



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

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## University Examinations 2023/2024

FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE MASTER OF  
SCIENCE IN CHEMISTRY

### SCH 7132: CHEMISTRY OF MATERIALS

DATE: APRIL 2024

TIME: 2 HOURS

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INSTRUCTIONS: Answer question *one* and any other *two* questions

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#### QUESTION ONE (30 MARKS)

- a) Differentiate between gel and glass in terms of their formation (4marks)
- b) Explain the following terms
- i) Thermoforming (2 marks)
  - ii) Blow molding (2 marks)
  - iii) Sintering (2 marks)
- c) Discuss four classifications of materials (4 marks)
- d) Explain two methods commonly used in the synthesis and fabrication of nanostructures materials (4 marks)
- e) Using a well labelled diagram, explain the apparatus used for the evaluation of gas separation membranes (6 marks)
- f) Why study materials chemistry? (4 marks)
- g) What are *Clathrates*? (2 marks)

## QUESTION TWO (15 MARKS)

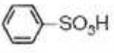
- a) Discuss the materials selection process (6marks)
- b) Explain the chemical vapor deposition method for depositing diamond-like carbon on a substrate (5 marks)
- c) Distinguish between;
- i) Bioerodible and biocompatible material (2 marks)
  - ii) Dimensional and thermal stability (2 marks)

## QUESTION THREE (15 MARKS)

- a) Discuss including relevant illustrations, the operating principle of Powder X-ray diffraction (7 marks)
- b) Explain the overall polymerization mechanism applied in most materials synthesis (8 marks)

## QUESTION FOUR (15 MARKS)

- a) Explain the properties associated with the polymer material side groups in the table below (13 marks)

Side Group	Properties
$\text{CH}_3, \text{C}_2\text{H}_5, \text{C}_3\text{H}_7, \text{etc.}$	
$\text{CF}_3, \text{CH}_2\text{CF}_3, \text{CH}_2\text{CF}_2\text{CF}_3, \text{etc.}$	
$\text{Si}(\text{CH}_3)_3$	
Phenyl rings	
Naphthyl or biphenyl groups	
Phosphate groups	
Pyridine groups	
$\text{NH}_2$	
$\text{COOH}$	
$\text{COONa}$	
$\text{OH}$	
$\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OCH}_3$	
	

- b) What are microcrystalline materials? (2 marks)