

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 Title and - Code	: CMU3127 (Chemical Aspects of Food Industry)
Academic Year	: 2019/2020
Date	: 22/02/2021
Time	: 1.30 p.m to 3.30 p.m
Duration	: 2 hours

General Instructions

1. Read all instructions carefully before answering the questions.
 2. This question paper consists of six (6) questions in six (6) pages. Question 1 is compulsory.
You are required to **answer four (04) questions** out of six (06) including compulsory question number 1.
 3. All questions carry equal marks.
 4. Answer for each question should commence from a new page.
 5. Draw fully labelled diagrams where necessary.
 6. Involvement in any activity that is considered as an exam offense will lead to punishment.
 7. Use blue or black ink to answer the questions.
 8. Clearly state your index number in your answer script.
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(1) Compulsory Question

- (I) What is the prosthetic group present in glycoproteins?
- (II) Name two major natural carbohydrates present in honey.
- (III) Name the two major enzymes responsible for formation of cyanide in manioc.
- (IV) Which pigment is responsible for the yellow color in freshly milled wheat flour?
Explain how it can be removed to obtain the white color wheat flour
- (V) Name the main (i) carbohydrate (ii) protein in cow's milk.
- (VI) What is meant by a functional food?
- (VII) Explain the difference between whole wheat flour and refined flour.
- (VIII) Why is it necessary to use O₂ impermeable films for packing of processed meat products?
- (IX) What role does Codex Alimentarius Commission play in relation to GHP?
- (X) How is the conversion factor from Kjeldahl nitrogen to protein obtained as 6.25?

(10 marks each)

(2)

- (I) Bread is usually made from wheat-flour dough, that is cultured with yeast, allowed to rise and finally baked in an oven. The bread crust is formed from surface dough during the baking process, which has a hardened and brown colored appearance.

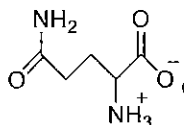
- (a) What are the two major food components present in wheat-flour?
- (b) Briefly explain the chemical compositions of the two major components of the wheat-flour you mention above in **Q2(I)(a)**.
- (c) Name the chemical reaction responsible for the hardened, browned surface crust formed in bread.
- (d) Briefly explain the type of chemical reaction mentioned above, **Q2(I)(c)**, that occurs during surface crust formation.
- (e) Explain why the usage of the rice flour is limited in the bread making industry.

(40 marks)

- (II) (a) Draw the basic chemical structure of a simple lipid using the notations R¹, R² and R³ to indicate alkyl groups.
- (b) Name one "compound lipid" found high concentrations in egg yolk which is important in food industry.
- (c) Draw the basic structure of the compound lipid you mentioned in the above question **Q(2)(II)(b)**.
- (d) Explain the role of the compound lipid you mentioned above in **Q(2)(II)(b)** during the production of mayonnaise in food industry.

(30 marks)

- (III) Answer the following questions by considering the structure of an amino acid given below.



- (a) Draw the above structure of the amino acid in your answer script and circle the amino group. Is this amino group neutral or ionic? (30 marks)
- (b) Draw the structure of neutral/ ionic species of the amino acid expected to form when a base (alkali) is added to the above amino acid.
- (c) Define the term "zwitterion"
- (d) Can this amino acid be considered a zwitterion? Give reasons.
- (3) (a) What is meant by the preservation of food? (10 marks)
- (b) Name three methods used for preserving food. (12 marks)
- (c) State the scientific reason/s for the following steps in the production of Cheese.
- (i) Salting (ii) Ripening (iii) starter culture addition (30 marks)
- (d) What is meant by lactose intolerance? Briefly state the suitability of consuming yogurt for lactose intolerance and Justify your answer. (18 marks)

- (e) Using the nutrition information panels provided below from two yoghurt containers, evaluate which yoghurt is the better choice for maintaining a healthy weight.

