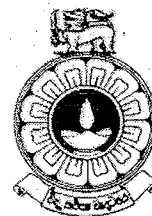


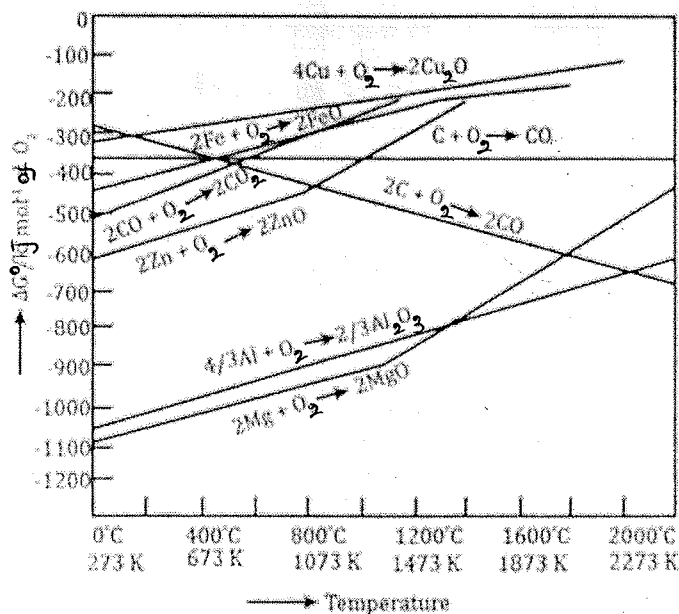
The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc. Degree Programme



Department : Chemistry
Level : 5
Name of the Examination : Final Examination
Course Code and Title : **CYU5312 Industrial Chemistry**
Academic Year : 2023/2024
Date : 05/10/2023
Time : 1.30 pm – 3.30 pm
Duration : 2 hours
Index number :

Answer All FOUR (04) questions. All questions carry equal marks.

1. A) Ellingham Diagram (Gibbs free energy change vs temperature) for the formation of metal oxides is given below.



- Write down the balance equation for extraction of Mg from its oxides by the cork reduction and calculate the percentage of atom economy for the Mg extraction. (Mg-24, C-12, O-16)
- Briefly explain whether Zn can be extracted by cork.
- “You cannot extract the Al by cork reduction”. Justify the statement.
- Giving reasons, suggest a most suitable method that can be used to extract the Fe other than the cork reduction. **(50 Marks)**

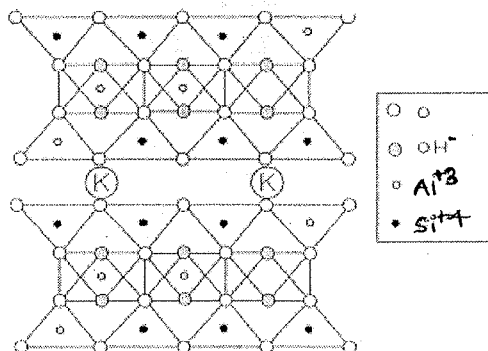
- B) A current of 5.36 A was passed through a highly concentrated electrolyte solution to plate the metal(M) to a plastic object. The metal deposited on the object is 7.2 g for 1 hour.
- What is electroplating?
 - Why highly concentrated electrolytic solution added to the plating bath during electrolysis?
 - Calculate the oxidation state of the metal M. The atomic mass of M is 72 g mol^{-1} and the Faraday constant is $96,500 \text{ C mol}^{-1}$.
 - “Irregular shape object cannot be plated easily”. Justify the statement.

(50 Marks)

2. A) Ceramic materials are inorganic, nonmetallic materials. They may be crystalline, glassy or both.
- State **three (03)** characteristic properties of ceramic materials.
 - Briefly describe the slip casting process in traditional ceramic process.
 - What are the purposes of drying ceramic products before firing?
 - Briefly explain the difference between traditional ceramic and advanced ceramic.

(20 Marks)

- B) Phyllosilicate clay minerals are potentially applied in Industries. Kaolinite is a phyllosilicate clay mineral that is used heavily in Ceramic Industry.
- Briefly discuss Kaolinite suitability for the ceramic industry based on its structural features.
 - Briefly explain what is meant by cation exchange capacity of clay minerals.
 - The structure of illite, phyllosilicate clay mineral is given below. Comment on its cation exchange capacity?



(30 Marks)

- C) Viscosity is an important physical parameter in the glass industry. The melting behavior of glasses depends on their viscosity – Temperature relationship.
- What is meant by the term “viscosity?”
 - Briefly explain the “working range” in glass technology.
 - What are photo chromic glasses?
 - Name two applications of photo chromic glasses.
 - Giving necessary chemical reactions, explain what happens when photochromic glasses are exposed to light.

