

UNIVERSITY OF SWAZILAND
FACULTY OF HEALTH SCIENCES

RE-SIT EXAMINATION PAPER – JULY, 2019

TITLE OF PAPER : INTRODUCTION TO MICROBIOLOGY AND IMMUNOLOGY
COURSE CODE : EHS110
TIME : 2 HOURS
MARKS : 100

INSTRUCTIONS : ANSWER QUESTION 1 AND ANY THREE QUESTIONS
: EACH QUESTION CARRIES 25 MARKS
: NO FORM OF PAPER SHOULD BE BROUGHT INTO NOR TAKEN OUT OF THE EXAMINATION ROOM
: BEGIN THE ANSWER TO EACH QUESTION ON A SEPARATE SHEET OF PAPER
: CALCULATORS MAY BE USED BUT THEY MUST BE THE SILENT TYPE
: ALL CALCULATIONS/WORK-OUT DETAILS SHOULD BE SUBMITTED WITH YOUR ANSWER SHEET

This question paper consists of 6 printed pages including this one

QUESTION 1

- a. Write down the letter corresponding to your chosen answer to illustrate your response to each of the items in this question. (20)
- i. Passage of water from a low solute concentration into a cell is referred to as:
 - A. plasmoptysis
 - B. plasmolysis
 - C. isotonic
 - D. hypertonic
 - E. hypotonic

 - ii. Which of the following is/are produced by microorganisms?
 - A. Fermented dairy products
 - B. Breads
 - C. Alcoholic beverages
 - D. Fermented dairy products, breads and alcoholic beverages
 - E. None of the above

 - iii. Gram-positive bacteria are usually more susceptible to:
 - A. streptomycin
 - B. tetracyclin
 - C. penicillin
 - D. ampicillin
 - E. all of the above

 - iv. Lag phase is also known as:
 - A. period of initial adjustment
 - B. transitional period
 - C. generation time
 - D. period of rapid growth and multiplication
 - E. rapid decline period

 - v. Which of the following apparatus is used to provide steam under regulated pressure?
 - A. Autoclave
 - B. Laminar air flow
 - C. Incubator
 - D. Hot oven
 - E. Refrigerator

 - vi. Which of the following methods is used for killing microorganisms of only certain types and not all microorganisms?
 - A. Fractional distillation
 - B. Incineration
 - C. Autoclaving

- D. Pasteurisation
 - E. Boiling water
- vii. Which of the following enzymes acts on the DNA after its entry into the cell?
- A. Ligases
 - B. Endonucleases
 - C. Deoxyribonucleases
 - D. Exonucleases
 - E. Ribonucleases
- viii. The basic Ig unit is composed of:
- A. 2 identical heavy and 2 identical light chains
 - B. 2 identical heavy and 2 different light chains
 - C. 2 different heavy and 2 different light chains
 - D. 2 different heavy and 2 different light chains
 - E. non-covalently bound polypeptide chains
- ix. Which cell type produces antibodies?
- A. Macrophages
 - B. T-lymphocytes
 - C. Natural Killer cells
 - D. Plasma cells
 - E. Eosinophils
- x. Which of the following are receptors for HIV?
- A. RENES
 - B. Gp120 and Gp41
 - C. CD54
 - D. CR5
 - E. CXCR4 and CCR5
- b. Write **T** (for True) or **F** (for False) to indicate your response to the items in this question. (5)
- i. Some bacteria have cilia which they use to facilitate movement
 - ii. Some Rickettsia may multiply inside endothelial cells of the gastrointestinal tract, the brain, skin and heart
 - iii. During bacterial staining, acidic dyes stain the bacteria and basic dyes stain the background to enhance visibility
 - iv. Natural Killer cells develop from the lymphoid lineage of development that also produce the lymphocytes, T and B cells
 - v. The granules inside neutrophils stain dark purplish blue with the basic dye methylene blue

[25 marks]

