SOUTH EASTERN KENYA UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (CHEMISTRY)

SCA 403: NANOCHEMISTRY

DATE: 12TH APRIL, 2017 **TIME: 1.30-3.30 P.M**

INSTRUCTIONS TO CANDIDATES

(a) Answer question One and any other Two questions

(b) Question 1 carries 30 marks while the other questions carry 20 marks each

(c) Illustrate your answers with well labeled diagrams where appropriate

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Question 1 (30 marks)

a.) Define the following terms in the nanochemistry/nanotechnology context;

i.) Nanoscale materials (1 mark)

ii.) Aspect ratio (1 mark)

iii.) Knudsen diffusion (2 marks)

iv.) Nanoscience (1 mark)

v.) Lithography (1 mark)

b.) Differentiate between nanocluster and nanoparticle. (2 marks)

c.) Briefly how nanorods are used in cancer therapeutics (4 marks)

d.) Explain why nanorods are used in cancer therapeutic (3 marks)

e.) Compare and contrast properties of materials at bulk and nanoscale. You may choose any materials, for instance gold or silver in your comparison and contrasting. (4 marks)

f.) Give five specific applications of nanomaterials in our society (5 marks)

g.) Give three types of porous solid and their corresponding pore diameters. (3 marks)

h.) Name three types of gases used in sorption studies to determine surface area and pore size/distribution of nanomaterials (3 marks)

Question 2 (20 marks)

a.) State four factors that make nanomaterials have different properties from those of atoms and bulk materials. (4 marks)

b.) Mechanical grinding is one of "top down approach" for making nanomaterials. Give two disadvantages of this method. (2 marks)

c.) Nanomaterials are made using two broad strategies. State and explain the two strategies. Use of diagrams or cartoon is encouraged. Give one limitation for each strategy and remedies for two limitations. (8 marks)

Question 3 (20 marks)

a.) i.) What is the size for a particle to qualify to be called a "nanoparticle". (1 mark)

ii.) Name four morphologies of nanostructures including their corresponding dimensions. (4 marks)

b.) Different techniques are used to study nanomaterials and their application. Give five techniques used for nanomaterials and state the information obtained from each technique. (10 marks)

c.) Briefly describe photolithography and in one sentence or two state the role of masks in photolithography (5 marks)

Question 4 (20 marks)

a.) Describe five disadvantages of nanomaterials (5 marks)

b.) Write a detailed synthesis scheme of preparing cadmium selenide (CdSe) nanoparticles of different particle size. Give three parameters that can be manipulated to control the size, and show how the sizes can be determined. You may use diagrams. Give two possible applications of gold nanoparticle (15 marks)

Question 5 (20 marks)

a.) Define the terms "intercalation" and "exfoliation" and show how these two processes are important in graphite or graphene chemistry. (4 marks)

b.) Briefly describe the five distinct steps involves in sol-gel process. (5 marks)

c.) Briefly describe the key stages in gas phase synthesis of nanomaterials. You may use chemical vapor deposition (CVD) as a representative of gas phase synthetic technique in your description. (6 marks)

d.) Give four advantages of chemical vapor deposition (CVD) (4 marks)

e.) Explain the role of carrier gas in gas phase synthesis techniques for nanomaterials (1 mark)