



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

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 (TiO_2) when used in sunscreens (4 mks)
- c) State two ways in which 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 flourographene (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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