

National Exams - May 2002
98-Agric-A7 Chemistry and Microbiology of Foods
3 hours duration

NOTES:

- 1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.**
- 2. Candidates may use one of two calculators, the Casio or Sharp approved models. This is a closed book exam. Two aid sheets written on both sides are allowed.**
- 3. Any five questions from section I and any four questions from section II constitute a complete paper.**
- 4. Marks for each question are given on the question paper. All questions in each section are of equal value.**

I. Food Chemistry

Do any five questions from this section.

1(a) Sketch a sorption desorption isotherm and indicate the probable path of a product at low moisture and relative humidity in a leaky package when subjected to a high humidity environment. How does the water state differ from a product formed by desorption to the same final moisture content? (6 marks)

(b) What are three solutes which are used to control water activity of intermediate foods? Briefly discuss their limitations. (4 marks)

2 (a) Differentiate structurally milk fat and marine oil. (5 marks)

(b) What are phospholipids and describe their use and role in food processing? (5 marks)

3 (a) What is nonenzymatic browning or Maillard reaction, and describe its importance in food manufacturing. (7 marks)

(b) What are six major functional properties of proteins? (3 marks)

4 (a) How starches are modified? What is the use of modified starches in food manufacturing? (5 marks)

(b) Describe the caramelization reaction in carbohydrates. (5 marks)

5 (a) Provide 5 methods of immobilizing enzymes. (5 marks)

(b) What are the functions of enzymes in food manufacturing? Provide three food processes where enzymes are used to complete the process. (5 marks)

6 (a) How you prevent rancidity in food with high fat content? (5 marks)

(b) Describe (i) hydrogenation, and (ii) interesterification. (5 marks)

7 (a) Describe basic protein structure. (5 marks)

(b) Differentiate between meat proteins and soybean proteins. (5 marks)

8 (a) Differentiate between mono-saccharides and oligo-saccharides. (5 marks)

(b) What are gums? Describe their use in food manufacturing. (5 marks)

II. Food Microbiology

Do any 4 questions from this section.

9. In a food product, a microorganism has a D value of 3 min at 121°C and a Z value of 11°C. If the process was calculated at 138°C for a Z value 6°C, how many minutes of heating is required for a 5 D process? What would be the actual probability of spoilage from an initial inoculum of 100 spores/can for the above 138°C process (Z = 10°C) if the organism actually has a Z value of 11°C when heated with the product? (12.5 marks)

10 (a) Describe the differences in cell wall structure between Gram-positive and Gram-negative bacteria. (6 marks)

(b) Compare viruses to bacteria in terms of structure and function. (6.5 marks)

11 (i) Draw and label a bacterial growth curve using the following data (3.5 marks):

Time, h	0	1	2	4	8	12	16	20	24	28
Bacteria/ml	1E6	1E6	2E6	8E6	1E8	1.2E9	2E9	4E9	2E8	1E7

(ii) What are the major events in each phase of microbial growth? (3 marks)

(iii) During which phase in the growth cycle are organisms most susceptible to destruction by metabolic inhibitors? (3 marks)

(iv) What two factors contribute to the termination of the log phase? (3 marks)

12. Growth of bacteria contaminating the surface of fresh vegetables leads to spoilage and is responsible for the short storage life of most vegetables. What physical factors might influence the growth rate of these bacteria? Design an experiment to test whether controlling these factors during storage would be an effective method for reducing spoilage. (12.5 marks)

13. You are performing a plate count of commercial preparations of pasteurized and raw (unpasteurized) milk. To do this, you dilute your samples in water and plate aliquots into plate count agar (PCA). For each of the following items in your project, select the most appropriate sterilization method and justify your choice (a) plastic petri dishes, (b) plate count agar, (c) glass pipettes, (d) water for dilutions, (e) inoculating loop, and (f) contaminated petri dishes (after the plate count). (12.5 marks)

14. What level of inoculation of a microorganism ($D_0 = 1.2$ min) is required such that a probability of spoilage of one to 100 attributed to the organism would be equivalent to 12 D_0 inactivation of *Clostridium botulinum*? Assume the same temperature process and the same value for both organisms. The D_0 value of *Clostridium botulinum* is 0.22 min. (12.5 marks)

15. Describe four ways to determine whether a food is spoiled. What specific microbial activities are responsible for most of these changes? (12.5 marks)