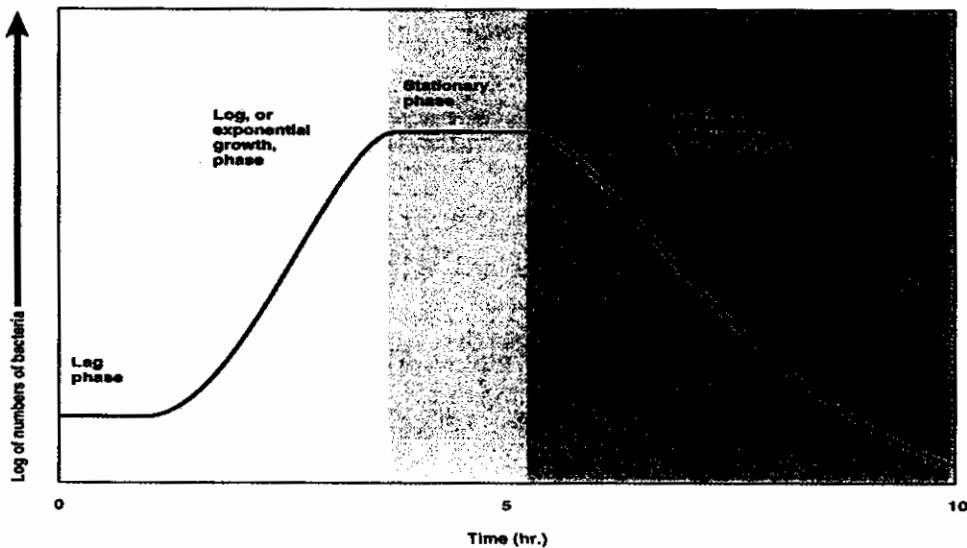
QUESTION 2

- a. Write down the functions of each of the organelles of the bacterial cell listed below:
 - i. Cell wall (2)
 - ii. Ribosomes (2)
 - iii. Lysosomes (2)
- b. A microbiologist resolves to perform the simple staining procedure to observe the shape and arrangement of the cells of a bacterium. List the SIX step procedure he has to follow during the simple staining procedure. (6)
- c. The gram staining technique developed by Dr Christian Hans Gram has remained an important procedure for differentiating gram-positive from gram-negative bacteria.
 - i. Why is it important to determine whether a bacterium is gram-positive or gram-negative? (1)
 - ii. What characteristic of a bacterium determines whether it is gram-positive or gram-negative? (2)
 - iii. Describe the FOUR basic steps of the gram-staining procedure, also explaining how the results are interpreted to provide conclusion whether a bacterium is gram-positive or gram-negative. (10)

[25 marks]

QUESTION 3

- a. The growth of microbes in vitro and in vivo is influenced by physical, chemical and biological factors.
 - i. Name FOUR physical factors that influence the growth and multiplication of microbes. (4)
 - ii. Explain how each of the four factors mentioned in a (i) above influence the growth and multiplication of microbes. (8)
- b. A laboratory technologist performs a bacterial culture and periodically counts the number of bacterial cells in the culture. After 10 hours he draws the curve below from the log number of bacterial cells and the time period in hours.



- i. Give THREE reasons why the curve shows a logarithmic decline in the bacterial cell population in the last phase. (3)
- ii. Suppose the laboratory technologist establishes that the generation time of this bacterium is 30 minutes. How many bacterial cells will be in the culture after 4 hours if there are 400 bacterial cells at the beginning of the culture? (Assume that none of the bacteria are killed and they all reproduce) (5)
- c. The most frequently used method of measuring bacterial populations is the plate count which measures the number of viable cells only.
 - i. Give TWO disadvantages of this method. (4)
 - ii. Microbiologists prefer to count only plates with 30 to 300 colonies. How do microbiologists ensure that the colony counts will be within the 30 to 300 range? (1)

[25 marks]

QUESTION 4

- a. Explain what you understand by the term "*bacteriostatic agent*"? (2)
- b. Determine whether the following processes are microbistatic or not. (5)
 - i. Freezing
 - ii. Heating a wire loop prior to transfer of bacteria
 - iii. Immersing in salt solution
 - iv. Passing gamma radiation
 - v. Adding antibiotics
- c. Explain the difference between sterilisation and disinfection processes. (4)
- d. Sterilisation procedures are used routinely inside operation theatres.
 - i. Explain why it is important to routinely sterilise equipment and the air inside operations theatres. (3)
 - ii. Describe a method that may be used to sterilise equipment used in operation theatres. (3)
 - iii. Describe a method that may be used to sterilise the air inside operation theatres. (2)
 - iv. Disinfection and sterilisation techniques are commonly used in different applications. Describe the applications where each is used. (4)
- e. Explain how radiation methods may be used to sterilise syringes, needles and IV sets before they are disposed of in landfills to prevent transmission of microbial agents of disease to other people handling hospital waste. (2)

[25 marks]

QUESTION 5

- a. A laboratory technologist performs microbiological procedures to understand the illness afflicting a patient. He stains the blood cells of the patient using methylene blue and the granules of certain cells stain dark purplish blue. He determines that the cells have a nucleus that is lobed. He then counts the cells and determines that they are 300 per millilitre of blood.
- Name the cells that the technologist was observing? (1)
 - What conclusion is the laboratory technologist likely to make from the number of cells he counted? Give a reason for your answer. (3)
 - Describe the purpose served by these cells in the immune response against infecting microbes. (6)
- b. Cytokines perform important action related to immune response against infecting microbes.
- Name the cells that secrete interleukin-1 (IL-1) (1)
 - Write down one function of interleukin-1 (IL-1) (1)
 - Name the cells that secrete interleukin-2 (IL-2) (1)
 - Write THREE functions of interleukin- 2 (IL-2) (6)
- c. A five year old child acquires infection with *Ascaris lumbricoides*, a giant parasite of the intestines. Describe how IL-4 and IL-5 interact with other immune mechanisms to cause destruction of worms in the child's body. (6)

[25 marks]**QUESTION 6**

- a. Write down FOUR differences between innate and adaptive immune responses. (8)
- b. Autoimmune diseases such as insulin-dependent diabetes type 2, Hashimoto's thyroiditis, systemic lupus erythematosus and others are responsible for the loss of thousands of human lives.
- What are autoimmune diseases? (2)
 - Explain the autoimmune processes involved when an individual eventually suffers from insulin-dependent diabetes type II? (3)
 - What medical intervention is available to assist an individual with insulin-dependent diabetes type II to manage the disease and live longer? (2)
- c. Immunisation has become a major strategy for disease control and elimination.
- Define immunisation. (2)
 - What is the difference between active and passive immunisation? (4)
 - What is the difference between naturally acquired immunisation and artificially acquired immunisation? (4)

[25 marks]