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THE OPEN UNIVERSITY OF SRI LANKA

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

CHU 3237/CHE 5237 INDUSTRIAL CHEMISTRY- PAPER I

FINAL EXAMINATION- 2009/2010

(2 ½ HOURS)

Friday 2nd July 2010 *9.30 a.m.- 12.00 ~~p.m.~~ noon*

Reg. No.: .....

Attempt as many questions as possible.

Total mark allocated to this paper is 120. However, the maximum a candidate can score is 100 marks. Those who obtain more than 100 will be deemed to have scored 100 marks.

1. What is the function of a ball mill in ceramic industry? (2 marks)

2. What property of transition metals makes it possible to use their oxides as colouring agents along with glazes in ceramics? (2 marks)

3. Crystal glassware is made by adding special elements/compounds of elements to the glass body mixture. Name the most important element that is added in the preparation of crystal glassware. (4 marks)

4. Why is glass categorized as an amorphous solid ? (4 marks)

5. B_2O_3 is an ingredient added to make a special type of glass. What is this special type of glass? Why is it special? (4 marks)

6. "Glass ceramics" are known to have low thermal expansion. What are their advantages? (4 marks)

7. Briefly explain why boron nitride is referred to as "inorganic graphite". (4 marks)

8. Write **two** reasons for carrying out petroleum cracking. (4 marks)

9. State the products formed in each of the following reactions: (4 marks)

$$H_2C{=}CH_2 \xrightarrow[(2)\ 500^{O}C]{(1)\ Cl_2 / FeCl_3} \ ?$$

$$\text{Propylene} \xrightarrow[CO,\ H_2]{Ni\ /Co} \ ?$$

10. What are the pungent principles of the following spices?

(a) Ginger .....

(b) Chillie .....

(c) Pepper ..... (3 marks)

11. List the components of steam distillation equipment. (4 marks)

12. To how many categories cardamons are graded in Sri Lanka and on what basis? (5 marks)

13. Write chemical equations for splitting and interesterification of fat. Give the necessary conditions.

(6 marks)

14. Draw the flow chart for the extraction of coconut oil from copra. (6 marks)

15. Draw the full structure of the fatty acid, C18:2 Δ 9c, 12c (Linoleic).
Write the IUPAC name and the shorthand notation (using the Δ system).

(6 marks)

16. Define the term, 'slip point' of a fat. (2 marks)

17. Indicating the main location, name **two** main mineral sands found in Sri Lanka.

(4 marks)

18. Write **two** examples of products manufactured in the dry rubber – based industries.

(2 marks)

19. Write chemical equations to show how apatite from Eppawala in Sri Lanka can be converted to its useful products. (6 marks)

20. What do you understand by the term 'passivation'? (2 marks)

21. What is measured by the 'throwing power' of a plating bath? List the factors which determine the value of the above parameter. (6 marks)

22. When the metal ion in the plating bath is present in the form of complex ion, plating becomes uniform. Give reasons. (4 marks)

23. Suggest a method of production of iodine from natural I^- - bearing brine. (4 marks)

24. Draw a flow diagram for the production of free- flowing table salt. (4 marks)

25. How is soda ash obtained naturally? (4 marks)

26. List four products obtained from the salterns in Sri Lanka. (4 marks)

27. Write two examples of each of argillaceous material and calcareous material:

Argillaceous materials: ....

Calcareous materials: ....

(4 marks)

28. Write down the product(s) formed when the following clinker phases in Portland cement undergo hydration: (4 marks)

C_3S ..... C_3A (in the absence of gypsum).....

29. Identify the crystalline phase(s) responsible for the following:

Initial set: ..... Early strength: .....

Long- term strength: ..... (4 marks)

30. Write down the order in which the rate of hydration of the crystalline phases in Portland cement increases. (4 marks)

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

CHU 3237/CHE 5237 INDUSTRIAL CHEMISTRY- PAPER II

FINAL EXAMINATION- 2009/2010

(2 ½ HOURS)

Friday 2nd July 2010 *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 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 a good refractory clay.

(iii) What is meant by the cation exchange capacity of a clay mineral? Distinguish between cation exchange and isomorphous substitution in clay minerals.

