

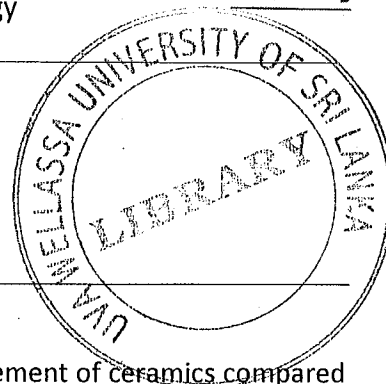
**Instructions to candidates**

Duration: Two (02) hours

Number of questions: Four (04)

Mark allocation: 80

Answer all questions



1.
  - i. Briefly describe differences and similarities of atomic arrangement of ceramics compared to glass and metals.  
(06 marks)
  - ii. Why ceramics show poor thermal and electrical conduction, low ductility, and high melting point?  
(06 marks)
  - iii. What are the two characteristic components of ions that determine the crystal structure of a ceramic compound?  
(2 marks)
  - iv. Sphalerite is a ceramic material formed by zinc and sulfur. It crystallizes in the cubic crystal system having tetrahedrally coordination. Calculate the cation-anion radius ratio for this compound using appropriate crystal geometry.  
(6 marks)
  
2.
  - i. Magnesium oxide (MgO) is a ceramic material and has FCC crystal structure. The density of MgO is  $3.58 \text{ g/cm}^3$ .
    - a. Determine edge length of the unit cell.
    - b. How does this result compare with the edge length as determined from the ionic radii?  
(Assume that the  $\text{Mg}^{2+}$  and  $\text{O}^{2-}$  ions just touch each other along the edges. Consider ionic radii of  $\text{Mg}^{2+}$  and  $\text{O}^{2-}$  are 0.072 nm and 0.14 nm respectively. Atomic weights of Mg and O are 24 g/mol and 16 g/mol respectively).  
(6 marks)

- ii. Write chemical formulas for three different silicate structures present in silicate ceramics.  
(3 marks)
- iii. Using a simple schematic diagram show that how the polymeric forms of silica change with changing the temperature.  
(5 marks)
- iv. Ceramics play an important role in repairing living tissues and organs. Briefly describe the biomedical applications of ceramics.  
(6 marks)
- 3.
- i. High purity ceramic powders can be obtained using sol-gel method. Briefly describe this method.  
(6 marks)
- ii. How do we obtain ceramic nano particles?  
(4 marks)
- iii. Briefly describe the production process of ceramic manufacturing company that you have visited in Sri Lanka.  
(10 marks)
- 4.
- i. Name four different types of mechanical milling used in ceramic powder production.  
(4 marks)
- ii. How do we characterize ceramic powders using basic methods?  
(4 marks)
- iii. We usually use following main steps when we produce ceramic based products. Briefly describe each step using appropriate diagrams.
- a. Slip
  - b. Shrinkage
  - c. Shaping
  - d. Sintering
- (12 marks)

