THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN CHEMICAL ENGINEERING

ECH 2305: INDUSTRIAL CHEMICAL PROCESSES III

YEAR III SEMESTER I SUPPLEMENTARY EXAMINATION

SERIES: MARCH 2012

TIME: 2 HOURS

INSTRUCTIONS:

You should have the following for this examination:

- Non-programmable Scientific calculator
- Answer booklet
- Writing material (Pen, Pencil, Rubber and Ruler) Only*!*

This paper consists of TWO sections; **A** and **B**.
Answer **ALL** questions in section **A** and any **TWO** questions in section **B**.
Section **A** carries **20 marks** while section **B** carries **40 marks**.
Each question in section **A** carries **5 marks** while in section **B** carries **20 marks**.
Maximum marks for each question / part of question are as indicated.
This paper consists of **THREE** Printed pages.

---

1. (a) <u>Define</u> cement setting. [2 marks]

   (b) <u>State</u> the **three** types of cement setting. [3 marks]

2. (a) <u>Define</u> glass. [2 marks]

   (b) <u>Differentiate</u> the two types of furnaces used in glass making. [3 marks]

3. (a) <u>Name</u> the **three** basic raw materials used in ceramic industries. [3 marks]

   (b) <u>State</u> **two** properties (physical/chemical) related to refractories. [2 marks]

4. (a) <u>Define</u> environmental pollution in relation to chemical processing industries. [2 marks]

   (b) <u>Name</u> **three** sources of CO_2 associated with Portland cement manufacture. [3 marks]

SECTION B

5. (a) <u>Name</u> **four** cement clinker bogue compounds responsible for cement properties.

   [2 marks]

   (b) <u>Describe</u> cement manufacture by the wet process. [4 marks]

   (c) The following materials and equipment are to be used in the manufacture of cement.

   Raw materials: Gypsum, limestone, clay

   Equipment: Rotary kiln, cement mill, raw mixture mill, clinker silo, raw mixture silo.

   <u>Draw</u> a block flow diagram to represent the cement manufacturing process. [7 marks]

   (d) <u>Proportionate</u> to 92% lime saturation factor shale and limestone with the following

   percentage composition;

	SiO_2	Al_2O_3	Fe_2O_3	CaO
Shale	50.6	24.12	0.81	4.32
Limestone	3.10	0.7	0.42	60.12

$$L.S.F. = \frac{\%CaO - 0.7\,SO_3}{2.8\,SiO_2 + 1.2\,Al_2O_3 + 0.65\,Fe_2O_3}$$

   [7 marks]

6. (a) With the aid of diagrams, <u>differentiate</u> a food chain from a food web. [4 marks]

   (b) Briefly <u>explain</u> the following terms giving suitable examples where applicable.

   (i) Point source pollution. [3 marks]

   (ii) Non-point source pollution. [3 marks]

   (c) <u>Explain</u> the effects of the following cycles on the environment; [6 marks]

   (i) hydrological,

   (ii) nitrogen,

(iii) oxygen.

(d) <u>Define</u> eutrophication and state any **two** of its effects. [4 marks]

7. (a) <u>Explain</u> the main chemical composition difference between soda-lime glass and lead

glass. [2 marks]

(b) <u>State</u> **three** properties of glass that make it conducive for its applications. [3 marks]

(c) A sample glass composition is SiO_2 (silica) 71%, CaO (lime) 8.5%, Al_2O_3 (alumina)

1.5%, Na_2O (sodium) 15.5%, MgO (magnesia) 3.5%. The raw materials for glass

manufacture has the composition as shown in the table below.

Material	SiO_2	Na_2O	CaO	MgO	Al_2O_3	Fe_2O_3	Fusion loss
Silica (sand)	98.54	–	0.58	–	0.64	0.13	0.11
Soda	–	57.2	–	–	–	–	42.8
Lime	1.47	–	53.9	–	–	0.6	44.2
Dolomite	3.2	–	27.06	19.62	2.57	0.53	47.02
Technical Alumina	0.4	–	0.35	–	97.9	0.05	1.30

Given that fusion loss is the loss of material during the melting process, determine the

respective quantities of the raw materials in a batch of a mixture required to produce

100 kg of the sample glass whose composition is stated above. [15 marks]