

UNIVERSITY OF OTTAWA
FACULTY OF HEALTH SCIENCES

MICROBIOLOGY AND IMMUNOLOGY

BAC 2100

FINAL EXAMINATION

April, 2010

TIME ALLOTTED: 3 HOURS

STUDENT NAME: _____

STUDENT NUMBER: _____

You are given an examination (question sheets) and an ANSWER SHEET. **Make sure your name and correct student number appears on both, including all exam sheets.**

Part A (50 marks)

Answer questions first on your examination (question sheets). After you have finished, check your answers and then transfer carefully to the ANSWER SHEET using an HB pencil.

If you made an error, erase thoroughly the wrong answer. There is only **ONE** correct answer for each question in this part. Each correct answer is worth 1 mark.

Part B (34 marks)

Part C (16 marks)

Answer questions directly on the question sheet using a pen. Find the best match or give the most appropriate short answers.

Return both QUESTION SHEETS and ANSWER SHEET at the end of the examination.

Part A

Which of the following statements about viruses is true?

- a) **They can infect man or animals or both;**
- b) They are structurally too simple to trigger an immune response;
- c) They replicate in living cells and a few artificial media;
- d) Most can be seen with the ordinary light microscope;
- e) They are by definition eukaryotes.

Most viral infections can be treated with:

- a) Penicillin;
- b) Streptomycin;
- c) Wide-spectrum antibiotics (e.g., tetracyclines);
- d) Anti-parasitic drugs;
- e) **None of the above.**

Detection of the presence or absence of antibody against a specific virus is referred to as a(an):

- a) Diagnostic test;
- b) Cell culture (example, plaque assay) test;
- c) Paired sera test (acute and convalescent);
- d) **Immunity test;**
- e) Red blood cell agglutination test.

Recurrent cold sores of the lips are most often caused by:

- a) **Herpes simplex type 1;**
- b) Herpes simplex type 2;
- c) Varicella virus;
- d) Chancres;
- e) Rubella virus.

Herpes zoster (shingles) is a manifestation of a latent infection with:

- a) Herpes simplex virus;
- b) Influenza virus;

- c) Measles virus;
- d) Rubella virus;
- e) **Varicella virus.**

Infectious mononucleosis is caused by:

- a) Hepatitis B virus;
- b) Epstein-Barr virus;**
- c) Measles virus;
- d) Echoviruses;
- e) *Streptococcus pyogenes.*

Major epidemics of influenza are caused by:

- a) The failure to vaccinate the entire population against influenza;
- b) The appearance of new strains of *Haemophilus influenzae*;
- c) The appearance of influenza viruses resistant to antibiotics;
- d) Shifts in the antigenic make-up of Influenza A virus causing immune evasion;**
- e) A sudden increase in humidity and drop in temperature.

Which of the following statements is TRUE?

- a) Hepatitis Delta agent can be controlled with vaccination against HepB;**
- b) Hepatitis C virus can be controlled with vaccination;
- c) Hepatitis A is a blood-borne virus;
- d) Spores are more sensitive than vegetative cells to sanitizers or detergents;
- e) Pre-cleaning is not essential before decontamination of endoscopes.

Viral capsids are mostly composed of which of the following molecules?

- a) Nucleic acids;
- b) Proteins;**
- c) Carbohydrates;
- d) Phospholipids;
- e) Cholesterol.

Killing all the organisms including spores present in a material is known as:

- a) Filtration;
- b) Sanitization;

- c) Lyophilization;
- d) Sterilization;**
- e) Pasteurization.

The common cold is caused by which of the following microorganisms?

- a) Echovirus;
- b) Influenza virus;
- c) Rhinovirus;**
- d) Epstein-Barr virus;
- e) Mycoplasma.

Which of the following statements is TRUE?

- a) The most important procedure in preventing hospital-acquired infections is patient isolation;
- b) Hospitalized patients may have weakened defense mechanisms caused by disease, surgery, radiation and invasive medical procedures;**
- c) Infections caused by a patient's normal flora are called exogenous;
- d) It is only necessary to culture samples from patients when investigating an outbreak of nosocomial disease;
- e) Microorganisms that primarily infect hosts with weakened defense mechanisms are called emerging pathogens.

Which of the following central nervous system (CNS) viruses have an animal reservoir and the human as an accidental or dead-end host?

- a) Mumps virus;
- b) Rabies virus;**
- c) Herpes simplex 1 virus;
- d) Polio virus;
- e) None of the above.

Which of the following reasons is why vaccination against the common cold does not exist?

