



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

SEPTEMBER – DECEMBER 2019 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

REGULAR PROGRAMME

PHY 313: PHYSICS OF MATERIALS

Date: DECEMBER 2019

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and ANY other TWO Questions

Q1. a) Define the following terms:

(5marks)

- i) Polymorphism
- ii) carrier density
- iii) Hardness
- iv) electrical conductivity
- v) allotropy

b) Differentiate between:

(4marks)

- i) Inter-diffusion and self-diffusion
- ii) Tensile and compressive strength

c) Calculate the atomic packing factor for a face centred cubic structure

(4marks)

d) Outline the uses of the following Semiconductors and polymers

(4marks)

e) State two types of secondary bonds

(2marks)

f) What is diffusion flux? State Fick's first law

(3marks)

g) Outline two types of Stereoisomerism

(2marks)

h) Discuss the mechanism of electrical conductivity as follows:

(6marks)

i) Metals

ii) Semiconductors and insulators

Q2. a) Differentiate between heat capacity and thermal conductivity **(2marks)**

b) Explain how thermal conductivity occur in:

i) Metals

(3marks)

ii) Semiconductors

(2marks)

c) Explain the applications of thermal expansion in solids

(6marks)

d) Differentiate between conduction band and valence band

(3marks)

e) Explain two specific quantum mechanical effects that happen when atoms come together to form a solid

(4marks)

Q3. a) State and give types of polymers **(3marks)**

b) What is crystallinity **(1mark)**

c) Explain four factors that affects crystallinity

(8marks)

d) Discuss the formation of different types of materials

(6marks)

i) Crystalline

ii) Polycrystalline

iii) Amorphous

e) Name two different forms of condensed matter

(2marks)

Q4. a) What is diffusion

(2marks)

b) Discuss different types of diffusion mechanism

(4marks)

c) Explain four factors affecting diffusion

(8marks)

d) Differentiate between edge and screw dislocations

(3marks)

e) Name three mechanisms of strengthening in single-phase metals

(3marks)

Q5. a) Explain the difference between primary and secondary bonding

(2marks)

b) Discuss the formation of ionic and covalent bonds in materials

(5marks)

c) By use of a diagram explain how bonding occurs in materials

(4marks)

d) Name the three common crystal structures

(3marks)

e) Explain the three common types of solids

(6marks)

END