

**OLLSCOIL NA hÉIREANN, GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY**

**Semester 1
Examinations 1999/2000**

**Third Science
Microbiology**

EXTERN EXAMINER: Professor C M Browne
INTERN EXAMINER: Internal Examiners

TIME ALLOWED: 3 hours

ANSWER QUESTION **FIVE** QUESTIONS

**(INDICATE CLEARLY THE QUESTIONS ANSWERED ON THE
FIRST PAGE OF YOUR ANSWER BOOK)**

- 1) Microorganisms are typically equipped with control mechanisms to ensure efficient balanced growth. Discuss strategies to overcome these mechanisms so as to achieve the type of overproduction of enzymes and metabolites favoured by the industrialist.
- 2) The following problems are concerned with the batch heat sterilisation of 8,000 litres of liquid in order to achieve a 1 in 1000 chance of contamination. The concentration of bacteria in the unsterile liquid is 9×10^4 organisms/ml (for safety, assume that they are all *Bacillus stearothermophilus* spores).

What is the holding time required for:

- a) A holding temperature of 122°C (ignore heating and cooling time)
- b) As a), but with a heating rate of 0.4 min/°C and a cooling rate of 1.2 min/°C.
- c) What would be the value of the holding time if the heating and cooling rates were twice as fast?

Discuss these results. What points do you think they make about batch heat sterilisation?

Note: Tables of k and nabla values for Richard’s rapid method are available below. Logarithmic tables are also available.

Del values for B. stearrowthermophilus spores for the heating-up period over a temperature range of 100 to 130°, assuming a rate of temperature change of 1° min⁻¹ and negligible spore destruction at temperatures below 100° (Richards, 1968)

T°C	k min ⁻¹	∇
100	0.019	----
101	0.025	0.044
102	0.032	0.076
103	0.040	0.116
104	0.051	0.168
105	0.065	0.233
106	0.083	0.316
107	0.105	0.420
108	0.133	0.553
109	0.168	0.720
110	0.212	0.932
111	0.267	1.199
112	0.336	1.535
113	0.423	1.957
114	0.531	2.488
115	0.666	3.154
116	0.835	3.989
117	1.045	5.034
118	1.307	6.341
119	1.633	7.973
120	2.037	10.010
121	2.538	12.549
122	3.160	15.708
123	3.929	19.638
124	4.881	24.518
125	6.056	30.574
126	7.506	38.080
127	9.293	47.373
128	11.494	58.867
129	14.200	73.067
130	17.524	90.591

- 3) Discuss the value and limitations of the statement "bacteria cause infectious diseases".
- 4) Discuss the value of classifying diseases by their vectors.
- 5) The study of microbial ecology has been advanced through the application of molecular techniques. Discuss three of these techniques.

6) **Part A**

Write short notes from **two** of the three topics outlined below:

- a) The basis of immunological techniques
- b) The tools used in recombinant DNA technology
- c) Problems of plate culture in microbial ecology

Part B

Write short notes from **two** of the three topics outlined below:

- a) Faecal coliforms and Faecal streptococci as indicator organisms of pollution
- b) Production and respiration in lakes
- c) Biological Oxygen Demand (B.O.D.)

Note: On answering this question both parts A and B **must** be attempted.

- 7) Distinguish between food infections, intoxications and intoxications. Discuss in detail the role played by fungi in food intoxications.
- 8) Compare and contrast the use of high temperatures and ionising radiation for the preservation of foods.