



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

RE-SIT EXAMINATION PAPER 2019

TITLE OF PAPER	:	INTRODUCTION TO MICROBIOLOGY AND IMMUNOLOGY
COURSE CODE	:	EHS127
DURATION	:	2 HOURS
MARKS	:	100
INSTRUCTIONS	:	READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
	:	ANSWER <u>QUESTION 1 AND ANY THREE OTHER</u> QUESTIONS
	:	EACH QUESTION <u>CARRIES 25</u> MARKS.
	:	WRITE NEATLY & CLEARLY
	:	NO PAPER SHOULD BE BROUGHT INTO OR OUT OF 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.

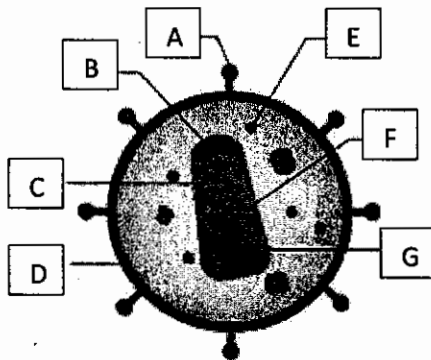
QUESTION 1

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

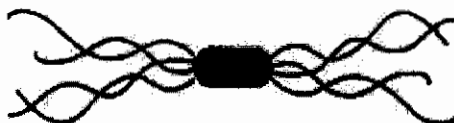
- i. Which one of the following is never found in prokaryotic cells?
 - A. flagella
 - B. capsule
 - C. cilia
 - D. ribosomes
 - E. lysosomes

- ii. Which of the following characteristics is found in all Gram-positive bacteria?
 - A. Thick peptidoglycan layer in cell wall
 - B. Thin peptidoglycan layer in cell wall
 - C. Lipopolysaccharide in cell walls
 - D. Capsule
 - E. Endospore

iii. Shown below is the diagram of a virus. Which of the parts marked A – G is the viral genome?



iv. A laboratory technologist looks at bacteria from a culture. He recognizes several bacterial cells with the following shapes and flagella.



The laboratory technologist is likely to conclude that the bacterium is:

- A. lophotrichous
- B. polar or monotrichous
- C. amphitrichous
- D. amphilophotrichous
- E. peritrichous

- v. To prevent *Clostridium* infections in a hospital setting, what kind of disinfectant should be used?
- A. fungicidal
 - B. pseudomonicidal
 - C. sporicidal
 - D. tuberculocidal
 - E. antiviral
- vi. Which of the following nitrogenous bases IS NOT found in an RNA molecule?
- A. adenine
 - B. guanine
 - C. thymine
 - D. uracil
 - E. cytosine
- vii. Which of the following scientists discovered penicillin?
- A. Paul Ehrlich
 - B. Alexander Fleming
 - C. Robert Koch
 - D. Edward Jenner
 - E. Louis Pasteur
- viii. Which of the following IS NOT a common mechanism by which antimicrobial agents kill or inhibit growth of bacteria?
- A. damage to cell membrane
 - B. destruction of capsules
 - C. inhibition of cell wall synthesis
 - D. inhibition of protein synthesis
 - E. All of the above
- ix. Blood transfusion reaction results in which of the following types of hypersensitivity reactions?
- A. Type I
 - B. Type II
 - C. Type III
 - D. Type IV
 - E. Types III and IV
- x. Of the following, which is the least likely to be involved in cell-mediated immunity?
- A. antibodies
 - B. cytokines
 - C. macrophages
 - D. T cells
 - E. Neutrophils

- b. **TRUE OR FALSE:** Write **T** (for true) or **F** (for false) to indicate your response to the items in this section of the question. (5)
- All bacteria have a single flagellum which is used to facilitate movement
 - Antibiotics are prescribed to patients with colds and influenza only to treat secondary bacterial infections and not to kill the causative virus
 - Viruses are much smaller than the smallest bacterial cell
 - Innate immune response are antigen-dependent while adaptive immune responses are antigen-independent
 - TNF-alpha, which is produced by macrophages and other cell types, plays an important role in initiating the inflammatory response

[25 marks]

