Microbiology and Immunology 2500 A/B: Virology Practice Questions

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Introduction

Dear student,

This document contains content derived from the Microbiology & Immunology 2500A/B course and it focuses specifically on the **virology unit** by providing practice questions to help students follow along with the content presented in lectures. This resource has been created by the Education Team at Webstraw. The Education Team consists of students that have previously taken and/or students that are currently taking Microbiology 2500A/B.

Purpose

This resource focuses on key concepts that are important for students to understand to succeed within this course. This resource was created by students for other students. Our goal is to help students (1) further develop their understanding of course content and (2) achieve greater academic success. (3) Our resource is also open access meaning there are no financial or legal barriers to students who wish to access and use our resource.

Instructions

Before the exam, we recommend that you attempt to familiarize yourself with all the content covered in the bacteriology unit. This document is a supplementary resource used to help organize all the species of viruses in the virology unit, separated by lecture.

This document is accompanied by an **answer document** that will be released on **April 12th.**

Disclaimer: This resource is supplementary to your course content and is not meant to (1) replace any of the resources provided to you by your instructor nor is it meant to (2) be used as a tool to learn the course material from scratch. We assume that students who use this resource will have a basic understanding of the course content. This resource does not contain everything you need to know for your evaluations. Please refer to the course material provided by your instructors if there are any discrepancies between our resource and your course content.

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We wish you the best of luck on your exams!

- The WebStraw Team

Note to Instructors:
If this resource has been created for your course and you would like to collaborate with us, please email us at team@webstraw.ca

Basic Virology Concepts

1. Which of the following are **TRUE** regarding the measles virus?
    A. Its prevalence is reduced in Canada due to the MMR vaccine
    B. It is transmitted via aerosols
    C. It is highly contagious
    D. It is still found in regions in South America and Africa
    E. All of the above

2. What is true about the Ivanovsky and Beijerinck experiments with the tobacco mosaic virus?
    A. The resulting cell debris was able to replicate and infect new plants
    B. The collected cell filtrate could replicate on its own but not infect new plants
    C. The collected cell filtrate could infect new plants but not replicate on its own
    D. Neither the cell debris nor filtrate were able to infect new plants
    E. Both the cell debris and cell filtrate were able to replicate on its own

3. Which of the following are **FALSE** regarding the Mimivirus?
    A. They are 1/1000th the size of *E. coli*
    B. They can be visualized under a light microscope
    C. They infect amoebae, which serve as their host.
    D. They cannot pass through a 0.2 micron filter
    E. All of the above are true

4. What is the term for the first identified patient of a disease?
    A. Original Case
    B. Core Case
    C. Primary Case
    D. Index Case

5. An unvaccinated student who was confirmed to be infected with the measles virus comes back to their crowded school. Which of the following is the most likely scenario?
    A. Only that student will be infected, since direct transmission of measles is difficult
    B. Several other students may be infected from the original student
    C. The student will be resolved in the infection quickly before it spreads to others
    D. Vaccinated students will be most likely to be infected as the MMR vaccine is not very effective against measles

6. What disease was the first animal virus (discovered by Loeffler and Frosch) responsible for?
    A. Herpes
    B. Condylomas (warts)
    C. Pneumonia
    D. Foot and mouth disease
    E. Severe bleeding

7. How do polydnaviruses benefit wasps that lay their eggs in caterpillars?

A. They allow the wasp egg to survive by suppressing the innate immunity of the caterpillar
B. The virus gives the caterpillar a deadly disease, killing it within days
C. The hatching cycle of the egg increases exponentially in speed
D. There is no benefit; the egg will die due to the immune response of the caterpillar

8. What was responsible for the formation of "broken" tulips (i.e. multi-coloured petals)?

A. A pigment-eating bacteria, *Tulipulosis*
B. Chance mutations in pigment genes
C. Genetic cross-breeding between different tulip species
D. A potyvirus that affects pigment synthesis

9. Which of the following are **TRUE** regarding viruses in general?

1. Cannot translate proteins on their own
2. Their genomes are obligate molecular parasites
3. High mutation rates allow for formation of mutant strains
4. Their genome is not required for replication in a host

