



Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF
TECHNOLOGY IN APPLIED CHEMISTRY
BTAC

ACH 4307: MATERIAL CHEMISTRY

SPECIAL/SUPPLEMENTARY EXAMINATION

OCTOBER 2013 SERIES

2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions

Answer question **ONE** (compulsory) and any other **TWO** questions

Question ONE

a) Differentiate between the following terms

- (i) Elasticity and plasticity
- (ii) Galvanic and microbial corrosion
- (iii) Crystalline and amorphous material

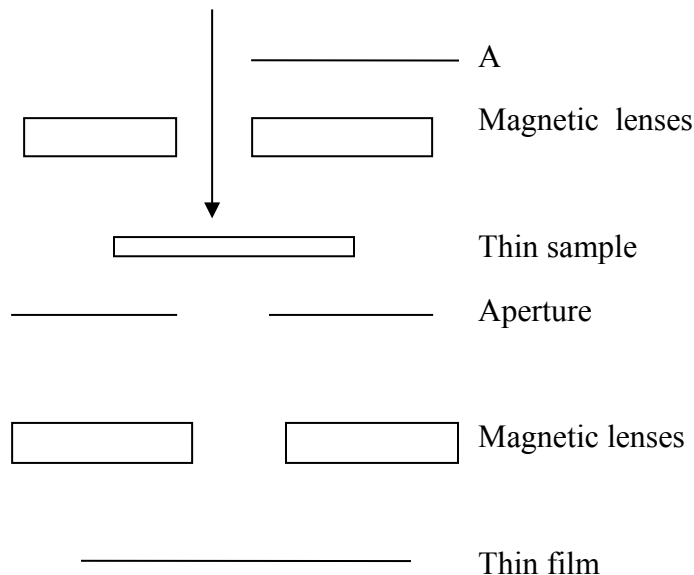
(6marks)

b) Explain the following terms as used in material chemistry.

- (i) Passivation
- (ii) Glass ceramic

(4marks)

- c) Materials can be characterized to obtain surface and bulk properties. Explain any three of the properties. **(6marks)**
- d) Bioactive glasses are used for hard characteristics properties that allow them to be used as biomaterial. **(4marks)**
- e) (i) Outline the components of a Zeolite which are used as good adsorbents for industrial separations and purification **(4marks)**
- (ii) Phosphors are made from suitable host materials with an added activator state any TWO phosphor activator materials **(2marks)**
- f) The figure below is a schematic diagram of a common Transmission Electron Microscope (TEM)



- (i) What does arrow A represent ? **(1mark)**
- (ii) Explain the mode of operation in characterization of materials using TEM **(3marks)**

Question TWO

- a) Different substances can be classified according to their behavior when electrical to their behavior when electrical or heat energy fall on them. Give THREE classes and explain their behavior using quantum theory of molecular crystals. **(6marks)**
- b) (i) State any SIX ingredients added to common class and how they improve the properties of glass. **(6marks)**

- (ii) Explain TWO advantages of cullet added to glass **(2marks)**

Question THREE

- a) Giving examples outline any three microstructures in biomaterials **(6marks)**
- b) (i) Explain biocompatibility as applied to biomaterial performance **(2marks)**
(ii) State THREE properties of polyethylene oxide as a protein resistant coating **(3marks)**
- c) Explain the hierarchy in order of magnitude in structure of synthetic system in living organism. **(3marks)**
- d) (i) For Na F the repulsive (Born) exponent $n = 8.7$. Making use of data given calculate the molar crystal energy (ΔE_{Cryst}). $E_o = 8.85 \times 10^{-12}$, $e = 1.69 \times 10^{-19}$ C, $M = 1.747$, ionic radii $\text{Na}^+ = 0.95 \text{ \AA}$ and $\text{F}^- = 1.36 \text{ \AA}$ and $N_A = 6.23 \times 10^{23}$. **(4marks)**
(ii) State any TWO assumptions made in d(i) above. **(2marks)**

Question FOUR

- a) (i) Name the THREE primary types of chemical bonding. **(3marks)**
(ii) What are general consequences of the differences in the chemical bonding to properties of materials at the crystal structure level? **(3marks)**
- b) Describe the general working mechanism of laser **(6marks)**
- c) (i) List any FOUR components of a laser device. **(2marks)**
(ii) Write LASER in full. **(1mark)**
- d) (i) List any FOUR types of lasers based on operating principles **(2marks)**
(ii) State any THREE applications of lasers **(3marks)**

Question FIVE

- a) Describe the chemical transport reaction process where crystals of hematite are reportedly observed at the mouth of volcanoes. **(5marks)**
- b) Draw and label a sketch graph to explain the occurrence of super conductivity in some

materials

(5marks)

- c) Devise an experiment to demonstrate the properties of a superconductor. **(6marks)**
- d) Devise a simple test to describe the rate of corrosion and give the relevant expression.

(4marks)