

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS
EXAMINATION FOR THE AWARD OF
MASTER OF SCIENCE IN CHEMISTRY

CHEM 848: ADVANCED NANO-ELECTROCHEMISTRY

STREAMS: MSC (CHEM)

TIME: 3 HOURS

DAY/DATE: THURSDAY 11/04/2019

2.30 PM – 5.30 PM

INSTRUCTIONS:

Answer ALL Questions

Question One (20 Marks)

1. (a) List three advantages of ultramicroelectrodes [3 marks]
- (b) (i) Define nanoelectrodes [1 mark]
- (ii) Briefly discuss the extraordinary properties of nanoelectrodes. [4 marks]
- (c) Briefly discuss the limits of DFT in modeling electrochemical reactions and how this has been solved by thermodynamics of electrochemical reaction. [4 marks]
- (d) Using equations write the hydrogen evolution reaction in acidic media. [4 marks]
- (e) Explain why there is a large decrease of the absorption energy for copper and gold wires. [3 marks]
- (f) Write short notes on the following
 - (i) Amperometric collision detection using electrocatalytic amplification
 - (ii) Stair case current response. [4 marks]

Question Two (20 Marks)

- (a) Discuss nanoelectrode fabrication [4 marks]
- (b) Write the equation for the calculation of the wire surface energy and define the terms [2 marks]
- (c) Explain the following in terms of the wire surface energy:
- (i) A positive wire surface energy
 - (ii) A low wire surface energy [2 marks]
- (d) Briefly explain blip (or splice) response. [3 marks]
- (e) (i) Compare fullerenes and graphene as carbon electrode material. [3 marks]
- (ii) Draw the graphene edge structure [3 marks]
 - (iii) Briefly discuss doping in carbon nanotubes and graphene. [3 marks]

Question Three (20 Marks)

- (a) Briefly discuss three materials for obtaining monolayer graphene. [6 marks]
- (b) Draw the structures of hollow type, herring bone and bamboo multi walled carbon nanotubes. [3 marks]
- (c) Briefly explain the fundamental aspects for creating templated nanomaterials. [3 marks]
- (d) Briefly discuss
- (i) The anodic oxide template synthesis [3 marks]
 - (ii) Block copolymer thin template [3 marks]
- (e) Describe the two kinds of microelectrode arrays. [4 marks]
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