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. All of the above

10. Which of the following are **FALSE** regarding *Dichanthelium lanuginosum*?

1. It can grow in temperatures 50 degrees Celsius and above
2. Its survival is dependent on a fungus
3. A virus gives the fungus thermotolerance
4. It is continuously infected with the curvularia thermal tolerance virus

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. All of the above

Viral Infectious Cycle

11. What does the host **NOT** provide the virus with in order to complete its infectious cycle?
    A. Energy
    B. Genetic material
    C. Transport vehicles
    D. Protein translation machinery

12. A cell that takes up a virus is _____, and a cell that allows the virus to replicate within is _____.
    A. Susceptible and permissive
    B. Permissive and susceptible
    C. Endogenous and exogenous
    D. Endogenous and resistant

13. Why are monkeys preferred to rodents as a whole animal host for viral replication in the lab?
    A. Monkeys are cheaper than rodents.
    B. It is easier to infect monkeys than mice
    C. Rodents show more resistance to viruses than monkeys
    D. They are not; rodents are preferred over monkeys

14. Which cytopathic effect is characterized by uncontrollable division to create a pile of round cells?
    A. Syncytia
    B. Cell lysis
    C. CPE
    D. Transformation

15. What patterns are expected from cells that undergo syncytia due to viral induction?
    A. Uncontrollable division into mounds of cells
    B. Bursting open of cell membranes
    C. Fusion of adjacent plasma membranes
    D. Immediate apoptosis of infected cells

16. What is a plaque assay used to measure?
    A. Infectivity
    B. Cytopathic effects
    C. Rate of cell division
    D. Rate of cell fusion

17. With Crystal Violet staining in a plaque assay, what colour are the live cells expected to be?
    A. Clear
    B. Purple
    C. Metallic green
    D. Crystal Violet staining is not used in a plaque assay

18. When would red dots be seen in a hemagglutination assay?
    A. When a virus is present in the sample and binds to red blood cells
    B. When a virus is present in the sample and creates a crystal lattice
    C. When a virus is absent in the sample
    D. When both viruses and bacteria are present in the sample to amplify RBC binding

19. Which of the following are methods of physical measurement for viral infection?
    1. Hemagglutination assay
    2. Immunoblotting
    3. Gene sequencing
    4. Transformation assay

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

20. Which of the following are **TRUE** regarding the plaque assay?
    1. Agar is overlaid in order to prevent spread of infection
    2. It was first used to characterize the Herpes virus
    3. Several dilutions are performed prior to counting plates
    4. Plaques represent areas where uninfected bacterial cells reside

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

Viral Genomes

21. Which observation was the key finding of the original Hershey - Chase Experiment of 1952?
    A. The presence of radioactive sulfur in the supernatant after blending and separation
    B. The presence of radioactive phosphorus in the bacterial cells after blending and separation
    C. Fluorescence of the bacterial cell interior increases after blending and separation, decrease in phage capsid fluorescence
    D. The presence of radioactive sulfur in the bacterial cells after blending and separation

22. How does the green fluorescent protein pinpoint the location of a viral protein of interest?
    A. Synthetic GFP is added to a viral sample, and delivered to the target using antibodies specific for the protein of interest.
    B. GFP is given to a host organism, and invading viruses will incorporate GFP into their structures during the viral life cycle.
    C. GFP genes are inserted downstream of the protein of interest's genes in the viral genome, and are thus transcribed/translated alongside the protein of interest
    D. GFP is non-specific, it is incorporated into all viral proteins to indicate the virus' position.

23. Which of the following accurately describes all RNA and DNA viruses?
    A. RNA and DNA viruses arose at the same time, and are the same age
    B. Both are entirely dependent on the host for their life cycle, and do not provide translational/transcriptional machinery of their own.
    C. RNA viruses originated before DNA viruses.
    D. Both (+) ssRNA and (+) ssDNA viruses can be directly translated to proteins

24. Which of the following viruses require RNA dependent RNA polymerase to be translated?
    A. All (+) ssRNA viruses
    B. Rotaviruses and Ebola virus
    C. Poliovirus and Picornaviridae
    D. Rotaviruses and Retroviridae

25. Which of the following cells would contain reverse transcriptase in their cytosol?
    1. A retrovirus, outside of its host
    2. Bacteria infected with the Influenza virus
    3. Human cells infected with JC virus
    4. Human cells infected with HIV