QUESTION 2

- a. During investigation of bacteria, negative staining may be conducted to characterise bacterial capsules.
- Of what benefit is the capsule to the bacterial cell? (7)
 - Explain what you understand by the phrase 'negative staining'. (2)
 - Name one dye used during negative staining of bacteria containing capsules. (1)
 - Explain why negative staining is conducted for bacteria containing capsule instead of using basic or acidic dyes? (2)
- b. Three types of endospores are commonly identified during staining of bacteria containing endospores.
- Write down TWO genera of bacteria commonly found containing endospores. (2)
 - Describe these three types of endospores. (3)
 - Describe the staining technique used to differentiate endospores from the vegetative cells of bacteria. (4)
- c. The gram-staining technique is never used to identify *Mycobacterium tuberculosis* in a patient sputum sample.
- Explain why the gram-staining technique is never used to determine infection of patients of tuberculosis. (2)
 - Name the staining technique and the stain commonly used to identify *Mycobacterium tuberculosis* from a patient sputum sample. (2)

[25 marks]

QUESTION 3

- a. Describe the FOUR structural components of a virus (a drawing may be included to enhance clarity) (4)
- b. Discuss the replication of the Human Immunodeficiency virus (HIV) under the following headings:

- i. Recognition, entry and internalisation (4)
- ii. Replication, enzymes involved and their roles (8)
- c. Ebola is a disease caused by the Ebola virus and has an 83% or higher fatality rate.
 - i. What is the shape of the Ebola virus? (1)
 - ii. Describe the different ways through which people acquire infection with the Ebola virus? (8)

[25 marks]

QUESTION 4

- a. A student microbiologist sets up a bacteriological culture from a patient sample in order to assist diagnosis. He prepares his culture under a laminar flow cabinet before transferring the culture plate to a microwave pre-heated to 37°C.
 - i. Why is it important to pre-heat the oven to 37°C? (4)
 - ii. Give TWO reasons why the student microbiologist prepares his culture plate under a laminar flow cabinet. (4)
 - iii. Give TWO properties of the fume cupboard that make it suitable for the reasons mentioned in (i) above. (4)
- b. The student microbiologist heats an inoculating wire to red hot and allows it to cool down before transferring the sample from the bottle to the culture plate.
 - i. Why does the student heat the wire loop to red hot before cooling it? (2)
 - ii. Why does the student wait and allow the wire loop to cool before using it? (2)
- c. List FOUR physical factors that the student has to control in order to ensure that the culture grows and multiplies well. (4)
- d. Gamma radiation is used extensively to sterilise heat-sensitive medical equipment, disposable items, and drugs such as penicillin.
 - i. Explain how gamma-radiation achieves control of microorganisms and prevent their multiplication. (3)
 - ii. Why is it important to prevent gamma radiation from striking humans? (2)

[25 marks]

QUESTION 5

- a. A healthy adult is walking on a dusty street on a winter day and suddenly has mucous continuously running down his nose.
 - i. Do you think the adult is ill? Explain? (2)
 - ii. Explain what purpose is served by the mucous secreted? (6)
- d. Explain how peristalsis serves to destroy microbes that accidentally enter the body with food. (3)
- e. Dendritic cells serve important immunologic functions in bodies of healthy humans.
 - i. Where are dendritic cells located? (3)
 - ii. Describe the mechanism through which dendritic cells protect humans against infectious bacterial agents? (5)
 - iii. What is the relationship between dendritic cells and lymphadenitis? (3)
- f. Other immune cells that perform the same function as dendritic cells are the Kupffer cells.

- i. Where are Kupffer cells located? (1)
- ii. Briefly describe the function of Kupffer cells. (2)

[25 marks]

QUESTION 6

- a. Discuss the role of lactoferrin and defensins in the immune response against infecting microorganisms. (4)
- b. Explain why eosinophils are more efficient in fighting parasitic worm infections compared to neutrophils and basophils. (4)
- c. Macrophages are also involved in the phagocytic destruction of microorganisms. Explain the process involved during destruction of pathogens by macrophages. (6)
- d. Autoimmune diseases include insulin-dependent diabetes mellitus and Hashimoto's thyroiditis (goitre).
 - i. What is autoimmune disease? (2)
 - ii. What immune processes lead to insulin-dependent diabetes mellitus? (4)
 - iii. What is Hashimoto's thyroiditis or goitre? (2)
 - iv. What immune processes lead to Hashimoto's thyroiditis (goitre)? (3)

[25 marks]