THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME – LEVEL 5

INDUSTRIAL CHEMISTRY – CHU3237

FINAL EXAMINATION 2013/14

Date: 23.11.2014 **Time: 9.30 a.m. – 12.30 pm.**

Part II (60 marks)

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

1.a. (i) Identifying the raw materials used, write down the essential steps in the process of extraction of iron.

(20 marks)

b. (i) Briefly explain the importance of sulphuric acid in chemical industries.

(ii) Outline the environmental factors that need to be considered before setting up a Sulphuric acid plant in Sri Lanka.

(20 marks)

c. (i) Write down the important steps in the manufacture of soda ash.

(ii) Write equation(s) for the production of sodium sulphide from sodium chloride.

(20 marks)

d. Briefly describe the phenomenon 'passivation'. Draw and label *i* vs. *E* curve for a metal, M that exhibits passivation. **(20 marks)**

e. (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?

(20 marks)

2.a (i) What is the main function of silica in a ceramic body?

(ii) Discuss the usage of the following terms in relation to ceramic industry. At what stage of the production are they being used?

(A) slip **(B)** powder pressing **(C)** flux

(30 marks)

b. (i) What is meant by the statement" glass lacks long range order"?

(ii) What is the significance of glass transition temperature, T_g? State the nature of a glass mixture below and above T_g?

(30 marks)

c. (i) 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.

(ii) Name **two** properties which make silicon nitride a suitable new ceramic. Relate the named property to its structure.

(40 marks)

3.a. (i) Explain what is meant by the terms;

(A) Spice oil
(B) Spice oleoresin.

(ii) List **three** Sri Lankan spices (with the part used) and **one** major ingredient present in the oil of each of them.

(25 marks)

b. (i) What are pungent principles?

(ii) Give one example for pungent principles of each of the following spices?

1. Ginger 2. Pepper 3. Chilli **(10 marks)**

c. (i) What are rosins?

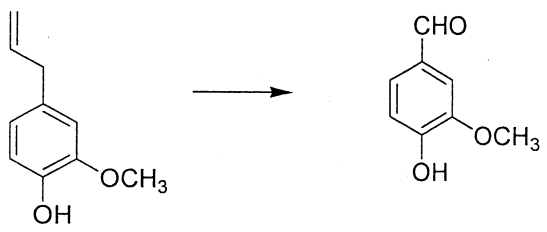
(ii) Give **three** industrial applications of rosin.

(iii) Draw and label simple flow diagram to show production of rosin from pine tree.

(20 marks)

d. Show how you would carry out the following conversion.

(ii)



(15 marks)

e. (i) What is value addition of a natural product?

(ii) Explain how value is added to pepper.

(iii) Give **three** value added products of ginger. **(30 marks)**

4.a. (i) Briefly explain what is "Octane number" of a fuel?

(i) Give **two** methods that used to increase the octane number?

(ii) Petrol used in cars has an octane number of 90. Would the addition of the following compounds increase or decrease the octane number?

1. iso-octane 2. n- hexane 3. toluene 4. methyl tertiary butyl ether

(iv) What is the major product of each of the following reactions?

1. $CH_3CH_2CH_2CH_2CH_3 \xrightarrow{\text{Pt catalyst, Heat}} ?$
2. $CH_3CH_2CH_2CH_2CH_2CH_2CH_3 \xrightarrow{\text{Cu, } 650^{\circ}\text{C}} ?$

(40 marks)

b. (i) Propylene is an important feedstock in the petrochemical industry. What are the products that are made from propylene via the following reactions?

1. $CH_3{-}CH = CH_2 \xrightarrow{\text{Zigler Natta catalyst}} A$

2. $CH_3CH = CH_2 \xrightarrow{\text{Hydration, Solid acid catalyst}} B \xrightarrow{\text{Zn or Cu } 400-500^{\circ}\text{C}} C$

(15 marks)

c. (i) What is meant by visbreaking in petroleum industry?

(ii) What are the purposes of carrying out visbreaking in petroleum industry?

(15 marks)

d. (i) List **five** polymers of industrial value that can be obtained through petrochemicals.

(ii) Write brief account of the following.

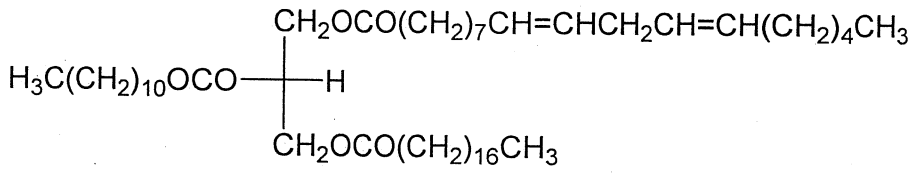
(A) Mordant dye (B) Vat dying (C) Auxochrome

(30 marks)

5. a. (i) Define iodine number of an oil.

(ii) Calculate the iodine value for the following compound triglyceride A.

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



A

(iii) What are the factors that affect the melting point of fats?

(iv) What is meant by the term "slip point" of fats?

(30 marks)

b. (i) Give the conditions necessary for hydrogenation of oil.

(ii) What are the purposes of hydrogenating oil?

(20 marks)

c. Briefly describe the method of determining fatty acid composition of oils.

(30 marks)

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

(20 marks)

6. a. (i) Distinguish between 'setting' and 'hardening'.

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

(iii) Write **two** important differences between the dry process and wet process of manufacture of Portland cement.

(50 marks)

b. (i) Briefly describe the changes that take place when the crystalline phase C_3S undergoes hydration. How does that compare with hydration of C_2S?

(ii) Identify the crystalline phase(s) responsible for initial set, early strength and long-term strength.

(50 marks)