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

26. Latent infection by the JC virus can develop into serious brain diseases when the host:

A. Is infected with a secondary polyomaviridae that overcomes the immune system
B. Is infected with HIV that cripples the host immune system
C. Is also infected with with influenza
D. Stops taking antivirals that would otherwise suppress the JC virus

27. Parvoviridae rely on which assortment of proteins to yield the final viral proteins?

1. Host supplied RNA polymerase
2. Viral encoded DNA polymerase
3. Host supplied DNA polymerase
4. Viral encoded translational machinery

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. All of the above

28. It is observed that a dsRNA viral genome 210 bases long has been damaged on the (+) strand at position 57 only. How might the mutation alter the final protein that is translated from this genome?

A. The protein will not be affected by this mutation
B. Amino acid #57 in the final protein will be different
C. Amino acid #19 in the final protein will be different
D. It is impossible to say without more information

29. The L protein of the Ebola Virus is an example of which of the following?

A. A mechanism to avoid immune detection
B. A host derived protein adapted for viral use
C. A virally encoded protein necessary for the virus to proliferate
D. Part of Ebola Virus' protein capsid after assembly

30. Which of these processes are **NOT** seen in any of the 7 viral classes?

1. RNA to RNA via viral machinery
2. (+) ssRNA to ssDNA with viral machinery
3. (+) ssRNA to protein with cell machinery
4. (-) ssRNA to ssDNA with viral machinery

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. All of the above

Viral Structure

31. Envelopes of viruses are derived from which of the following?
    A. The host lipid bilayer entirely
    B. A combination of host lipid bilayer and virally encoded proteins
    C. Virally encoded and synthesized proteins entirely
    D. The host cell's replicative machinery synthesizing special viral proteins

32. How many P1 precursor proteins are needed to complete the capsid of poliovirus?
    A. 60
    B. 5
    C. 12
    D. 80

33. Which of the following is **TRUE** about viral envelopes and capsids?
    A. The lipids of the capsid can bind with the viral genome to make a nucleocapsid
    B. Every virus has an envelope protecting it when outside of the host cell
    C. The capsids of viruses are derived from virally encoded proteins, while envelopes are primarily derived from host lipid bilayers
    D. In certain cases, the envelope and capsid of viral particles can fuse to form one structure

34. Which of the following are advantages of using NMR spectroscopy over electron microscopy?
    1. More details are visible in the NMR image
    2. No need to pre-crystallize the sample for viewing, allowing more specimens to be imaged
    3. No need to stain and destroy samples for imaging
    4. Process of negative staining allows for much better resolution compared to electron microscopy

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

35. A scientist wants to visualize the overall of a virus of interest, and where proteins are in relation to each other. Which method should he NOT use?
    A. NMR Spectroscopy
    B. Electron Microscopy
    C. Cryo-Electron EM
    D. X-ray crystallography

36. Which of the following bond types are **least** likely to be holding viral protein subunits together?

A. Hydrogen Bonding
B. Ionic bonding across permanent dipoles
C. Van der Waal interactions
D. Ethers formed by dehydration reactions

37.Which of the following could be a role for viral envelope glycoproteins?

A. Binding to surfaces as attachment points
B. Finding and phagocytosing of nutrients in the extracellular environment
C. Recognition of host receptors to initiate invasion
D. Binding with like-receptors to for group and chains or viral particles

38. Which of the following are types of symmetry that viruses fall into?

A. Helical and Polyhedral
B. Helical and tetrahedral
C. Polyhedral and longitudinal
D. Tetrahedral and cylindrical

39. Which of the following are machinery needed for Ebola to go from its genetic material to protein?

1. Host supplied RNA dependent RNA polymerase
2. Viral RNA dependent RNA polymerase
3. Cofactors that boost host ribosome activity
4. Viral supplied RNA dependent RNA polymerase

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. All of the above

40. Which of the following are universal to all viruses?

1. A protein capsid
2. A lipid Envelope
3. Reliance on host to proliferate
4. The L protein

A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. All of the above

Viral Entry

41. Which of the following is not a receptor that allows for virus entry?
    A. CD4P8
    B. GP1
    C. NPC1
    D. ACE2

42. Sialic acid:
    A. Is a receptor on the viral membrane
    B. Is a receptor on the host membrane
    C. Attaches to the ACE 2 receptor
    D. Only contains a 2-6 linkage