(25 Marks)

- D) (i) Distinguish between setting and hardening and between false set and Flash set.
 (ii) Write **two (02)** major differences between the dry process and wet process of manufacture of Portland cement.
 (iii) Briefly describe the changes that take place when the crystalline phase C3S undergoes hydration.
 (iv) Identify the crystalline phase(s) responsible for initial set, early strength and long-term strength.

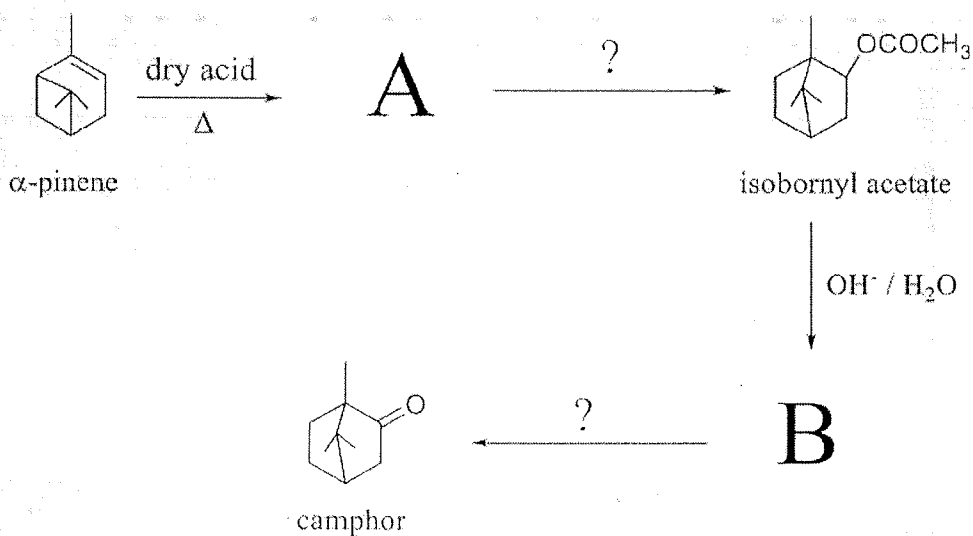
(25 Marks)

3. A) Briefly discuss the principle, equipment and different methods used in the isolation of essential oils and spice oils.

(30 Marks)

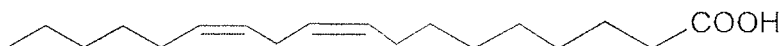
- B) Pure α -pinene compound is obtained from pine turpentine by high vacuum fractional distillation. It is converted to more value-added product, camphor by chemical conversion

- (i) What is pine turpentine?
 (ii) What is meant by value addition?
 (iii) Show by indicating the reagents and/ or the conditions how the following chemical conversion was carried out to obtain camphor.



(30 Marks)

- C) Unsaturated fatty acids are classified as ω_x series. Classify Linoleic acid as ω_x .



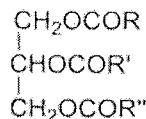
Linoleic Acid

- (i) Give a shorthand notation for Linoleic acid
 (ii) Write down the IUPAC name for Linoleic acid.
 (iii) Discuss the variation in the melting point of the following fatty acids A, B and C.
 A [18:0] = 69.6 °C B [18:1 (cis)] = 16.3 °C C [18:1(trans)] = 43.7 °C

(20 Marks)

D) Biodiesel is a value-added product which is produced from edible or non-edible oils by trans esterification.

- (i) What is biodiesel?
- (ii) What is meant by transesterification?
- (iii) Show how the following triglyceride is converted to biodiesel by chemical equation?



- (iv) What does B20, blends of biodiesel denote? (20 Marks)

4. A) Acidic and metallic components are used during the hydrocracking to produce gasoline.

- (i) What is hydrocracking?
- (ii) Write down an example of acidic and metallic components separately that are used to facilitate hydrocracking and identify the reactions that are facilitated by each component.

(20 Marks)

B) Octane numbers are used to explain the knocking characteristics of gasoline.

- (i) Draw the structure of iso-octane.
- (ii) Draw the mechanism for the formation of iso-octane starting from iso-butene through the alkylation reaction.
- (iii) "Octane number of 2-hexene is higher than n-hexane" Justify the statement.
- (iv) Write a balanced chemical reaction that increases the octane number of hexane during the refining process.

(45 marks)

C) Ethylene is produced by the thermal cracking of the propane and relevant alcohol is formed by direct hydration.

- (i) Write down the balanced chemical reaction for ethanol production with the conditions.
- (ii) Write down an impurity that formed during the direct hydration process.
- (iii) Thermal cracking of propene gives ethylene. Write down the balance chemical reaction.
- (iv) Write down three petrochemicals that are produced from ethylene for the polymer industry and name the relevant polymer formed by them.

(35 marks)
