THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME – LEVEL 5

INDUSTRIAL CHEMISTRY – CHU 3237

FINAL EXAMINATION 2012/13

3 Hours

Date: 31.05.2013 **Time: 9.30 a.m. – 12.30 pm.**

- This question paper consists of two sections. **Part I (Short questions)** and **Part II (Structured type).**
- **Part I** consists of **15** short questions; recommended time to complete this part is one hour.
- **Part II** consists of six questions; you are expected to answer four questions including **one compulsory** question to be answered out of six. Recommended time to complete this is two hours.

Part 1 (40 marks)

Index Number ---------- **Signature of Invigilator**----------

1 . Write down the raw material used and the process involved for the extraction of the following metals:

	Raw materials	process
Aluminium	....	.....
Iron	.....	.....

(04 marks)

2. Write chemical equations for the production of normal superphosphate (NSP) and triple superphosphate (TSP) from fluorapatite, [3 $Ca_3(PO_4)_2$. CaF_2]

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(02marks)

3. Is there any difference between the X-ray diffraction patterns of KCl and glass? Give reasons for your answer.

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(02 marks)

4. What is referred to as "water glass"? Why is it not suitable to make glass articles?

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(02 marks)

5. Distinguish between 'setting' and 'hardening' of cement.

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(02 marks)

6. Name **four** types of corrosion

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(03 marks)

7. What is meant by 'metal finishing'? Write down **three** types of metal finishing.

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(04 marks)

8. Write important characteristics that determine the quality of table salt. How do you achieve these characteristics in the normal salt?

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(02 marks)

9. How is soda ash obtained naturally? Write equations for the production of sodium sulphite from soda ash.

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(04 marks)

10. What is pungency?

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(02 marks)

11. Give **two** examples for special spice products.

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(02 marks)

12. Draw a flow diagram for the manufacture of dried green pepper.

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(03 marks)

13. Give the full structure of C18: 3 Δ 9c, 12c, 15c)

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(02 marks)

14. What are the factors that affect the melting points of fats and oils?

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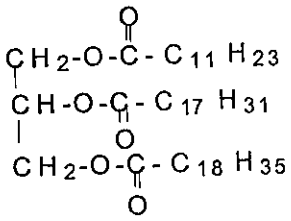
(02 marks)

15. Calculate the iodine value of the following compound.

[Relative atomic mass C= 12; H=1; O=16; I =127]



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(04 marks)

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Part II (60 marks)

Answer **four** out of six including **compulsory question number 1.**

1.a. (i) Write **two** examples each of products manufactured in industries based on latex and dry rubber.

(ii) Describe the environmental pollution problems associated with the discharge of effluents from rubber industry. (25 marks)

b. (i) Briefly describe the important features of the Ellingham diagram for metal oxides.

(ii) Write the advantages of this diagram in extraction metallurgy. (30 marks)

c. (i) What is meant by the 'throwing power' of a plating bath?

(ii) List **three** factors that determine the value of the above parameters.

(iii) Briefly explain why plating becomes uniform when the metal ion in the plating bath is present as a complex ion.

(25 marks)

d. Linear thermal expansion coefficient values of two types of manufactured glass are given in table below.

Glass type	Linear Thermal expansion coefficient /^{0}C
Soda glass	8.6×10^{-6}
Borosilicate glass	3.3×10^{-6}

(i) What is meant by the linear thermal expansion coefficient?
(ii) Giving reasons explain which type of glass is more suitable for the manufacture of laboratory ware used at high temperatures?

(20 marks)

2. a. (i) State **one** disadvantage of traditional ceramics over metals.

(ii) Name **two** properties that should be associated with a good refractory clay.

(20 marks)

b. Comment on the (i) melting point (ii) viscosity (iii) density (iv) refractive index of a glass mixture containing lead/ lead compounds. State any advantages related to change in refractive index.

(30 marks)

c. What precautionary measures are taken by glass manufactures in producing car windscreen glasses?

(20 marks)

d. Explain why Silicon nitride has long been used in high-temperature applications. Chemically, how does Silicon nitride differs from Sialon? (30 marks)

3.a. (i) What is meant by 'spice oleoresins'?
(ii) Give **two** methods that could be used to obtain oleoresins from a spice.
(iii) Which one is the better method? Explain why?

(30 marks)

b. (i) Give the major components of essential oils derived from the following plants.
cinnamon bark, clove, lemon grass and *Pinus caribae.*
(ii) Give **five** methods that are used in quality control of spices and oils.

(20 marks)

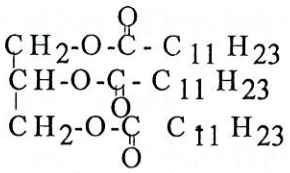
c. (i) What is meant by the term 'value addition' to spices?
(ii) Explain how value addition can be applied to pepper.
(iii) Explain briefly how value added pink ginger is prepared?
(iv) Name three value added products of ginger other than pink ginger.

(30 marks)

d. (i) What are rosins?
(ii) Draw and label a simple flow diagram to show the production of rosin and turpentine from pine trees.

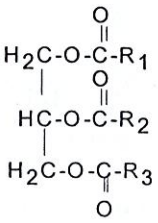
(20 marks)

4. a. (i) Define the saponification value of a fat and write the significance of this term.
(ii) Estimate the saponification value of glyceryltrilaurate.
[C = 12; H = 1; O = 16; K = 39]



(20 marks)

b. (i) Briefly describe the processes 'splitting', 'reduction' and 'transesterification' of fats and oils by using the following as an example in each case.



(ii) Give an important use of each of these processes.

(40 marks)

c. (i) What physical property of a natural oil would change due to interesterification?
(ii) Write down a chemical equation to describe interesterification.

(20 marks)

d. What is meant by the term Rancidity of oils? How does it occur in oils?

(20 marks)

5. a. (i) What do you understand by the term 'octane number' of a fuel.
(ii) State **three** methods that could be used to increase the octane number?
(iii) Give **three** additives that are added to increase octane number of petrol.

(30 marks)

b. (i) What is the purpose of refining petroleum?
(ii) What are the main operations involved in refining process?

(10 marks)

c. Methanol is an important industrial chemical produced by a process called steam reforming.
(i) Write down the basic reaction of steam reforming.
(ii) Write down the reaction that converts the products of steam into methanol.
(10 marks)

d. (i) What is meant by the term catalytic cracking of petroleum?
(ii) List **three** advantages of catalytic cracking over thermal cracking.
(iii) What catalysts can be used in fluid catalytic cracking?

(iv) What are the products that are made from propylene via the following reactions.
Propylene

1. $Propylene \xrightarrow{\text{Ziegler-catalyst}} A$
2. $Propylene \xrightarrow{H_2O,\text{solid acid catalyst}} B \xrightarrow{Zn/Cu\ \ 400-500^{o}\ C} D$

(50 marks)

6. a. (i) Distinguish between mortar and concrete.

(ii) Identifying the raw materials used, and draw the flow chart for the wet process of manufacture of Portland cement.

(40 marks)

b. (i) Distinguish between 'flash setting' and 'false setting'. How can you overcome false setting?

(ii) Write the **four** main crystalline phases present in cement clinker. Identify the crystalline phase(s) responsible for initial set, early strength and long- term strength.

(iii) Write down the product(s) of hydration of the crystalline phases indicated in (ii). Assume hydration in the absence of gypsum.

(60 marks)