ST

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

SUPPLEMENTARY/SPECIAL EXAMINATION

2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE (CHEMISTRY) AND BACHELOR OF INDUSTRIAL CHEMISTRY

COURSE CODE: SCI 461E

COURSE TITLE: GLASS, CERAMIC AND CEMENT CHEMISTRY

DATE: 04/08/2022 **TIME:** 8.00-10.00 AM

INSTRUCTIONS TO CANDIDATES

Total Marks: 70

Answer all the Questions

TIME: 2 Hours

QUESTION ONE (19 Marks)

(a) State the process of manufacturing ceramic ware using the wet process **(6 marks)**

(b) Distinguish between traditional and engineering ceramic materials and give examples of each **(4 marks)**

(c) Describe the vitrification process in ceramics **(2 marks)**

(d) Briefly state what causes the lack of plasticity in crystalline ceramics **(2 marks)**

(e) A soda-lime plate glass between 500 °C (strain point) and 700 °C (softening point) has viscosities between $10^{14.2}$ and $10^{7.5}$ P, respectively. Calculate a value for the activation energy in this temperature region. **(5 marks)**

QUESTION TWO (16 Marks)

(a) Define a tempered glass and explain how it is produced **(4 marks)**

(b) (i) State the basic composition of soda-lime glass **(2 marks)**

(ii) State any **two** advantages and **two** disadvantages of soda-lime glass **(4 marks)**

(c) List three basic components of traditional ceramics **(3 marks)**

(d) State three major applications of ceramic products in industries **(3 marks)**

QUESTION THREE (17 Marks)

(a) Write a brief account on setting and hardening of cement **(4 marks)**

(b) Write Reactions involved in setting and hardening of cement for:

(i) dicalcium silicate **(2 marks)**

(ii) tricalcium aluminate **(2 marks)**

(iii) tetra calcium alumino ferrite **(2 marks)**

(c) Explain why sintered alumina is widely used as a substrate for electronic-device applications **(2 marks)**

(d) Explain how specific volume versus temperature plot for a glass differ from that for a crystalline material when these materials are cooled from the liquid state **(5 marks)**

QUESTION FOUR (18 Marks)

(a) Explain how a glass is distinguished from other ceramic materials **(2 marks)**

(b) Explain how cracking of ceramic articles is controlled **(2 marks)**

(c) State any four properties of glasses that make them indispensable for many engineering designs **(4 marks)**

(d) Briefly state what causes the lack of plasticity in crystalline ceramics **(3 marks)**

(e) Define glass network modifiers and explain why they are added to silica glass **(3 marks)**

(f) A soda-lime glass has a viscosity of $10^{14.3}$ P at 570°C. Calculate the temperature at which its viscosity will be $10^{9.9}$ P if the activation energy for the process is 430 kJ/mol **(4 marks)**