



UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

DEGREE IN ENVIRONMENTAL HEALTH SCIENCE
DEGREE IN BACHELOR OF SCIENCE IN NURSING AND
MIDWIFERY

RE-SIT EXAMINATION PAPER MAY 2017

- TITLE OF PAPER : INTRODUCTION TO MICROBIOLOGY AND IMMUNOLOGY
- COURSE CODE : EHS 110
- DURATION : 2 HOURS
- MARKS : 100
- INSTRUCTIONS :
- : READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
 - : **QUESTION ONE IS COMPULSORY, THEN ANSWER ANY OTHER THREE QUESTIONS**
 - : EACH QUESTION **CARRIES 25** MARKS.
 - : WRITE NEATLY & CLEARLY
 - : NO PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.
 - : BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

QUESTION 1: COMPULSORY [You are required to answer this question]

- a. **MULTIPLE CHOICE:** Indicate your response to the items in this question by writing down the letter corresponding to your chosen answer. (20)

i. Which of the following compounds has the greatest energy for a cell?

- A. CO₂
- B. ATP
- C. glucose
- D. O₂
- E. lactic acid

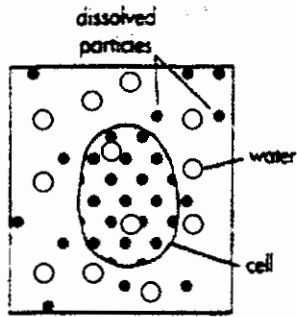
ii. The diagrams below show bacteria recovered from an infected 18 year old boy.



The most likely conclusion to make is that the boy is infected with:

- A. *Staphylococcus pneumoniae*
 - B. *Bacillus anthracis*
 - C. *Treponema pallidum*
 - D. *Streptococcus aureus*
 - E. *Clostridium tetani*
- iii. A graft that involves transfer of tissue material between genetically identical individuals such as identical twins is called:
- A. allograft
 - B. isograft
 - C. xenograft
 - D. autograft
 - E. None of the above
- iv. Which one of the parts of the microscope is used to focus a specimen placed on the stage for examination?
- A. eyepiece
 - B. mirror
 - C. the mechanical stage
 - D. coarse and fine adjustments
 - E. the diaphragm
- v. Which of the fungal infections listed below commonly occur in individuals that are immunocompromised due to infections with the Human immunodeficiency virus (HIV)?
- A. Aspergillosis
 - B. Candidiasis
 - C. Cryptococcosis
 - D. Norcadiosis
 - E. All of the above

vi. Study the diagram of a cell in a water solution below;



Which one of the following is likely to the cell later after leaving the set up to stand like this for a considerable period?

- A. The cell will absorb water and burst
- B. The cell will lose water and shrink
- C. The cell will remain the same because water will not move in or out of the water
- D. The dissolved particles of the solute will move into the cell
- E. The dissolved particles of the solute will move out of the cell to balance the concentration

vii. Which one of the following is most likely to be bactericidal?

- A. membrane filtration
- B. ionizing radiation
- C. lyophilisation (freeze-drying)
- D. deep-freezing
- E. all of the above

viii. Which of the following is used to control microbial growth in foods?

- A. organic acids
- B. alcohols
- C. aldehydes
- D. heavy metals
- E. all of the above

ix. Which of the following does not kill bacterial endospores?

- A. autoclaving
- B. incineration
- C. hot-air sterilization
- D. pasteurization
- E. All of the above kill endospores

- x. Cell-mediated immune response begins when:
- A. Cytotoxic T cells are stimulated by T-helper cells to search out and destroy any cells in the body that carry the antigen on their MHC
 - B. Antibodies recognize and bind to the antigen of a foreign microorganism to form an antigen-antibody complex
 - C. Antibodies activate the complement mechanisms of the immune system to destroy identified antigenic material
 - D. an antigen presenting cell, usually a macrophage, ingests foreign material, digests it and incorporates pieces of the antigen onto the surface of its membrane.
 - E. Phagocytic cells of the immune mechanisms identify, engulf and destroy foreign material without the aid of antibodies for recognition
- b. **TRUE OR FALSE:** Write **T** (for True) or **F** (for False) against each of the statements below to indicate your response. (5)
- i. Prokaryotes and bacterial cells contain no membrane bound organelles
 - ii. All viruses contain both DNA and RNA molecules as their genetic material
 - iii. Mycoplasma infections are easily and successfully treated with antibiotics
 - iv. The antigen binding site of an antibody is referred to as an epitope
 - v. The tuberculin skin test is an example of a hypersensitivity type IV

