CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE

CHEM 343: INDUSTRIAL AND APPLIED CHEMISTRY

STREAMS: BSC **TIME: 2 HOURS**

DAY/DATE: MONDAY 09/12/2019 **11.30 A.M. – 1.30 P.M.**

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (3O MARKS)

a) Differentiate between the following

i) Commodity and specialty chemicals (2 marks)

ii) Unit processes and unit operations (2 marks)

b) Define the following terms in reference to the material balance equation

i) Accumulation (1 mark)

ii) System (1 mark)

c) Write the general mass balance equation (2 marks)

d) Discuss four objectives of size reduction (4 marks)

e) i) Discuss emulsion polymerization (3 marks)

ii)Give two advantages and two disadvantages of emulsion polymerization (2 marks)

f) Write short notes including industrial applications of the following (4 marks)

i) Sulphonation

ii) Esterification

g) Consider the following reaction

ΔH= -98.3KJ/mol at 25°c

Explain the reason behind setting the conditions as follows (3 marks)

i) Temperature: 400 -450° C

ii) Pressure: 2 atmospheres

iii) O_2:SO_2 ratios 1: 1

h) Define the following terms i) Octane number ii) Thermosetting plastics (2 marks)

i) Discuss the two classification of industrial fermentation (4 marks)

QUESTION TWO (20 MARKS)

a) Discuss the three sources of raw materials for the chemical industry (6 marks)

b) What assumptions are made at the initial stages of carrying out material balance for a chemical process (2 marks)

c) Three raw materials are mixed in a tank to make a final product in the ratio 1:0.4:1.5 respectively. The first raw material contains A and B with 50% A. The second raw material contain C while the third raw material contains A and C with 75 % A. Assuming a continuous process at steady state determine the flow and composition of the product (6 marks)

d) Using appropriate equations discuss the main steps in the contact process of the manufacture of H_2SO_4 (6 marks)

QUESTION THREE (2O MARKS)

a) Discuss the stages of free radical polymerization (6 marks)

b) Describe how a magnetic separator works (3 marks)

c) i) Define the Chlor-alkali process (2 marks)

iii) Using a well labelled diagram discuss the Chlor-alkali membrane cell (5 marks)

d) Using equations discuss the conversion of the phosphate rock $Ca_5(PO_4)_3F$ into monocalcium phosphate and triple superphosphate (4 marks)

QUESTION FOUR (20 MARKS)

a) Write short notes on the following in the context of petroleum processing (9 marks)

i) Catalytic reforming

ii) Polymerization

iii) Alkylation

iv) Treating, sweetening and drying

b) i) Give the three types of polymers (3 marks)

iii) Discuss briefly the two main properties of polymers (4 marks)

c) Discuss two factors that affect the product yield in fermentation (4 marks)