1. There are too many serotypes of the cold virus
2. Immunity against one serotype does not prevent infection by another

- serotype
3. The only way to control the common cold is via passive immunization.
- a) 1 only;
 - b) 2 only;
 - c) 3 only;
 - d) 1 and 2 only;**
 - e) 2 and 3 only.

Which of the following descriptions about viruses is false?

- a) Genomes of either DNA or RNA but not both;
- b) Structurally very simple;
- c) Obligate intracellular parasites;
- d) Can only infect humans;**
- e) Incapable of growth on artificial medium.

For organ transplantation, an important organism of concern is:

- a) Mumps virus;
- b) Cytomegalovirus;**
- c) Botulinum neurotoxin;
- d) Rhinovirus;
- e) Yellow fever virus.

Which of the following are prokaryotic?

- a) Viruses;
- b) Fungi;
- c) Parasites;
- d) Bacteria;**
- e) None of the above.

18. Humoral immunity:

- a) Includes lysozymes (antibacterial substance such as tears);
- b) Involves B-cells;**
- c) Includes complement;
- d) Involves cell mediated activation against intracellular organisms;
- e) The skin is the largest member of the humoral immune response.

19. Which of the following is not a disease caused by a protozoan parasite?
- a) Amoebiasis;
 - b) Giardiasis;
 - c) Trichinosis;**
 - d) Cryptosporidiosis;
 - e) Cyclosporiasis.
20. Which of the following is not always guaranteed to be a method of sterilization?
- a) Moist heat, such as steam, under pressure;
 - b) Using an appropriate disinfectant;
 - c) Boiling water;**
 - d) Incineration;
 - e) Radiation.
21. Which of the following statements is true?
- a) Foods irradiated with gamma rays become radioactive;
 - b) Pasteurization kills the vegetative cells of most microorganisms but does not sterilize;**
 - c) Non-ionizing radiation is more penetrative than ionizing radiation.
 - d) Dry heat is more effective for sterilization than moist heat;
 - e) Longer exposure to a physical agent results in fewer number of cells killed.
22. The best method to sterilize small instruments that are contaminated by viruses is:
- a) Ultraviolet light;
 - b) Pasteurization;
 - c) Boiling;
 - d) Autoclaving;**
 - e) Filtration.
23. Any agent such as an insect that carries a disease from one person to another is called a (an):
- a) Episome;
 - b) Vector;**
 - c) Host;
 - d) Parasite;

- e) FBI operative.
24. An example of a disease that enters the body through the mouth and gastrointestinal tract is:
- a) Measles;
 - b) Tetanus;
 - c) Hepatitis A;**
 - d) Malaria;
 - e) Yellow fever.
25. Any site in which a pathogen can survive and multiply until it is transferred to a host is known as a (an):
- a) Infection;
 - b) Reservoir;**
 - c) Inflammation;
 - d) Stagnation;
 - e) Vector.
26. The following is an example of Gram-negative diplococci:
- a) *Escherichia coli*;
 - b) *Listeria monocytogenes*;
 - c) *Neisseria meningitidis*;**
 - d) *Streptococcus pneumoniae*;
 - e) None of the above are Gram-negative diplococci.
27. The most common route of infection with Hepatitis B virus is through:
- a) Contaminated water supply;
 - b) Ingestion of contaminated food;
 - c) Contaminated blood and blood products;**
 - d) Inhalation of contaminated aerosols;
 - e) None of the above.

28. Genital herpes is caused by which of the following organisms?
- a) *Toxoplasma*;
 - b) Herpes simplex type I;
 - c) *Salmonella* species;
 - d) Herpes simplex type II;**
 - e) *Varicella*.
29. Which of the following disease is not caused by bacteria?
- a) Gonorrhea;
 - b) Strep throat;
 - c) Diphtheria;
 - d) Histoplasmosis;**
 - e) Tetanus.
30. Contaminated objects such as wound dressings, stethoscopes or even a physician's tie that transfer infectious disease agents to someone are known as:
- a) Fomites;**
 - b) Carriers;
 - c) Reservoirs;
 - d) All of the above
 - e) None of the above.
31. *Giardia lamblia*, a protozoan parasite:
- a) Have easy-to-recognize trophozoites because they have bilateral symmetry;
 - b) Have world wide distribution;
 - c) Require a tick bite for transmission;
 - d) A and B only;**
 - e) All of the above.
32. Which of the following is not associated with important congenital infections?
- a) *Toxoplasma gondii*;
 - b) *Treponema pallidum*;
 - c) *Entamoeba histolytica*;**
 - d) Human Immunodeficiency virus;
 - e) Herpes Simplex Virus.

