National Exams - December 2003
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.** One aid sheet written on one side is permitted.

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) What are the effects of temperature and water concentration on water activity? Why is water activity important in food processing and storage? (6 marks)

(b) What is the relationship between water activity and mole fraction of solute for an ideal system? What is the water activity of a one molar sucrose solution (i) if ideal, and (ii) if the activity coefficient is 1.6? (4 marks)

2 (a) What are saturated and unsaturated fatty acids? (5 marks)
(b) Describe the structures and uses in the body of fats, phospholipids and steroids. (5 marks)

3 (a) List the main properties of enzymes. (5 marks)
(b) In what way do structural proteins and enzymes differ? (5 marks)

4 (a) Describe the process of starch modification? Why starches are modified? (5 marks)
(b) Describe the Michelis and Menten equation to describe enzymatic reactions. (5 marks)

5 (a) What factors affect the rate of enzyme activity? (5 marks)
(b) How can enzyme-catalyzed reactions are inhibited? (5 marks)

6 (a) Use diagrams to illustrate the differences among ionic, covalent and hydrogen bonds. (5 marks)
(b) Distinguish among metabolism, catabolism and anabolism and between exergonic and endergonic reactions. (5 marks)

7 (a) What is the basic structure of a monosaccharide? How are disaccharides and polysaccharides different from monosaccharides? (5 marks)
(b) What are gums? Describe their use in food manufacturing. (5 marks)

8 (a) Describe the four levels of protein structure. How is each maintained? (5 marks)
(b) Define amino acid, peptide bond, and protein denaturation. (5 marks)

II. Food Microbiology
Do any **four** questions from this section.

9. (a) In 1995, a well-publicized study reported that hot-air blowing hand dryers were less sanitary than paper towels, which left the hands 40% more microbe-free. Having noticed that the study was funded by the paper towel industry, you wonder just how reliable these results are. Design an experiment to test the reliability of these findings, making sure that adequate controls are established. (9 marks)
(b) What is the difference between aerobic and anaerobic respiration? (3.5 marks)

10 (a) What are three basic shapes of bacteria? What are prokaryotic and eukaryotic cells alike? How are they differ? (6 marks)
(b) What is the major function of the cell membrane, and what additional functions does a prokaryotic membrane perform? (6.5 marks)

11. If an initial inoculum of 10 spores per can of a product ($D_{250}{}^{\circ}{}_{F}$= 1.2 min) and a spoilage rate of one can in 100 000 is desired, calculate an F value for the process that would give the desired level of inactivation. Calculate the $F_{280}{}^{\circ}{}_{F}$ for a Z value of 18°F. (12.5 marks)

12. (a) Name three ways of measuring bacterial growth. What kinds of errors are likely to occur in measuring bacterial growth? (6.5 marks)
(b) How does each of the following factors affect growth in bacteria – pH, temperature, moisture, hydrostatic pressure, osmotic pressure and radiation. (6 marks)

13. (a) Compare and contrast the effects of different ways to control microorganisms with heat. (6.5 marks)
(b) Explain how freezing, drying and freeze drying can be used to control or to preserve microorganisms. (6 marks)

14. (a) What is a pure culture? Why do we place such importance on obtaining and maintaining pure cultures? (6.5 marks)
(b) Why are so many types of microbiological media employed in laboratories for the culture of microorganisms? What are selective and differential media used in the food laboratory? (6 marks)

15. (a) What are the advantages and limitations of the following processes for sterilization? (i) boiling, (ii autoclaving, (iii) irradiation, (iv) dry heat, (v) ethylene oxide, and (vi) filtration. (6.5 marks)
(b) For each of the following agents, indicate situations in which it would be effective and situations in which it would be ineffective (i) surfactant, (ii) alcohol, (iii) iodine, and (iv) chlorohexidine. (6 marks)

Marking Scheme

1. (a) 6 marks (b) 4 marks
2. (a) 5 marks (b) 5 marks
3. (a) 5 marks (b) 5 marks
4. (a) 5 marks (b) 5 marks
5. (a) 5 marks (b) 5 marks
6. (a) 5 marks (b) 5 marks
7. (a) 5 marks (b) 5 marks
8. (a) 5 marks (b) 5 marks
9. (a) 9 marks (b) 3.5 marks
10. (a) 6 marks (b) 6.5 marks
11. 12.5 marks
12. (a) 6.5 marks (b) 6 marks
13. (a) 6.5 marks (b) 6 marks
14. (a) 6.5 marks (b) 6 marks
15. (a) 6.5 marks (b) 6 marks