

UNIVERSITY OF SWAZILAND
FACULTY OF HEALTH SCIENCES

SUPPLEMENTARY EXAMINATION PAPER – JULY, 2015

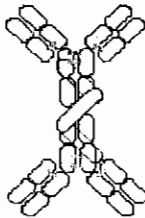
TITLE OF PAPER : INTRODUCTION TO MICROBIOLOGY AND IMMUNOLOGY
COURSE CODE : HSC 105
TIME : 2 HOURS
MARKS : 100

INSTRUCTIONS : ANSWER **QUESTION 1** AND **ANY THREE** OTHER 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 7 printed pages including this one

QUESTION 1 (All students must answer this question)

- a. MULTIPLE CHOICE: Write the letter corresponding to your chosen answer among the options provided for each question. (20)
- Which one of the following microorganisms is a good example of a gram-negative anaerobic bacteria?
 - Escherichia coli*
 - Staphylococcus aureus*
 - Mycobacterium tuberculosis*
 - Nisseria gonorrhoea*
 - Clostridium botulinum*
 - All bacteria require certain elements for growth and multiplication. Which one of the following elements is NOT a basic requirement of all bacteria?
 - carbon
 - sulphur
 - iron
 - phosphorus
 - nitrogen
 - The causative agent of measles is a:
 - bacteria
 - virus
 - fungus
 - Rickettsia
 - Mycoplasma
 - Which one of the following bacteria is NOT susceptible to antibiotic treatment?
 - Treponema pallidum*
 - Mycoplasma pneumoniae*
 - Nisseria gonorrhoea*
 - Escherichia coli*
 - Salmonella typhimurium*
 - The immunoglobulin shown below is likely to be:



- IgD
- IgE
- IgG

- D. IgA
E. IgM
- vi. Which one of the following fungal diseases normally causes opportunistic disease among individuals with a low CD4 cell count?
A. chromoblastomycosis
B. candidiasis
C. histoplasmosis
D. chromoblastomycosis
E. paracoccidioidomycosis
- vii. A child is infected by a nematode, *Schistosoma haematobium* that result in the child passing blood in urine (haematuria) for a few days after which the infection spontaneously resolves itself. Which group of immune cells are primarily responsible for the resolution of the infection in the child?
A. Neutrophils
B. Basophils
C. Eosinophils
D. B cells
E. T cells
- viii. The Human Immunodeficiency virus (HIV) requires CCR5 and CXCR4 co-receptors in order to recognise and enter human cells for multiplication. Which of the following human cells carry these co-receptors?
A. Red blood cells
B. Cytotoxic T lymphocytes
C. Microphages
D. CD4 cells
E. Platelets
- ix. Which immunoglobulin primarily causes anaphylaxis through mediation of the release of mast cells and granules around the bite of a mosquito that becomes itchy, swells into a wheal and reddens?
A. IgE
B. IgG
C. IgA
D. IgM
E. IgD
- x. Which of the immune diseases below is/are examples of autoimmune disease?
A. Rheumatoid arthritis
B. Acquired Immune Deficiency Syndrome (AIDS)
C. Insulin-dependent diabetes mellitus
D. Both rheumatoid arthritis and insulin-dependent diabetes
E. Both AIDS and rheumatoid arthritis

- b. Write **T** (for true) and **F** (for false) for each of the following statements: (5)
- i. Elie Metchnikoff, was the first scientist to demonstrate and describe phagocytosis and was awarded the Nobel Peace Prize in 1908 and hence is regarded as the Father of immunology
 - ii. Eukaryotic cells contain lysosomes that contain lysozyme and other digestive enzymes that break down foreign material brought into the cell by phagocytosis
 - iii. Cocci bacteria are generally non-motile.
 - iv. An example of passive immunisation could be that received by a child when IgA antibodies are secreted in the breast milk of a mother to protect the breast-fed child.
 - v. Heating a wire loop over a Bunsen burner for use in the transfer of samples during laboratory culture of bacteria does not completely sterilize the wire loop