33. Which of the following is an example of an Enterovirus?
- a) Rotavirus;
 - b) Poliovirus;**
 - c) Adenovirus;
 - d) Norwalk virus;
 - e) Astrovirus.
34. In which of the following infections is a vaccine currently NOT available?
- a) Measles;
 - b) Chickenpox;
 - c) HIV;**
 - d) German measles;
 - e) Mumps.
35. If you had to vaccinate an immunocompromised individual against polio, you would use:
- a) Passive immunization;
 - b) The Salk vaccine;**
 - c) The Sabin vaccine;
 - d) Once you get polio, you are immune for life so it doesn't matter;
 - e) The best antiviral medication available.
36. Which of the following statements is false?
- a) *Clostridium* species are Gram-positive, spore-forming rods capable of growing in anaerobic conditions;
 - b) *Clostridium difficile* is responsible for antibiotic-associated enterocolitis;
 - c) *Bacillus anthracis* is a capsulated, Gram-positive bacillus;
 - d) Infection with *Bacillus cereus* causes gastroenteritis and should be treated with antibiotics.**
 - e) None of the above is false.

37. Rank in size, from smallest to largest, the following organisms:
1. Yeast such as *Candida albicans*;
 2. Measles virus;
 3. *Chlamydia trachomatis*;
 4. *Staphylococcus aureus*;
 5. *Histoplasma capsulatum*;
- a) 2, 1, 3, 4, 5;
 - b) 3, 2, 4, 5, 1;
 - c) 2, 4, 3, 5, 1;
 - d) 2, 3, 4, 1, 5;**
 - e) 2, 5, 3, 4, 1.
38. Which of the following is a Foodborne virus?
- a) Norovirus;**
 - b) Adenovirus;
 - c) Rotavirus;
 - d) Poliovirus;
 - e) Coxsackievirus.
39. Which of the following statements is false?
- a) Immunity against one serotype of the cold virus does not prevent infection by another;
 - b) Humans become infected with histoplasmosis after inhaling conidia present in soil dust;
 - c) *Legionella* is transmitted from person to person;**
 - d) Scarlet fever is a complication arising from *Streptococcus pyogenes* infection;
 - e) Endotoxins are less potent than exotoxins.
40. Which of the following is not associated with a sexually transmitted disease?
- a) *Trichomonas vaginalis*;

- b) ***Chlamydia psittaci***;
 - c) Herpes simplex 2 virus;
 - d) *Neisseria gonorrhoea*;
 - e) *Treponema pallidum*.
41. Which of the following is not transmitted by an insect?
- a) *Borrelia burgdorferi*;
 - b) *Plasmodium* spp.;
 - c) ***Mycobacterium leprae***;
 - d) West Nile virus;
 - e) Yellow fever virus.
42. Suppose you were a pharmacist and you received a prescription for penicillin, what disease would the affected individual most likely have?
- a) **Streptococcal infection**;
 - b) HSV-1;
 - c) Staphylococcal skin infection;
 - d) Hepatitis;
 - e) Rabies.
43. Hospital infection control programs include:
- a) Infection control nurses;
 - b) Infection control physicians;
 - c) Infection control laboratory facilities;
 - d) **All of the above**;
 - e) None of the above.
44. Which of the following is a Gram positive bacterium capable of causing food poisoning/gastroenteritis?
- a) *Shigella sonnei*;
 - b) ***Bacillus cereus***;
 - c) *Streptococcus agalactiae*;
 - d) *Pseudomonas aeruginosa*;
 - e) *Corynebacterium diphtheriae*.
45. Which of the following is not an example of an Altered Target mechanism of antibiotic resistance?
- a) Ribosomal RNA methylation;

- b) Ribosomal protection;
 - c) New drug resistant dihydropteroate synthase;
 - d) Production of B-lactamase;**
 - e) Altered DNA gyrase.
46. Which of the following statements is false?
- a) Nosocomial infections can sometimes be unpreventable;
 - b) A patient cannot be considered a source for nosocomial infection;**
 - c) Handwashing is the most effective means of reducing the transmission of a pathogen from source to host;
 - d) Infection control programs are mandatory in most Canadian hospitals;
 - e) Alcohol-based hand rubs remove transient flora.
47. Rank the following microorganisms in order from the MOST resistant to disinfectants to the LEAST resistant to disinfectants:
1. *Mycobacterium tuberculosis*;
 2. *Clostridium botulinum* spores;
 3. *Escherichia coli*;
 4. Norovirus;
 5. Fungus such as *Candida albicans*.
- a) 2,4,1,3,5;
 - b) 1,2,3,4,5;
 - c) 2,1,5,3,4;**
 - d) 5,2,1,3,4;
 - e) 2,5,1,3,4.
48. The following can be used to treat small amounts of liquids that can be damaged by heat:
- a) Autoclaving;
 - b) UV radiation;
 - c) Filtration;**
 - d) Dry heat;
 - e) None of the above.
49. Which of the following about the bacterial cell wall is false?
- a) The cell wall is a rigid structure giving characteristic shape of bacterial cells;

