



SOUTH EASTERN KENYA UNIVERSITY
UNIVERSITY EXAMINATIONS 2016/2017

**SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE (CHEMISTRY)**

SCI 202: UNIT OPERATIONS

DATE: 21ST APRIL, 2017

TIME: 1.30-3.30 P.M

INSTRUCTIONS TO CANDIDATES

(a) Answer question One and any other Two questions

(b) Question 1 carries 30 marks while the other questions carry

20 marks each

(c) Illustrate your answers with well label diagrams where applicable

$$R = 8.3144598 \text{ J mol}^{-1} \text{ k}^{-1}$$

Question 1 (30 marks)

(a) With relevant examples in each case, distinguish the following terms(10 marks)

- i. Unit Operations and Chemical Kinetics(2 marks)
 - ii. Process Flow Sheets and Utility Flow Sheets (2 marks)
 - iii. Fractional and Azeotropic Distillation(2 marks)
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- iv. Comminution and Agglomeration (2 marks)
 - v. Agitation and mixing(2 marks)
- (b) Describe the four steps of carrying out a material balance (2 marks)
- (c) Name two applications where cutting machines are desirable (2 marks)
- (d) State the six purposes of agglomeration and granulation(3marks)
- (e) Process flow sheet is a vital document to the Chemist.
- i. What are the purposes of process flow sheet?(2 marks)
 - ii. List six information you can obtain on a Process Flow Sheets(3 marks)
- (f) A solution of common salt in water is prepared by adding 20kg of salt to 100kg of water, to make a liquid of density 1323kgm^{-3} . Calculate the concentration of salt in this solution as
- i. Weight fraction (1 mark)
 - ii. Weight/ volume fraction (1 mark)
 - iii. Mole fraction(1 mark)
 - iv. Molal concentration(1 mark)
- (g) What are the 5 purposes of agitation(2 marks)
- (h) Compare and contrast crushers and grinders (2marks)

Question 2 (20 marks)

- a.) Discuss six factors/ areas of feasibility study (12 marks)
- b.) Discuss the three postulates for crushing (8 marks)

Question 3 (20 marks)

- a) Agglomeration and granulation are the key unit operations in Powder technology industries.
- i. Define two processes that can cause agglomeration of particles (4 marks)
 - ii. Explain seven size enlargement techniques employed in agglomeration (7 marks)
- b) With elaborate examples discuss grinding machines(9 marks)

Question 4 (20 marks)

- a) Agitation and mixing are unit operations utilized manufacturing industry.
- i. Discuss the standard agitation equipment (10marks)
 - ii. Explain the two classes of impellers(2marks)
- b) Mixing of solid particles in industry is essential in material science (8 marks)
- i. Explain the three mechanisms involved in mixing of the solids (3 marks)
 - ii. Discuss the degree of mixing in solids (5 marks)

Question 5 (20 marks)

- (a) Discuss the four pressure driven membrane separation processes (12 marks)
- (b) Separations are vital in Chemical Industry.
- i. Differentiate between diffusional and mechanical separations(4marks)
 - ii. Discuss screening equipment (4 marks)