[25 marks]

QUESTION 2

- a. The growth of microbes is influenced by physical, chemical and biological factors.
- i. Other than temperature, list three physical factors that influence microbial growth. (3)
 - ii. Explain why temperature is an important physical factor for microbial growth.
 - iii. With regard to the influence of temperature, explain what mesophiles, psychrophiles and psychotrophs are: (6)
 - iv. What type of bacteria are referred to as saprophytic bacteria? Also explain how these bacteria benefit the ecosystem. (5)
 - v. With regard to saprophytic bacteria, explain the difference between fermentation and putrefaction. (2)
- b. A bacterial type utilises the equation shown below during its nutrition:
 $\text{CO}_2 + \text{H}_2\text{S} \longrightarrow \text{Sugars} + \text{Sulphur} + \text{Water}$
Name this bacterial type and explain the nutrition process. (3)
- c. Control of microbes in hospitals may be achieved through the use of disinfectants and antiseptic fluids. What is the difference between a disinfectant and an antiseptic fluid? (4)
- d. Explain why refrigeration is considered a non-sterilisation method for controlling microbial growth. (2)

[25 marks]

QUESTION 3

- a. Name the glycoproteins on the surface of the following microorganisms that are involved in recognition and attachment to initiate entry into human cells:
- i. Poliovirus (2)
 - ii. Human immunodeficiency virus (2)
 - iii. Influenza virus (2)
- b. With regard to microbial replication, define the following terms:
- i. Transduction (2)
 - ii. Transcription (2)
 - iii. Translation (2)
 - iv. Conjugation (2)
- c. The replication process of viruses takes place inside specific host cells.
- i. Which host cells are used by the human immunodeficiency virus (HIV) for replication. (1)
 - ii. Discuss the replication process of the human immunodeficiency virus (HIV) in the human body and mention all the enzymes involved and their roles. (10)
- [25 marks]**

QUESTION 4

- a. The early understanding of the role of immunology in protection against infecting microorganisms benefitted from the work of one Russian scientist, Elie Metchnikoff, around 1882. Describe the experiments that Elie Metchnikoff performed to enhance the global understanding and acceptance of the role of immune cells in protection. (8)
- b. Implementation of an immune response often involves the process of phagocytosis.
- i. Define phagocytosis. (2)
 - ii. Phagocytosis involves a five step process, list the five steps involved in the process. (5)
 - iii. Name four cells of the immune system that are commonly involved in phagocytosis (4)
 - iv. Once phagocytosis has occurred, explain how phagocytic cells facilitate destruction of infecting microorganisms. (4)
- [25 marks]**

QUESTION 5

- a. The gastrointestinal tract provides the first-line of defence against invading microorganisms. Describe FIVE ways by which the gastrointestinal tract provides defence against ingested pathogenic bacteria. (10)
- b. Define inflammation as it applies to immunologic response. (2)
- c. What purpose is served by the inflammatory response? (4)

- d. Describe the events that occur during the inflammatory response, describing clearly the roles played by different cells of the immune system. (4)
- e. Antibodies are an important part of the humoral immune mechanisms. Write down the four functions of antibodies during an immune response. (5)

[25 marks]

QUESTION 6

- a. Define immunization. (2)
- b. Explain the difference between passive acquired immunity and active acquired immunity. (4)
- c. There are two types of active acquired immunity, describe them. (4)
- d. Poliovirus infection results in complications such as acute flaccid paralysis among infected children because of the invasion of three parts body of the host by the virus. Name the three parts. (3)
- e. Describe the process of recognition and attachment of the poliovirus prior to entry into human cells. (3)
- f. Two vaccinations have been developed for the prevention of poliomyelitis in children. Name the two vaccines and explain the difference between them. (4)
- g. The World Health Organisation (WHO) has recommended changes in the immunisation processes against polio to facilitate global eradication of polio. Describe the recent changes and explain the benefits cited by the WHO towards the polio eradication efforts. (5)

[25 Marks]