



Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF
TECHNOLOGY IN APPLIED CHEMISTRY
BTAC 11M

ACH 4305: INDUSTRIAL PROCESSES

SPECIAL/SUPPLEMENTARY EXAMINATION

OCTOBER 2013 SERIES

2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions

Answer question **ONE** (compulsory) and any other **TWO** questions

Question ONE

a) State be chatdiers principle as applied to a chemical system when there is a change in the following:-

(i) Temperature

(ii) Pressure

(5marks)

b) Outline mechanical pulping

(6marks)

c) State FOUR raw materials for manufacture of ordinary glass.

(4marks)

d) State :-

- (i) Three conditions imposed in conveying zone of kiln which govern the quality of the cement clinker. **(3marks)**
- (ii) Advantage of silicate cements over Portland cements **(2marks)**
- (iii) Differentiate between green liquor and white liquor **(4marks)**
- (iv) List TWO types of furnaces used in glass manufacture and state when each is used **(4marks)**
- (v) Name an important by product from black liquor chemical recovery and state its use in paper manufacture. **(2marks)**

Question TWO

- a) State TWO types of materials necessary for cement manufacture. **(2marks)**
- b) Describe cement manufacture by the wet process **(5marks)**
- c) Name the FOUR clinker bogue compounds responsible for cement properties and state the property each is responsible for. **(6marks)**
- d) State the formulae for the three control factor used in the cement manufacture **(7marks)**

Question THREE

- a) List any THREE sources of raw materials for pulp and paper manufacture **(3marks)**
- b) State the functions of the following paper additives
 - (I) Rosin emulsion
 - (II) Dyes **(2marks)**
- c) State FOUR properties of the fillers that are used in paper manufacture **(4marks)**
- d) Figure I is a simplified flow diagram for pulp production using magnesium hydrogen sulphite.
 - (i) Identify stream labelled P and Q, and the units labelled 1,2,3 and 4
 - (ii) State the advantage of using magnesium hydrogen sulphite over calcium hydrogen sulphite in sulphate pulping.
 - (iii) Outline the next treatments the pulp undergoes to produce a relatively pure pulp

Question FOUR

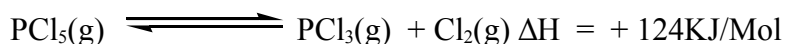
Assume you are a newly employed chemical process engineer at a proposed sulphuric acid manufacturing plant on examining the design data, you come across the following reaction that has been proposed hydration of sulphur-trioxide to produce sulphuric acid.



- a) (i) Would you agree or disagree with this proposal **(1mark)**
 (ii) Give reasons for your opinion of (i) above **(3marks)**
 (iii) From your knowledge of the manufacture of sulphuric acid, what alternative would you give? **(4marks)**
- b) State any FOUR reason why deodorized ethanol is considered a suitable vehicle in perfumes **(4marks)**
- c) Define fertilizer and from your knowledge of salts, differentiate between organic and inorganic fertilizers. **(4marks)**
- d) Define the term “Broke” as used in the paper manufacture **(2marks)**
- e) Explain TWO types of broke **(2marks)**

Question FIVE

- a) List THREE sulphide ores used in sulphuric acid manufacture. **(3marks)**
- b) For the reversible reaction which is in equilibrium



- (i) State THREE ways by which the rate of production of Cl_2 is enhanced. **(3marks)**
- (ii) Explain the effect of the following on the reaction.
- . Doubling partial pressure of gas PCl_5
 - . Doubling the size of the reaction vessel
 - . Adding an inert gas
 - . Increasing the reaction temperature
 - . Increasing the reaction temperature
 - . Withdrawing product gases PCl_3 and Cl_2 .
 - . Doubling the concentration of the reactant gas. **(8marks)**

- (iii) Wet ammonium nitrate granules were found to contain 60% by wt water. After

drying it was found that 80 % of the original water was removed. Calculate the water solid composition by weight of the dried salts. **(6marks)**