE (Compulsory)

(30 Marks)

- a. Define the following terms
- i) Atomic mass
 - ii) The atomic weight
 - iii) Unit cell
 - iv) Atomic Packing factor
- (4 marks)**
- b. Calculate the number of atoms contained in water of density 1000Kg/m^3 given that its molar mass is 18g/mol and calculate its inter-particle distance **(3 marks)**
- c. The element Krypton has mass number of 50. Given that it has 42 electrons, write down its electron configuration and state whether it is a stable element or not. **(3 marks)**
- d. With aid of diagrams, explain the following terms
- i. Crystalline solid
 - ii. Amorphous solid
- (4 marks)**
- e. List the three common types of unit cell in metallic structures. **(3 marks)**
- f. If the atomic radius for Pb = 0.175nm (Fcc), Find the volume of the unit cell. **(3 marks)**
- g. Magnesium is hcp, with $c/a = 1.624$, density = 1.74g/cm^3 . Find the atomic radius of magnesium. **(3 marks)**
- h. Using a graph fully explain a potential well. **(2 marks)**
- i. Based on band theory, explain why semiconductors gain higher thermal conductivity at very high temperatures compared to conductors **(5 marks)**

SECTION B

QUESTION TWO

(20 Marks)

- a. Fully Describe the following crystal structures giving detailed account of their atom locations, number of atoms per unit cell, coordination number and the atomic packing fraction
 - i. Hexagonal close packed
 - ii. Body centered cubic
 - iii. Face centered cubic (18 marks)
- b. Draw a sketch of an atom indicating electrons in ground state and in an excited state. (2 marks)

QUESTION THREE

(20 Marks)

- a. Defects in solids can be categorized into four major classes namely: point defects, dislocations, grain boundaries and bulk defects. Give a detailed account of each (12 marks)
- b. Discuss the types of elasticity linear elasticity and finite elasticity giving their applications and the factors affecting elasticity (8 Marks)

QUESTION FOUR

(20 Marks)

Discuss five types of bonding describing;

- (i) How the bond is formed.
- (ii) The particular elements with the particular bond and their location on a periodic table.
- (iii) Their physical properties

QUESTION FIVE

(20 Marks)

Using well labeled diagrams, fully explain the band diagrams for the following semiconductors

- a. P type semiconductor 3
- b. N type semiconductor 3
- c. P-N junction in open circuit 4 P-N junction in forward biased circuit 5
- d. P-N junction in reverse biased circuit 5

