



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2010/2011
OPEN, DISTANCE AND E-LEARNING EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION

SCH 405: INDUSTRIAL CHEMISTRY

DATE: Friday 8th July 2011

TIME: 11.00a.m – 1.00p.m

INSTRUCTIONS: ANSWER ALL QUESTIONS

[Use examples, diagrams or chemical equations where appropriate]

QUESTION 1

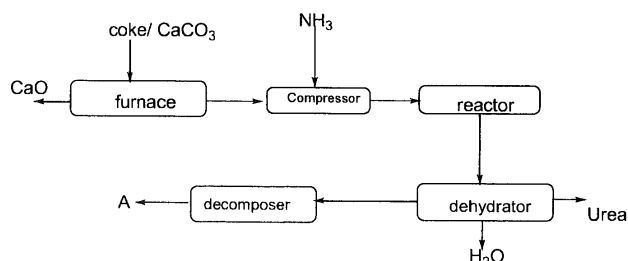
[20 marks]

- a) Outline briefly the importance of the following to an industrial chemist
- i) Quality control [2mks]
 - ii) Environmental pollution control [2mks]
 - iii) Location of the plant near water source [2mks]
 - iv) Research and development [3mks]
- b) Ammonia is manufactured on a large scale from nitrogen and hydrogen by Haber process and the following chemical equation takes place in the catalytic chamber



- i) State the likely composition of C [2marks]
- ii) Using the equation given and with justification, write down any two possible physico-chemical conditions employed in the above process [3marks]
- iii) State any two methods employed to conserve energy in the above process [2mks]

d) Ammonia from the process in (1b) is used together with carbon dioxide for the manufacture of a fertilizer called urea (NH_2CONH_2). The manufacturing process is summarized in the flow chart below. Use it to answer questions that follow.



- Write chemical equation to show what takes place in the furnace and the reactor [3marks]
- Give properties of materials from which the hydrator should be made of [2marks]
- Give the composition of **A** and state possible use in the process [2marks]

Question 2

[20 marks]

- Define the term herbicide and give any two properties of a good herbicide [3mks]
- There is a move to introduce the use of DDT as a measure to control malaria in endemic areas (areas where malaria occurs regularly) in Kenya. However there are fears of the long term disadvantages of DDT. Suggest how these disadvantages can be reduced [3mks]
 - A lot of research is being done with a view of finding alternative insecticides from natural sources such as local flora or fauna. State any two advantages these natural pesticides may have over synthetic ones such as DDT [2mks]
- The feed to a distiller consists of a mixture of propane, butane and pentane in the ratio of 1:1:1 by mass and is fed at the rate of 10000kg per 2 hours. The distillate leaves the column in three streams **X**, **Y** and **Z**. Stream **X** contains 0.9 of propane, 0.07 of butane and the rest pentane and is produced at the

rate of 2800kg per 2 hours. Stream Y which enters a holding tank of diameter 3 metres is produced at the rate of 3500kg per 2 hours and contains 0.2 of propane, 0.7 of butane and the rest pentane.

- i) State the type of processing suitable in the above process [1mark]
- ii) With justification, state the reactor that is suitable for the process [2mks]
- ii) For one hour operating interval, calculate the percentage composition of butane in stream Z giving any assumptions made [6mks]
- d) Explain how reaction stages and separations increase the capital cost in setting up any manufacturing industry [3mks]

Question 3

[15 marks]

a) Trona from lake Magadi is a source of soda ash and exists naturally as sodium sesquicarbonate ($\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$). Some of the processes (not in order) employed in extraction of soda ash include. Calcination, physical grading, storage, purification, mining

- i) Sketch a well labeled flow or line diagram to show the above manufacturing process. [2mks]
- ii) Give the chemical equations to show the chemistry involved in the calcinations process [3mks]
- b) One major use of soda ash from the above process in the manufacture of soda glass and involves four stages namely: Melting, forming, annealing and finishing.
 - i) Briefly explain how annealing is achieved and give its importance [2mks]
 - ii) State any four methods used for writing on glass [2mks]
- c) An industry, first of its own in Kenya, employs you in the department that deals with research in waste product management. Write down your expected role as a chemist [3mks]
- d) Define the term vitrification and give its importance in the manufacture of ceramic products [3mks]

Question four

[15 marks]

- a) i) Explain the principle on which any type of a heat exchanger works and state any two types of heat exchangers employed in industrial processing
[4mks]
- ii) Explain how use of heat exchanger in a manufacturing process can reduce cost of production
[2mks]
- b) i) One of the major products of catalytic cracking is ethene. State four major industrial processes that carried out on ethene to convert it into industrially useful products
[2mks]
- c) There are two broad ways of carrying out chemical processes in industries viz: Batch and continuous processing. Give any three advantages of using continuous processing over batch processing
[4mks]
- d) Employment projection indicate that newer jobs come from small scale enterprises commonly known as **jua kali**. Explain briefly the advantages of studying the basics of industrial chemistry in view of this statement
[3marks]