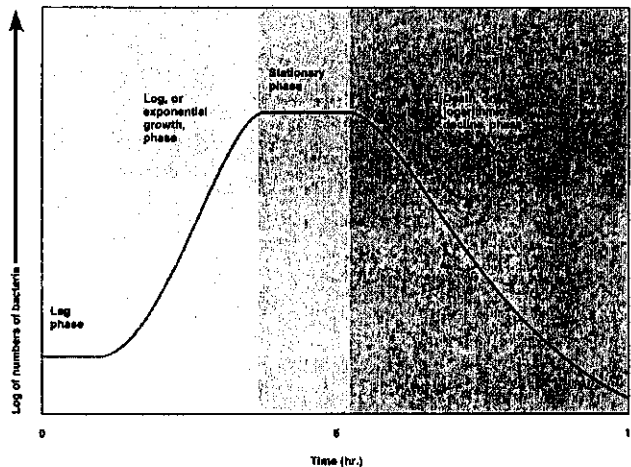
[25 marks]

QUESTION 2

- a. Discuss briefly the components of the general structure of a viral cell. (A drawing may be included to give clarity to your discussion) (5)
- b. Define:
 - i. Transduction (2)
 - ii. Transcription (2)
- c. Discuss the replication cycle of the influenza virus under the following headings:
 - i. Entry into the host cell (3)
 - ii. Entry of vRNPs into the host cell nucleus (3)
 - iii. Transcription and replication of the viral genome (4)
 - iv. Export of vRNPs from the nucleus (3)
 - v. Assembly and budding (3)

QUESTION 3

- a. A microbiology student cultures bacteria in the laboratory and records the number of bacterial cells produced over a time period in days. He plots the log of the number of bacteria against time in days and obtains the bacterial multiplication curve shown below:



- i. Explain why the number of bacteria doesn't change during the lag phase. (2)
 - ii. Explain why the number of bacteria remain constant during the stationary phase. (4)
 - iii. Why does the number of bacteria eventually decrease in the last phase of the culture? (3)
 - iv. The student analyses the culture after and finds that only one type of microorganisms remain after the end of the death phase. What property did these microorganisms have to survive the death phase? (2)
- b. Explain how the following methods effectively control multiplication of microorganisms in the food sample given:
- i. salting of meat (2)
 - ii. keeping meat in a freezer (2)
 - iii. drying of meat in the sun before keeping it (2)
 - iv. boiling milk at 15°C for 15 seconds (2)
 - v. passing pressurised steam through dental equipment prior to re-use (2)
- c. The bodies of hosts have varying conditions that prevent or restrict growth and multiplication of microbes. List ONE microbe that normally grows in each of the following body parts of humans as normal flora.
- i. Nose (1)
 - ii. Mouth (1)
 - iii. Throat (1)
 - iv. Urogenital tract (1)

[25 marks]

QUESTION 4

- a. Giving one example for each, differentiate between:
- i. A disinfectant fluid and an antiseptic (4)
 - ii. Pasteurization and sterilization (6)
- b. Explain why heat treatment of items containing *Clostridium perfringens* commonly fail to remove the microorganisms. (3)
- c. Explain briefly how the following processes are used to destroy microorganisms from substances in order to preserve them:
- i. Ultra-violet radiation (3)
 - ii. Gamma radiation (3)
- d. Some methods of preservation of food are said to be non-sterilizing. Using named examples, discuss briefly how the following techniques may be used to reduce the multiplication rate of microorganisms.
- i. Filtration of fluids (3)
 - ii. Filtration of air (3)

[25 marks]

QUESTION 5

- a. The inflammatory response is an important activity in the protection of animal hosts against invading microorganisms. List the four stages of the inflammatory response. (4)
- b. What signs are associated with an inflammatory response? (4)
- c. Describe briefly the importance of each of the cells and substances listed below in the inflammatory response:
- i. Histamines (2)

- ii. Endothelial cells (2)
 - iii. Phagocytes (2)
 - iv. Platelets (2)
- d. Monocytes circulate in blood and also migrate into tissue during the inflammatory response.
- i. Name two type of cells that develop from circulating monocytes when they are released into tissue. (2)
 - ii. Describe briefly the function of the cells mentioned in (i) above in the tissues where they are formed during an inflammatory response. (7)

[25 marks]

QUESTION 6

A bacterial pathogen enters the body from a skin abrasion. Outline the immune responses that occur to remove the pathogen as well as the development of a response that would be elicited if the same bacterial pathogen happens to enter the body again. (A flow diagram may be used to make your outline clearer).

[25 marks]