# The Open University of Sri Lanka
## Faculty of Natural Sciences
## B.Sc. / B. Ed Degree Programme

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|---|---|
| **Department** | **: Chemistry** |
| **Level** | **: 5** |
| **Name of the Examination** | : Final Examination |
| **Course Title and - Code** | **: Industrial Chemistry – CMU3232** |
| **Academic Year** | **: 2019/20** |
| **Date** | **: 1st November 2020** |
| **Time** | **: 9.30 a.m. – 12.30 p.m.** |
| **Duration** | **: 3 hours** |

**Part II (60 marks)**

It consists of **six (06)** questions; you are expected to answer **four (04)** out of six questions including the **first compulsory question.** Recommended time to complete this part is **two hours.**

1.a. i. Natural rubber is one of the major agricultural export products of Sri Lanka. What is the major chemical component present in Natural rubber?

ii. Describe the environmental pollution problems associated with the discharge of effluents from rubber industry.

iii. What do you understand by the term "throwing power" of an electroplating solution?

iv. Give **two (02)** main factors that determine the throwing power.

**(20 marks)**

b. i. State the function of a ball mill in a ceramic industry.

ii. Why is the said function important?

**(20 marks)**

c. i. What is meant by the statement "glass lacks long range order''?

ii. What is the significance of glass transition temperature, Tg?

iii State the nature of glass mixture below and above Tg?

**(20 marks)**

d. i. Define iodine number of an oil.

ii. What is the purpose of hydrogenating oil?

iii. Give the conditions necessary for hydrogenating oils.

**(20 marks)**

e. i. What is meant by visbreaking in petroleum industry?

ii. What are the purposes of carrying out visbreaking?

iii. List **three (03)** advantages of catalytic cracking over thermal cracking.

**(20 marks)**

2.a. i. Write down the essential steps in the manufacture of Portland cement. What is the most important step in manufacturing process?

ii. Draw the flow diagram for the manufacture of Portland cement by wet process.

**(40 marks)**

b. Draw the rotary kiln for the dry process showing the different temperature zones within it. Identify the type of reactions that take place within these temperature zones.

**(20 marks)**

c. i. Distinguish between 'setting' and 'hardening'.

ii. Giving the product of hydration reactions of the phases, $C_2S$, $C_3S$ and $C_3A$ (when $C_3A$: gypsum ratio is 1:1), compare the reaction rate, amount of heat liberated and contribution to strength of the phases, $C_2S$, $C_3S$ and $C_3A$ when they undergo hydration.

iii. What is the role of gypsum in setting of cement paste?

**(40 marks)**

3.a. Explain why Borosilicate glasses and fused silica are resistant to thermal shock.

**(20 marks)**

b. Will glass have a sharp melting point? Explain.

**(20 marks)**

c. i. What are the **three (03)** main components of a white ware ceramic such as porcelain?

ii. What role does each component play in the forming and firing procedures?

**(30 marks)**

d. i. It is said that the relationship between Sialon and $Si_3N_4$ is similar to that between brass and pure copper. Explain this statement by referring to the structures.

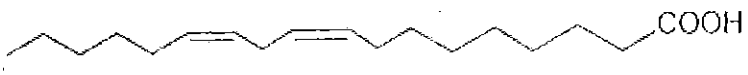
ii. Why is SiAlON considered a better ceramic than Silicon nitride?

**(30 marks)**

4. a. i. Draw the full structure of the following fatty acid.

C20:5 (5c, 8c,11c,14c.17c)

ii Classify the following unsaturated fatty acids as $\omega_x$ series.




iii. Write down the IUPAC name for the above fatty acid.

**(15 marks)**

b. i. What is meant by the term saponification number?

ii. What are its significance?

iii. Briefly explain how you would determine saponification number of a fat.

iv. 5.00 g of fat sample requires 12.70 ml of 1.0 M HCl to neutralize the unreacted KOH and 17.65 ml of the same acid was consumed during blank titration. Calculate the saponification number of the fat. [Relative atomic weight: K= 39; O =16; H = 1].

**(30 marks)**

c. i. What is meant by the term 'rancidity of oils?

ii. How does it occur in oils?

**(10 marks)**

d. Briefly explain the following terms.

i. Slip point

ii Flash point

iii. Smoke point

**(15 marks)**

e. i. Draw a flow chart to indicate the basic steps of cold process used in soap making.

ii. Give **three (03)** advantages of cold process.

iii What is meant by "photooxidation"?

iv. State **three (03)** factors that affect photooxidation.

**(30 marks)**

5.a. i. What is catalytic cracking of Petroleum?

ii. Show how olefin and branched olefin are formed from $CH_3CH_2CH{=}CH_2$ during catalytic cracking.

**(30 marks)**

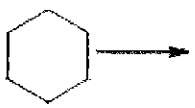
b. i. What is meant by the term 'octane number'?

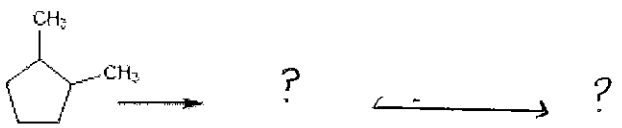
ii. What are the composition of blends used to measure an octane number of 90?

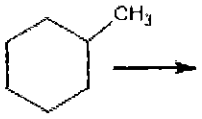
**(15 marks)**

c. i. Distinguish between cracking and reforming process involved in refining of crude oil.

ii. Give the products that could be formed during reforming for each of the following.








**(30 marks)**

d. i. List **two (02)** methods to show how ethylenedichloride can be produced from ethylene.

ii. Give the appropriate conditions that should be fulfilled to produce vinylchloride from ethylenedichloride

**(25 marks)**

6.a. Write down the major heavy minerals found in Pulmodai beach?

**(10 marks)**

b. Describe the stages how pure titanium dioxide is manufactured from the ore using sulphate process?

**(30 marks)**

c. Explain the refining method of zircon (pure and less pure) into zirconium metal.

**(30 marks)**

d. Explain the chemical process during the synthetic rutile production.

**(30 marks)**

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