- b) **The lipopolysaccharide (LPS) is attached to the peptidoglycan layer of Gram positive bacteria;**
- c) Gram negative cell wall is more complex than the Gram positive cell wall;
- d) The peptidoglycan layer of Gram positive bacteria is much thicker than that of Gram negative bacteria;
- e) Not all bacterial cell walls are stainable by the Gram stain method.

50. **BONUS QUESTION:** BAC2100 has:

- a) Made me realize that microbiologists are the coolest!
- b) Turned me into a vegetarian (Cooked veggies only please!)
- c) Been a bore but the professor is GREAT!
- d) Been GREAT but the professor is a bore!
- e) Been the easiest University course I have taken so far!
- f) _____ 😊 add your own 😊

Part B

1. List the FIVE major steps in viral replication (multiplication) in their correct sequence: (10 Marks)

- (i) Adsorption
- (ii) Penetration and uncoating
- (iii) Nucleic acid and protein synthesis
- (iv) Assembly and maturation
- (v) Release

2. What 3 essential factors must hospital infection control programs focus on in order to control nosocomial infections? (3 Marks)

- (i) Source (of infection)
- (ii) Route (way) of transmission
- (iii) Host (immune status)

3. Match the following choices with the descriptions listed below: (5 Marks)
(Each choice should only be used once)

- a) Autoclave;
- b) Pasteurization;
- c) Ionizing radiation;
- d) Non-ionizing radiation;
- e) Incineration;

C Microbicidal treatment used to sterilize packaged food and medical supplies

E Sterilization of highly hazardous material (ebola virus, used needles)

A Sterilization of surgical instruments, linens, media and other liquids

B Destruction of vegetative cells of pathogens and other microorganisms in milk

D Microbicidal treatment of operating room tables and floors

4. What are THREE major mechanisms of bacterial resistance to antibiotics? (3 Marks)

- (i) Alternation in drug target
- (ii) Production of inactivating enzymes
- (iii) Decreased uptake of antibiotic

5. List the three main approaches for detecting viruses in a clinical sample: (3 Marks)

- (i) Detection of virus using EM

- (ii) Inoculation effects in cell culture - cytopathic (plaques)

Inoculation effects in cell culture - immunofluorescence for non-cytopathic viruses

Inoculation effects in cell culture - red blood cell agglutination

- (iii) Direct detection of viral antigens (ELISA)

6. List 5 factors which affect the efficiency of disinfectant action: (5 Marks)

- (i) Concentration of germicide
- (ii) Microbes present
- (iii) Contact time
- (iv) Temperature
- (v) Organic and inorganic load
- (vi) Other factors (pH, age, condition of storage, humidity, method of application)

7. List 5 different types of vaccines used in active immunization (looking for general formats of vaccines, not ones against specific diseases) (5 Marks)
- (i) Live-attenuated
 - (ii) Killed, sub-unit or toxoid
 - (iii) Recombinant
 - (iv) Adsorbed
 - (v) Conjugated
 - (vi) Combined
 - (vii) Combined active-passive

Part C. Match the most appropriate property with each of the following terms: (16 Marks)

- A. Common cold
Mycobacterium tuberculosis _C
- B. Inflammation of the liver
 Influenza virus _J
- C. Mantoux test
 Papilloma virus _E
- D. Cat faeces as common vector of transmission
 Varicella zoster virus _O
- E. Warts and cervical cancer
Enterobius vermicularis _I
- F. Cytocidal for T4 helper cells
 Rotavirus _L
- G. Vaccination of wild animals
Toxoplasma gondii _D
- H. Swelling of parotid glands
 Hepatitis virus _B
- I. "Scotch-tape" test of perianal area
 Norovirus _K
- J. Annual vaccination for high risk groups
Clostridium tetani _N
- K. Majority of non-bacterial related gastroenteritis
 Mumps virus _H
- L. Diarrhea associated with daycares
 Polio virus _P

- M. Toxic shock syndrome in women
Rabies virus G
- N. Lockjaw and severe muscle
spasms M
Staphylococcus aureus
- O Chickenpox F HIV
- P Global WHO vaccination launched
in 1988 A
Rhinovirus