THE OPEN UNIVERSITY OF SRI LANKA

B.Sc DEGREE PROGRAMME/ STAND ALONE COURSES- LEVEL 5

CHU3237/CHE 5237 INDUSTRIAL CHEMISTRY- PAPER II

FINAL EXAMINATION- 2008/2009

(2 ½ HOURS)

Wednesday 1st July 2009 ***1.30 p.m.– 4.00 p.m.***

Answer any FOUR (04) questions. ***Only the first four answers will be marked.***

1(a)(i) Write the raw materials used in glass industry. What specific role(s) does each of these chemicals play in a glass mixture?

(ii) As you know viscosity is the most important physical property of glass melt in the manufacturing process. Briefly describe the variation of viscosity with temperature for soda lglass and write the significance of the 'working range'.

(iii) What is meant by 'annealing'?

(iv) What is meant by 'glass transition temperature' (T_g)? (50 marks)

(b)(i) Write down the raw materials used in ceramic industry. Briefly explain the function of each raw material in a ceramic body.

(ii) What are refractory clays? Give two properties of good refractory clay. (25 marks)

(c) Titanium dioxide is one of the common chemicals used in glazing ceramic product.

(i) What do you mean by a 'glaze'?

(ii) Write two advantages of using glaze on a ceramic article.

(iii) What role is played by TiO_2 in a glaze?

(v) Transition metal oxides are widely used as glazes in ceramic industry. Explain why this is so. (25 marks)

2. (a)(i) Petroleum refining involves 'cracking' and 'reforming' operations. Distinguish between these two terms.

(ii) What is the purpose of catalytic reforming? What are the main products of the reactions?

(iii) What do you mean by hydro cracking? What is it used for? (40 marks)

(b)(i) What is meant by octane number?

(ii) What methods can be used to increase the octane number? (15 marks)

(c) List five polymers of industrial value that can be obtained through petrochemicals. (10 marks)

(d) Using aniline as a starting material, briefly describe the synthesis of Indigo. (20 marks)

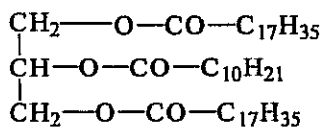
(e) Write short notes on the following:
(i) Catalytic cracking (ii) Mordant dye (iii) Natural colorants (15 marks)

3.(a)Giving appropriate examples, briefly discuss 'components of spices'. (30 marks)

(b) Discuss the method including the technology of isolating lemongrass oil as a cottage industry. (35 marks)

(c) Using appropriate examples and diagrams describe methods involved in fractionation of essential oils for the purpose of value addition. (35 marks)

4.(a) An oil contains the following triglyceride as the main ingredient:



(i) Write down the chemical equations, giving conditions, for splitting and interesterification of this triglyceride.
(ii) Briefly describe a chromatographic method for the analysis of the oil.
(iii) Define the term 'saponification value' and write its significance. Estimate the saponification value of the oil.
(H= 1, C= 12, O= 16, K= 39) (50 marks)

(b) Write the conditions necessary for hydrogenation of oil. What is the purpose of hydrogenating oil? (20 marks)

(c) Write the starting materials used in the preparation of alkyd resins. (15 marks)

(d) What are the main tests for the quality of oils and fats? (15 marks)

5. Answer any **two** of Parts **A, B** and **C**.

Part A

(a) Briefly describe the essential features of an Ellingham diagram. What are the advantage(s) of it? (25 marks)

(b) Briefly describe industries based on dolomitic limestone in Sri Lanka.
(10 marks)

(c) Briefly explain the importance of the manufacture of H_2SO_4 for many other chemical industries. (15 marks)

Part B

(a)(i) Write down the expression for the corrosion current ($i_{corrosion}$) if a piece of metal weighing w_1 g, dropped into an aqueous solution of the metal ions weighed w_2 g ($w_1 > w_2$) after time t s. Define any other term(s) in it.

(ii) A piece of metal M (Relative Atomic Mass = 102) of weight 1.123g is dipped in an aqueous solution of M ions. After two hours, the weight of dried metal was found to be 1.02g. Calculate the corrosion current. ($F = 96485\ C\ mol^{-1}$) (30 marks)

(b) What is measured by the 'throwing power' of a plating bath? List the factors which determine the value of the above parameter. (20 marks)

Part C

(a) Write down the essential steps involved in the process of manufacture of A.R. grade sodium chloride. (15 marks)

(b) Briefly describe the process of manufacture of free- flowing table salt. (15 marks)

(c) Soda ash is obtained from underground deposits of trona in Wyoming. Elsewhere, it is manufactured by the ammonia- soda (Solvay) process.
(i)Write chemical equation(s) for the production of soda ash from trona.
(ii) Write the essential steps involved in the manufacture of soda ash in the Solvay process.
(20 marks)

6.(a)(i) Distinguish between mortar and concrete
(ii) Draw the flow chart for the semi dry process of manufacture of Portland cement, starting from limestone and clay.
(iii) Compare semi dry process vs. dry process of manufacture of Portland cement.
(50 marks)

(b)(i) Briefly describe the process of hydration of the crystalline phase C_3S.
(ii) Identify the crystalline phase(s) responsible for initial set, early strength and long-term strength. (30 marks)

(c) Briefly describe the standard tests available for cement. (20 marks)

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