

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME – LEVEL 5

INDUSTRIAL CHEMISTRY - CMU3232

FINAL EXAMINATION 2013/ 2014



Date: 23.11.2014

Time: 9.30 a.m. – 12.30 p.m.

Part II (60 marks)

Answer four out of six including compulsory question number 1.

1.a. Which one out of the two clays given below is more suitable to be used as refractory clay? Give reasons for your choice.

(A) A clay with a high percentage of alumina with no feldspar.

(B) A clay with mica, feldspar, iron oxide and a small percentage of alumina.

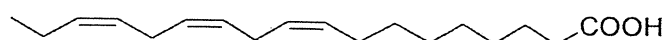
(30 marks)

b. Explain the differences in the density and the refractive index of the two types of glasses mentioned in the table below.

	Soda glass	Lead glass
Density (g cm^{-3})	2.20	3.05
Refractive index(at $\lambda = 589 \text{ nm}$)	1.459	1.560

(20 marks)

c. Consider the following fatty acid, Z

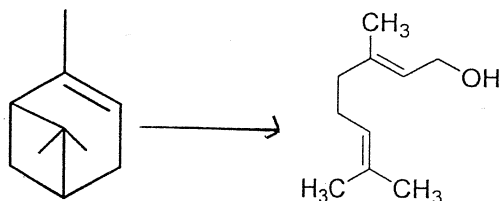


Z

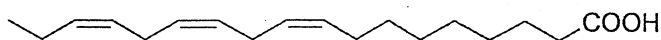
Give short hand notation for Z.

- (i) Write down its IUPAC name.
(ii) What is meant by the term "Autooxidation of fatty acids"?
(20 marks)
- d. (i) Give **two** essential oil bearing plants with plant parts used and one major ingredient present in each case.
(10 marks)
- e. (i) What is Octane number? What are the major techniques used in refining process to increase the octane number?
(ii) How is polyvinyl acetate made from simple petrochemicals?
(20 marks)
- 2.a. (i) What is the main function of silica in a ceramic body?
(ii) Discuss the meaning of the following terms in relation to ceramic industry?
(A) slip (B) powder pressing (c) flux
(30 marks)
- b. (i) Montmorillonite and Kaolinite are two different clay minerals referred to as 2:1 mineral and 1:1 mineral.
(A) What basic structural differences exist between the two mineral types mentioned above?
(B) Which is more suitable to be used in the manufacture of ceramic ware? Why?
(ii) Name **one** property which makes silicon nitride a suitable new ceramic? Relate the named property to its structure.
(40 marks)
- c. (i) Name **two** advantages of using a glaze on a ceramic body.
(ii) Why is it important to select carefully the firing temperature of a glaze?
(iii) What special property of TiO_2 contributes when it is added to a glazing mixture?
(30 marks)
- 3.a (i) What is meant by the statement "glass lacks long range order"?
(ii) What is the significance of glass transition temperature, T_g ? What will be the nature of a glass mixture below and above T_g ?
(30 marks)
- b. (i) Explain how the concept of "oxidation-reduction" is used in the manufacture of photo chromic glasses.

- (ii) Name **one** possible feature you may observe in an article which has not undergone “annealing”. **(40 marks)**
- c. (i) Name **one** physical parameter that will change through any differences between the compositions of soda glass and borosilicate glass. Name one consequence of such a difference.
- (ii) What are the special properties associated with each of the following glass types:
(A) Non-reflective glass (B) Tempered glass (c) Tinted glass **(30 marks)**
4. a. State the major heavy minerals found in Pulmodai beach? **(10 marks)**
- b. What are the chemical and physical characteristics of them? **(10 marks)**
- c. Explain the major steps involved during the separation of mineral sands from Pulmodai. **(40 marks)**
- d. Explain the chemical process during the synthetic rutile production **(40 marks)**
- 5.a. (i). What is meant by value addition of essential oils?
- (ii). Show how the following chemical conversion can be carried out.

**(40 marks)**

- b. (i) Linoleic acid (C₁₇H₃₁COOH, relative molecular mass 280) and stearic acid (C₁₇H₃₅COOH, relative molecular mass 284) both contain similar carbon atoms and similar masses. Explain why the melting point of linoleic acid is considerably lower than the melting point of stearic acid. **(15 marks)**
- (ii). Calculate the iodine number of the following fatty acid Z.



[Relative atomic masses: C = 12, H = 1; O = 16] (10 marks)

- c. Draw a flow diagram to show how edible oils are refined from crude oil and explain the important steps.

(35 marks)

6. a. (i) What is the difference between catalytic cracking and thermal cracking?
 (ii) Describe how ethylene is formed during thermal cracking.

(30 marks)

- b. (i) What is alkylation in catalytic reforming?
 (ii) How does the alkylation process differ from the polymerization process?

(40 marks)

- c. (i) How is caprolactam produced from cyclohexanone in the nylon industry?
 (ii) Give the mechanism involved.

(30 marks)