Yogurt 1

Nutrition information		
Servings per pack 1	serving size 150g	
	Quantity per serving	Quantity per 100 g
Energy	573 kJ(137 Cal)	382kJ(91 Cal)
Protein	6.8 g	4.6 g
Fat – total	2.9 g	1.9 g
- Saturated	2.0 g	1.3 g
Carbohydrate	18.9 g	12.6 g
-sugars	15.2 g	10.1g
Dietary fibre –total	3.6 g	2.4 g
Sodium	88 mg	59 mg
Calcium	225 mg	170 mg

Yogurt 2

Nutrition information		
Servings per pack 1	serving size 150g	
	Quantity per serving	Quantity per 100 g
Energy	408 kJ(97 Cal)	240 kJ(57 Cal)
Protein	16.5 g	9.7 g
Fat – total	0.3 g	0.2 g
-Saturated	0.2g	0.1g
Carbohydrate	7.1 g	4.2 g
- sugars	5.6 g	3.8 g
Sodium	54 mg	32 mg
Calcium	204 mg	120 mg

(30 marks)

(4)

- (I) When fresh fruits and vegetables are cut, the appearance of brown is occurred due to enzymatic browning taking place on the cut surface of the fruit or vegetable.
- Name the enzyme responsible for the enzymatic browning?
 - Write down the chemical reactions that occur which causes the formation of brown color pigments during enzymatic browning.
 - Name two undesirable effects that occur during enzymatic browning.
 - List five (5) methods that can be used to prevent enzymatic browning.
 - “Sulphur dioxide (SO₂) can be used as a preservative in the prevention of enzymatic browning in fruits and vegetable products”

Explain how enzymatic browning is prevented by SO₂ as stated above.

(40 marks)

(II)

- Explain two ways of reducing water activity (aw) of a food product.
- One of the options for decreasing water activity and thus improving the shelf life of food is to use additives with high water binding capacities (humectants).
 - Explain what humectants are?
 - Name few compounds which can be used commonly as humectants.

(40 marks)

(III) Why and how does a protein fold from its primary structure to form the secondary structure?

(20 marks)

- (5) (I) Under the Food Act No. 26 of 1980 there are several numbers of Approved Analysts
- List the approved analysts and additional approved analysts for Sri Lanka
 - Out of the approved analysts you mentioned above which one is the approved analyst for the whole country
 - Briefly explain the duties of Approved analysts.

(30 marks)

(II) The following questions are based on the regulations cited in “**Food (Labelling and Advertising) Regulations 2005**.”

- State in which panel of the package or container should contain the following information be displayed in respect of
 - The net contents of the package
 - the date of expiry
 - the date of manufacture
- Under the Act how this information of dates of expiry / date of manufacture shall be affixed by the manufacturer or the packer?
- State which food items may not be required the date of expiry to be provided on the package or container.

(30 marks)

- (III) (a) Explain what is meant by Hazard Analysis Critical Control Point (HACCP). Why is it important in the food industry?
- What are Critical Limits (CLs)?
 - In a cured meat product industry, an excessive level of nitrite (NO_2^-) was identified as the hazard material for meat. Identify **Critical Control Point** and **critical control limit** for this HACCP analysis.

(40 marks)

- (6) (I) (a) You have been asked to determine the moisture content of the cereal product using two (2) analytical methods namely method X and method Y.

“The quantitative results of the moisture analysis of method X was observed to be more accurate than method Y, but method X had lower precision”

Explain the meaning of this statement.

- (b) Write down three (3) important reasons for determining the ash content in food analysis.

(30 marks)

- (II) In the following methods of determining the major components of a given food sample, how would you overcome the following problems that could arise to obtain accurate results.

Explain your answer

- (a) In oven drying method of moisture determination of a milk sample you observed a crust or lump formation in milk sample during oven drying.
(b) At the end of dry ashing method, you observed gray coloured particles in the sample inside the crucible.

(30 marks)

- (III) The crude protein content of a dehydrated soya sample was analyzed in duplicate using the Kjeldahl method and the following data were obtained.

– Wt of Sample A = 2.110 g

– Wt of Sample B = 2.105 g

concentration of HCl used for titration = 0.10 M

–HCl used for Sample A = 12.05 ml

– HCl used for Sample B = 12.10 ml

– HCl used for reagent blank = 0.20 ml

Calculate the crude protein content on wet weight basis of the soya bean, assuming soya bean protein contains 16.0% nitrogen.

(40 marks)