00445

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

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| Department | : Chemistry |
| Level | : 5 |
| Name of the Examination | : Final Examination |
| **Course Code and Title** | **: CYU5312 Industrial Chemistry** |
| Academic Year | : 2020/2021 |
| Date | : 06.12.2021 |
| Time | : 1.30 pm-3.30 pm |
| Duration | : 2 hours |
| Index number | : |

**General Instructions**

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Four** questions in **four** pages.
3. **Answer All FOUR (04) questions. All questions carry equal marks.**
4. Answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary.
5. Relevant log tables are provided where necessary.
6. Having any unauthorized documents/ mobile phones in your possession is a punishable offense.
7. Use blue or black ink to answer the questions.
8. Circle the number of the questions you answered in the front cover of your answer script.
9. Clearly state your index number in your answer script.

1) a. ZnS ore concentrate is first "roasted" before introducing the coke.

i) What is roasting in pyrometallurgy?

ii) Briefly explain why ZnS is first roasted.

(20 Marks)

b. Iron is extracted from its ore using carbon (coke) at higher temperature (>710 °C):

$$2Fe_2O_3(s) + 3\ C(s) \rightarrow 4\ Fe(s) + 3\ CO_2(g)$$

i) Sketch an Ellingham diagram for the above reaction and briefly explain the effect of coke on extraction of Fe from its oxide.

ii) What is the atom economy (%) of the above reaction?
(Fe- 56, O- 16, C- 12)

(40 Marks)

c. Electroplating is used to deposit Cu on an anchor shape object from a solution of $Cu^{2+}$ complex ions by using 0.15 A current for 1 hour?

i) What is electroplating?

ii) Calculate the amount of Cu in grams deposited on the object?
(Faraday constant = 96,485 C $mol^{-1}$, Cu = 63.5 g $mol^{-1}$)

iii) Briefly explain the reason for introducing metal ions in complex form.

(40 marks)

2) a. Clay in ceramic and glazes are used to seal the ceramic body.

i) Briefly explain why Kaolinite type clay is commonly used in ceramic industry.

ii) Write down the three main components of glaze used in traditional ceramic industry with their main function?

(30 Marks)

b. Lime stones are added during the glass production.

i) Briefly explain the reason to add lime stones.

ii) Briefly explain why thick cold glass may crack when hot water is poured onto it.

(30 Marks)

c. There are seven stages in the production of Portland cement and the major phases present in Portland cement are C3S, C2S, C3A and C4AF

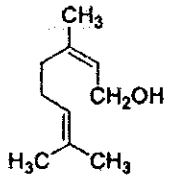
i) What are the essential raw materials used to make Portland cement?

ii) What are the different stages in the process of manufacture of Portland cement?

iii) Write down the balance chemical equations for the initial hydration of $C_3S$ and $C_3A$ in the absence of gypsum?

(40 Marks)

3) a. Steam distillation is used to extract the essential oils from the geranium plant. The formed geraniol is separated and converted to value-added products by hydrogeneration reactions.




geraniol (*trans-*)

i) Write down two advantages of steam distillation over water distillation during the essential oil extraction?

ii) Give two value-added products of geraniol after the hydrogenation with the hydrogenation conditions.

iii) Write down a use of each product.

(40 Marks)

b. Ginger oleoresin is commercially extracted by single stage extraction method.

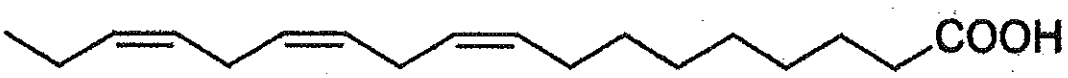
i) What is the common pungent compound present in fresh ginger?

ii) Explain the single stage extraction method.

(20 Marks)

c. Margarine is made from vegetable oils and contained unsaturated fats

i) Write down the IUPAC name of the following fatty acid?




ii) Draw the fatty acid structure indicated by the short-hand notation as 18:2 ω3.

iii) Compare the melting points of above two compounds in (i) and (ii).

iv) Briefly explain the reasons to add β-carotene and citric acid in the processing of Margarine.

(40 Marks)

4) a. Thermal cracking is used in petroleum industry.

i) What is meant by thermal cracking?

ii) Describe how ethylene is formed during thermal cracking.

(30 Marks)

b. MTBE (*methyl tertiary butyl ether)* is used to increase the octane number of the gasoline.

i) Define the term "octane number"?

ii) Starting from the C4 olefine uses for the production MTBE, briefly explain how to produce branched olefine in presence of catalyst.

iii) Compare the octane number of 2-methylbutane and pentane.

(50 Marks)

c. Two reactions are used to form formaldehyde from methanol.

i) Write down the balance equation for two reactions explain above.

ii) Write down a polymer material formed by formaldehyde?

(20 Marks)

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