(iv) Titanium dioxide is one of the common chemicals used in glazing ceramic product.
(I) What are glazes?
(II) Write two advantages of using a glaze on a ceramic article.
(III) What role is played by TiO_2 in a glaze?
(IV) Name two other compounds that could be used as glazes. (50 marks)

(b)(i) Giving examples explain the use of the terms "modifiers" and "stabilizers" in glass industry. What specific roles do they play in a glass mixture?

(ii) Why is it necessary for any glass article produced in a factory to undergo annealing"? Explain.

(iii) Silicon nitride, Si_3N_4 which is a network solid is referred to as "inorganic graphite". Sketch the structure of silicon nitride that qualifies the above statement. What properties of silicon nitride make it a suitable material for new ceramics?

(iv) Many people who wear eye glasses prefer those made with photochromic lenses. With relevant chemical equations explain the reason/s for this.

(50 marks)

2.(a)(i) Distinguish between the processes, 'cracking' and 'reforming'.
(ii) Briefly describe the processes, catalytic cracking and. thermal cracking.
(iii) List four advantages of catalytic cracking over thermal cracking
(iv) What do you mean by steam reforming and catalytic reforming? (50 marks)

(b) Ethylene, C_2H_2, can be converted to a large number of compounds.
(i) Write **three** such compounds.
(ii) Write conditions for each of these conversions. (30 marks)

(c) Write short notes on the following:
(i) octane number (ii) vat dyeing (iii) naphtha (iv) auxochrome
(20 marks)

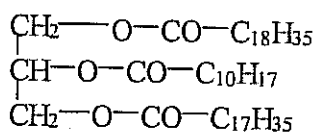
3.(a)(i) List three Sri Lankan Spices (plant and part used) and one major ingredient present in each case.
(ii) List three Sri Lankan essential oil bearing plants with the part used and one major ingredient present in each case. (30 marks)

(b) Briefly discuss how you would determine the eugenol content in a sample of essential oil using a chemical method. (15 marks)

(c) Sketch different types of oil collectors used in the essential oil production and explain their usage. (15 marks)

(d) Giving appropriate examples, write a short account on 'value addition' in the essential oil and spice industry. (40 marks)

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



(i) Define the term, 'iodine number' of oil and write its significance. Calculate the iodine value of the oil X.

(ii) Define the term 'saponification value' and write its significance. Estimate the saponification value of X.

(iii) Write down the chemical equations, giving conditions, for reduction and transesterification of this triglyceride. Give important use(s) of these reactions.
(H= 1, C= 12, O= 16, K= 39, I= 127) (70 marks)

(b) Write the three processes used for the preparation of soap. Briefly describe any <u>two</u> of them. (30 marks)

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

Part A

(a) Briefly explain why the graphs for metal oxides follow straight lines in the Ellingham diagram and slopes upwards. Why does this pattern change for some metals (e.g. Mg and Ca)? (20 marks)

(b) Briefly describe the type of products manufactured in the latex- based industries in Sri Lanka. (10 marks)

(c) Write essential chemical equations for the following reactions that take place in a blast furnace

(i) reduction of iron oxide (ii) slag formation (20 marks)

Part B

(a) Explaining the term 'corrosion', write equations to illustrate it. (15 marks)

(b)(i) What do you mean by 'metal finishing'? Give examples of different metal finishing processes.

(ii) How many grams of lead will be deposited from a solution of Pb^{2+} ions by a current of 0.15 A, flowing for 1 hour? (Pb= 207.2; 1 F= 96500 C) (20 marks)

(c) Briefly describe passivation using I vs. E plot for the metal. (15 marks)

Part C

(a) Draw a flow chart to show how the following could be produced, starting from sodium chloride. Give one use of each of these chemicals.
sodium bisulphite, sodium sulphate and sodium sulphide (15 marks)

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

(c) Briefly describe using appropriate equations, to show how

(i) bromine (Ethyl- Dow process) and (ii) magnesium (Dow process)
can be produced from seawater using the method indicated within brackets.
(20 marks)

6.(a) Distinguish between:

(i) mortar and concrete (ii) setting and hardening (iii) flash set and false set
(30 marks)

(b)(i) Draw the flow chart for the dry process of manufacture of Portland cement, starting from limestone and clay.

(ii) Compare the wet process with dry process of manufacture of Portland cement.

(iii) Indicating the temperature/ range of temperature, list the reactions taking place during burning of raw materials in the kiln. (50 marks)

(c) Briefly describe, identifying the instrument used in each case, the standard tests available for cement paste. (20 marks)

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