The Open University of Sri Lanka

Faculty of Natural Sciences

Diploma in Food Science

Department	**: Chemistry**
Level	**: 3**
Name of the Examination	**: Final Examination**
Course Title and Code	**: Fundamentals of Chemistry & Biology for Food Science (CYD3310)**
Academic Year	**: 2021-2022**
Date	**: 17th September 2022**
Time	**: 9.30 a.m. – 11.30 a.m.**
Duration	**: 2 hr**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of (4) essay questions in (3) pages.
3. **Answer all (4) questions.**
4. Use a blue or black pen not a pencil. Use the given book to write down answers for (4) essay questions.
5. **Answer for each question should commence from a new page.**
6. Draw fully labelled diagrams where necessary.
7. The use of a non-programmable electronic calculator is permitted.
8. Clearly state your **index number in your answer script.**
9. Involvement in any activity that is considered as an exam offense **will lead to punishment.**

01. (a) (i) Name five essential elements along with their chemical symbols.
(ii) Define the term "Concentration" and deduce SI units.
(iii) What is meant by a heterogeneous mixture? Give two examples.
(15 marks)

(b) Briefly describe a simple experiment to illustrate that matter consists of particles.
(10 marks)

(c) (i) How many **molecules** of formic acid (HCOOH) are there in 25g of the substance?
(ii) Calculate the following.
A. The number of hydrogen molecules in 4 moles of hydrogen.
B. The number of hydrogen atoms in 4 moles of hydrogen
(Relative atomic masses of H, C and O are 1, 12 and 16 respectively)
(25 marks)

(d) (i) What is meant by fuel value of a substance?
(ii) Calculate the amount of energy produced in joules when a person is served with two slices of bread and butter with 0.3 Cal.
(15 marks)

(e) (i) What is the difference between consecutive reactions and simultaneous reactions.
(ii) Consider the following reaction.
$2Al(s) + Fe_2O_3(s) \rightarrow 2Fe(s) + Al_2O_3(s) \quad \Delta H = -851.5\ kJ$
If 6 moles of Al reacts with 3 moles of Fe_2O_3, what will be the enthalpy change for the above reaction.
(35 marks)

02. (a) (i) Write down the balanced equation for the oxidation of Fe^{2+} to Fe^{3+} by acidified $Cr_2O_7^{2-}$ where $Cr_2O_7^{2-}$ is reduced to Cr^{3+}.

(ii) Suppose that 1.00g of hydrogen gas and 2.00g of chlorine gas were mixed together in a reaction vessel to produce hydrogen chloride gas.
What could be the limiting reagent? Show your calculations clearly.
(60 marks)

(b) (i) Why does ice float on water? Explain using the concept of bonding.
(ii) What is meant by the term "Osmosis"?
Describe an example how this phenomenon is applied in the food industry.
(iii) What are colloids? Explain why milk. Butter and whipped cream are categorized as colloids.
(40 marks)

03. (a) (i) What is the difference between molarity and molality?

(ii) "pH and the [H+] are closely related to many biological processes in our body" Justify the statement.

(iii) Briefly discuss the importance of pH in the following industrial processes.
Fermentation, enzyme hydrolysis.

(25 marks)

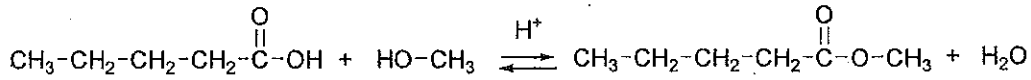
(b) (i) What are Gamma radiations? Compare its penetration power with Alpha radiation.

(ii) What is the significance of irradiation of food? Briefly explain. (20 marks)

(c) Molecular formula of a compound is $C_4H_{10}O$. Draw five (05) isomers for this molecular formula.

(25 marks)

(d) Methyl butanoate (methyl butyrate) (Compound C) is the compound responsible for the characteristic flavour of pineapple. It can be prepared in the laboratory as follows using compounds A and B.



Compound A Compound B Compound C

(i) Draw the structures of A, B and C on your answer script and circle the functional groups in each of them.

(ii) Give the name of each functional group.

(30 marks)

04. (a) Sensitivity or response to stimuli is one of the main characteristic properties of life. Organisms responds to diverse stimuli in their environment.

(i) Give three (03) examples that organisms respond to. (06 Marks)

(ii) What is meant by the term "chemotaxis" of an organism? (06 Marks)

(iii) Write down the biological levels of organization of living things up to the organism on the scale from small to large. (07 Marks)

(iv) Give two (02) examples of macromolecules which contains the genetic instructions for the functioning of the organism in a living body. (06 Marks)

(b) Life is made up of matter. All matter is composed of elements. Each element is made of atoms.

(i) What are the subatomic particles the atoms made up of? (10 Marks)

(ii) What are the major elements present in monosaccharides?
And write down the molecular formulae of monosaccharides.

(10 Marks)

(iii) Draw the structure of monosaccharide unit giving two (02) examples for monosaccharide. (10 Marks)

(iv) Explain how solid table salt (NaCl) can be dissolved in water? (10 Marks)

(v) What are acids, bases and buffers and explain the role of buffers in a biological system?

(10 Marks)

(c) A eukaryotic (plant or animal) cell is a cell that has a membrane-bound nucleus and other membrane- bound compartments, called organelles, which have specialized functions.

(i) Describe two main differences between animal and plant cells. (08 Marks)

(ii) Describe the overall result in terms of molecules produced of the breakdown of glucose by glycolysis. Where does it take place?

(10 Marks)

(iii) Describe the two phases through which the Photosynthesis takes place. And write down a general equation for photosynthesis. (07 Marks)
