



# **MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATIONS  
2018/2019 ACADEMIC YEAR  
THIRD YEAR SECOND SEMESTER**

**SCHOOL OF SCIENCE AND INFORMATION  
SCIENCES  
BACHELOR OF SCIENCE IN CHEMISTRY**

**COURSE CODE: CHE 3230  
COURSE TITLE: NANOCHEMISTRY**

**DATE: 18-4-2019**

**TIME: 11:00AM-1:00PM**

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## **INSTRUCTIONS TO CANDIDATES**

1. Answer Question **ONE** and any other **TWO** questions.
2. All Examination Rules Apply.

## SECTION A

### Question One (30mks)

- a) Distinguish between nanoscience and nanotechnology  
(2 mks)
- b) Define nanochemistry  
(1 mk)
- c) State and explain the two primary factors that cause nanomaterials to exhibit different properties from bulk materials  
(4 mks)
- d) State any three instrumentation methods used to characterize nanomaterials  
(3 mks)
- e) (i) Derive the simple equation from the geometric equations of a sphere that confirms the larger surface area to volume ratio of nanomaterials. Assume an imaginary spherical particle of radius  $r$   
(4 mks)
- (ii) Why is a spherical shape preferred in the analysis in (e)  
i above  
(1 mk)
- f) Distinguish between gas phase synthesis and gas condensation processing of nanomaterials  
(4 mks)
- g) Explain any two properties of nanomaterials  
(4 mks)
- h) (i) Distinguish between drug delivery and targeted drug delivery  
(2 mks)
- (ii) How is targeted drug delivery done and why is it important  
(2 mks)
- (i) State any three problems of nanomaterials associated with agriculture  
(3 mks)

## SECTION B

Answer any TWO questions from this section, each question carries 20 marks

### Question Two (20mks)

- a) Compare and explain the catalytic property of bulk silver and that of silver nanoparticles  
(2 mks)
- b) State four advantages of nanoparticles of titanium dioxide ( $\text{TiO}_2$ ) when used in sunscreens  
(4 mks)
- c) State two ways in which  $\text{TiO}_2$  nanoparticles in sunscreens prevent the harmful uv light from coming into contact with the skin  
(2 mks)
- d) Explain any two uses of fullerenes  
(4 mks)
- e) Describe the top down and bottom up methods used in the manufacture of nanomaterials giving an example of a method in each case  
(4 mks)
- f) Explain the mechanical and catalytic properties of carbon nanotubes  
(4 mks)

### Question Three (20mks)

- a) What is graphene?  
(1 mk)
- b) State the four desirable properties of grapheme that make it potentially useful in various fields  
(4 mks)
- c) What does the term “self healing” in reference to the property of graphene mean and why is this property important in the case of graphene  
(2 mks)
- d) State any four uses of graphene  
(4 mks)

- e) Describe the bonding in fluorographene (4 mks)
- f) State the two properties of fluorographene that make it a very stable surfacing material (2 mks)
- g) State any three uses of fluorographene (3 mks)

### Question Four (20mks)

- a) State the four very useful properties of cubic boron nitride (4 mks)
- b) Write the general chemical equation representing hydrolysis of cubic boron nitride (3 mks)
- c) (i) The bonding within a layer in hexagonal boron nitride is such that all the bond lengths are 0.145 nm while the layers are 0.334nm apart. Explain (2 mks)
- (ii) The inter-atomic and inter-layer bond lengths in c(i) above point to two properties of hexagonal boron nitride. Name the properties (2 mks)
- d) State two differences and two similarities between cubic and hexagonal boron nitrides based on their properties (4 mks)
- e) (i) Hexagonal boron nitride is used as a lubricant. Explain (2 mks)
- (ii) State the three distinctive physical properties of hexagonal boron nitride nanoparticles (3 mks)

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