CHUKA UNIVERSITY

COLLEGE

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF SCIENCE & BACHELOR OF EDUCATION (SCIENCE)

CHEM 341: INDUSTRIAL AND APPLIED CHEMISTRY

STREAMS: B.Sc. & B.Ed. (SC) **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 19/12/2012 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS:

ANSWER ALL QUESTIONS IN SECTION A AND ANY TWO IN SECTION B.

SECTION A: (30 MARKS)

QUESTION 1

(a) Write equations to show how quick line (CaO) and slaked line ($Ca(OH)_2$) are made starting with limestone. [2 marks]

(b) Calculate the % nitrogen in each of the following nitrogen fertilizers.

(i) Ammonium nitrate
(ii) Ammonia [2 marks]

(c) Define the following terms:

(i) Alkylation
(ii) Material balance
(iii) Fermentation [3 marks]

(d) Differentiate between

(i) Unit operations and unit processes
(ii) Heavy industry and light industry
(iii) Commodity and specialty chemical [3 marks]

QUESTION 2

(a) Give 4 sources of raw materials for the chemical industry. [2 marks]

(b) List 4 reasons why size reduction is important in industrial operations. [2 marks]

(c) What are the major and industrial users of ammonia? [3 marks]

(d) (i) Differentiate between batch and continuous processes. [1 mark]

(ii) Give 4 advantages of the continuous process over the batch process. [2 marks]

QUESTION 3

(a) Define the following

(i) Cement
(ii) Ceramics [2 marks]

(b) Distinguish between microbial and enzymatic fermentation. [2 marks]

(c) Differentiate between the following terms

(i) Basic and applied research
(ii) Technology push and technology pull [2 marks]

(d) (i) Define glass. [1 mark]
(ii) Give 2 properties common to all types of glass. [1 mark]

(e) Calculate the molar mass of polyethylene molecule – $(CH_2^-CH_2^-)n$ where n = 10,000. [2 marks]

SECTION B (40 MARKS)

QUESTION 4

(a) (i) Give 4 advantages of the diaphragm cells used in the Chlor-alkali process. [2 marks]

(ii) Discuss briefly two unit processes and 2 unit operations. [4 marks]

(b) Write the cell reactions for the mercury cell used in the Chlor-alkali process. [3 marks]

(c) Give and discuss briefly the factors that affect fermentation yield. [4 marks]

(d) Explain using equations how super-phosphate and triple superphosphate fertilizer is made. [4 marks]

(e) Describe briefly the contact process in the manufacture of sulphuric acid. [3 marks]

QUESTION 5

(a) Using the help of equations, explain briefly the Haber process used in the manufacture of ammonia. [3 marks]

(b) Differentiate between thermoplastic and thermosetting plastics and give an example of each. [4 marks]

(c) Give examples of raw materials used in the manufacture of ceramics. [3 marks]

(d) (i) Discuss briefly the three steps involved in free radical polymerization. [6 marks]

(ii) Give 2 advantages and 2 disadvantages of emulsion polymerization. [4 marks]

QUESTION 6

(a) Give and discuss the 5 main groups of ceramics. [5 marks]

(b) Consider the following reaction

$$2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)} \Delta H = \text{-}98.3KJ/mol$$

Explain why the conditions are set at

(i) temperature : 400 – 450^{o}C.
(ii) pressure : 2 atmospheres [4 marks]

(c) Cements can be classified according to their uses and properties into three main groups. Give them. [3 marks]

(d) 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 contain A and B with 50% A. The second raw material contain C; while the third raw material contain A and C with 75%. Assuming a continuous process at a steady state, find the flow and composition. [6 marks]

(e) Give two purposes of size enlargement in industrial raw materials. [2 marks]
