

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 lime (CaO) and slaked lime (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 – $(\text{CH}_2\text{-CH}_2)_n$ 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]

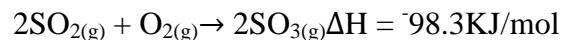
- (d) Explain using equations how super-phosphate and triple superphosphate fertilizer is made. [4 marks]
- (e) Describe briefly the contact process in the manufacture of sulphuric acid. [3 marks]

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



Explain why the conditions are set at

- (i) temperature : 400 – 450°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]
