UNIVERSITY OF RUHUNA

BACHELOR OF SCIENCE GENERAL DEGREE - LEVEL III (SEMESTER II) EXAMINATIONS – JANUARY 2018

SUBJECT: Chemistry

COURSE UNIT: CHE 321β **TIME: Three (02) hours**

Answer **Four (04)** questions only

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1. (a) (i) Le Chatelier's principle may be stated as "*if an external **stress** is applied to a **system at equilibrium**, the system adjusts in such a way that the stress is partially countered*".
Discuss this principle paying special attention to bolded phrases.

[15 marks]

(ii) Consider the following reactions at equilibrium:

(I) $2PbS(s) + 3O_2(g) \rightleftharpoons 2PbO(s) + 2SO_2(g)$

(II) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(III) $H_2(g) + CO_2(g) \rightleftharpoons H_2O(g) + CO(g)$

Giving your reasons, predict the direction of the net reaction in above systems as a result of increasing pressure at constant temperature.

[15 marks]

(iii) Consider the ammonia synthesis reaction:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The equilibrium constant K_C at 375 °C is 0.65.
Starting with $[H_2]_0 = 0.76$ mol dm^{-3}, $[N_2]_0 = 0.60$ mol dm^{-3}, and $[NH_3]_0 = 0.48$ mol dm^{-3}, when this mixture comes to equilibrium, which would have increased in concentration and which would have decreased in concentration?

[20 marks]

(b) Answer the following questions pertaining to corrosion.

(i) Define the term corrosion.

[06 marks]

(ii) Galvanic corrosion or bimetallic corrosion is one of the forms of corrosion occurs on metallic surfaces.

(I) What is meant by the galvanic corrosion?

(II) How the cathode and anode are identified in this process?

(III) Give possible cathodic reactions for acidic and basic corrosive environments.

[20 marks]

(iii) Suggest two methods which can be used to protect a buried iron-pipeline from corrosion.

[06 marks]

(iv) Briefly explain the methods you suggested in part (iii) using suitable diagrams.

[18 marks]

2. Answer **all** parts.

(a) (i) Cleaner production requires a new way of thinking pattern about processes and products, and how they can be made less harmful to humans and the environment.
Considering some of cleaner production principles and practices, briefly discuss the following by giving examples:

(A) input material changes.

(B) technological changes.

[20 marks]

(ii) An orange juice manufacturer in Australia was drying its waste orange peels and selling them as stock feed. However, the drying process created 4 million tons of effluent a month, which was causing environmental problems.

Make your suggestions to solve the above problem considering the cleaner production concepts.

[15 marks]

(iii) A Cleaner Production assessment is a methodology for identifying areas of inefficient use of resources and poor management of wastes. Make a simple questionnaire with at least 5 questions to be answered by workers in such a walk-through inspection of an organization/ company.

[15 marks]

(b) (i) "Sugar cane should be harvested and milled within 24 hours for production of sugar." Explain the above statement.

[10 marks]

(ii) Describe the process of crystallization of cane juice used in the sugar industry.

[15 marks]

(iii) What is meant by the dextrin fermentation? How this affects the sugar production process?

[10 marks]

(iv) Molasses is the byproduct in the sugar manufacturing industry which can be used to produce rectified sprit and absolute alcohol.

(I) What is the main difference between rectified sprit and absolute ethanol?

(II) Explain how absolute ethanol is made from rectified spirit.

[15 marks]

3. Answer **all** parts.

(a) What are the expected functions of paints when applied on a surface?

[10 marks]

(b) Identify physical and chemical properties of pigments

[10 marks]

(c) Discuss the criteria for the selection of different drier combinations in a paint formulation.

[15 marks]

(d) Sketch typical features of the following polymer molecules to distinguish the differences between them:

(i) Linear polymer.

(ii) Branched polymer.

(iii) Cross-linked polymer.

[15 marks]

(e) Give four (04) different analytical techniques used for the analysis of polymers.

[10 marks]

(f) Differentiate mechanical properties and non-mechanical properties of polymers.

[20 marks]

(g) Draw the structures of four (04) addition products that are formed when urea is reacted with formaldehyde in resin synthesis stage in the basic medium.

[20 marks]

04. Answer **all** parts

(a) Refrigeration and freezing of perishable food products is an important and fascinating application area of heat transfer and thermodynamics.

(i) Briefly discuss how refrigeration prevent or delay the spoilage of foods. How does freezing extend the storage life of foods for months?
(ii) What are the four primary methods of freezing foods?
(iii) What are the mechanisms of heat transfer involved during the cooling of fruits and vegetables by refrigerated air?
(iv) How does the rate of freezing affect the size of the ice crystals that form during freezing and the quality of the frozen food products?
(v) Discuss the difference between the freezing injury and the chilling injury of fruits and vegetables

[50 marks]

(b) Food additives and toxic chemicals may be found in processed foods.

(i) What are the possible toxic chemicals that may be found in foods?
(ii) What are food additives? What are the purposes of introducing additives to foods?
(iii) Briefly describe how intentional food additives can be classified based on the origin of food additives.
(iv) What does it mean by the term "GRAS" list with respect to food additives?
(v) Briefly explain the role(s) and disadvantages of following food additives:
    (I) Sorbic acids.
    (II) SO_2.
    (III) Nitrates and nitrites.

[50 marks]

5. Answer **all** parts.

(a) (i) What are the two main types of drugs? Explain them briefly.

(ii) What are the three main properties that should be concerned about a drug?

[20 marks]

(b) (i) What is meant by "drug administration"?

(ii) What are the parenteral routes of drug administration?

(iii) Give brief explanations to each parenteral route mentioned in above (ii).

[30 marks]

(c) (i) Name three organs / tissues in which oral drug absorption takes place mainly.

(ii) Briefly explain which properties of the above organs / tissues and drugs are important on absorption.

[30 marks]

(d) (i) What are the "drug receptors"?

(ii) Explain briefly how drug receptors involve in drug action process.

[20 marks]

6. Answer **all** parts.

(a). Rancidity is a common problem for fatty foods.

(i) What is rancidity? State which factors are favorable for causing rancidity.

(ii) Briefly explain the two main types of rancidity.

(iii) Give four methods that can be practiced to control the rancidity.

[25 marks]

(b) Several distinct processes are used industrially to modify the physical or chemical properties of fats and oils.

(i) Hydrogenation is one of such methods applied to fats and oil industry. Briefly explain what is meant by hydrogenation in the fats and oil industry.

(ii) Name three other fats and oil modification methods.

(iii) Give four reasons for modifying fats and oils.

[25 marks]

(c) Detergents are surfactants with cleaning properties in dilute solutions.

(i) Briefly explain the cleaning action of a detergent.

(ii) "Cleansing action of detergents is better than soap in hard water." Briefly explain

(iii) Give a balanced chemical reaction for the synthesis of sodiumdodecyl sulfate (SDS) from lauryl alcohol.

[30 marks]

(d) Briefly explain the term "optical brighteners."

[20 marks]

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