43. Which host receptor is required for recognition of SARS-COV2?
    A. CD4
    B. GP1
    C. NPC1
    D. ACE2

44. Which virus releases their genome at the most acidic pH?
    A. Poliovirus
    B. Reovirus
    C. Measles virus
    D. HIV

45. Which of the following are not methods of viral entry into a host cell?
    1. Passive diffusion
    2. Phagocytosis
    3. Osmosis
    4. Receptor-mediated endocytosis

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

46. Which of the following statements are **FALSE**?

1. Virion has to be stable
2. Virion has to be unstable
3. There are many different receptors that allow viral entry
4. All viruses require a single receptor for entry

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

47. Blocking viral entry:
    A. Is simple if we know the receptor used for entry
    B. Is simple if we know the structure of the virus
    C. Is difficult because the receptors have other functions
    D. Is difficult because one receptor recognizes only one virus

48. The avian virus:
    A. Cannot infect humans because it is only specific to birds
    B. Cannot infect humans because humans do not have the correct receptors to recognize the virus
    C. Can infect humans only if there are many virus particles inhaled during a deep breath
    D. Can infect humans because all viruses are recognized by the same receptor that is present on the membrane of all human cells

49. Which of the following are possible locations for the release of the viral genome?
1. Cell surface
2. Early endosome
3. Late endosome
4. Mitochondria

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

50. Which of the following statements is **FALSE**?
    A. One host receptor can recognize multiple viruses
    B. One virus can recognize multiple receptors on a host cell
    C. The one thing all host receptors have in common is that they are all membrane proteins.
    D. All viruses have an envelope

Viral Pathogenesis

51. Which of the following is not a viral mode of transmission?
    A. Diagonal
    B. Vertical
    C. Iatrogenic
    D. Horizontal

52. Which of the following statements is **TRUE** about the Hepatitis A virus?
    A. It has a negative stranded RNA genome
    B. Its mode of entry is through the alimentary tract
    C. A large percentage Puglia residents are infected with it in December
    D. Spreads to the kidney causing stones

53. Which of the following is not one of the levels of defense mechanisms that a virus must overcome?
    A. Intrinsic Immunity
    B. Innate Immunity
    C. Adaptive Immunity
    D. Extrinsic Immunity

54. Which is a characteristic of an inapparent infection?
    A. Symptoms of the infection are visible
    B. Viral replication is very likely
    C. Immune system is not activated by the infection
    D. Viral transmission is very unlikely

55. Which of the following are **TRUE** regarding virus shedding and transmission?
    1. Transmission occurs only between the same genus
    2. Fomites are insects infected by non-enveloped viruses
    3. Non-enveloped viruses are more sensitive to acidic pH than enveloped viruses
    4. Milk is a method of virus shedding

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

56. Which of the following is required for viral pathogenesis?
    1. Susceptible and permissive cells
    2. The correct amount of virions

3. Virus must overcome defense mechanisms
4. Virus must have an RNA genome

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

57. Which is incorrect regarding the Fenner experiment?
    A. The virus involved in the experiment was Mousepox
    B. The animals involved in the experiment were mice
    C. Blisters are a result of viral replication in the skin
    D. Virions in the blood is termed viremia

58. Which of the following is not a possible entry point for viruses?
    A. Conjunctiva
    B. Alimentary canal
    C. Intact skin
    D. Urogenital tract

59. Which of the following is **FALSE** regarding the respiratory tract?
    1. The membrane of the tract is lined by susceptible and permissible cells
    2. The lungs have a small surface area that allows for absorption of virus particles
    3. Viruses enter the tract as droplets produced during sneezing and talking
    4. Viruses must be able to survive the acidity of the upper respiratory tract

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

60. Which of the following is not a reason why the skin is a good barrier against viruses?
    A. The epidermis of the skin is made up of dead cells which cannot be a suitable host for viruses
    B. The dryness of the skin inactivates viruses
    C. The anti-viral peptides of the skin inactivate viruses
    D. The basic pH of skin inactivates viruses

HIV Pathogenesis

61. Which of the following major symptoms were documented in early cases of AIDS?
    1. Red lesions as a result of Kaposi Sarcoma

2. Diarrhea
3. Serious lung disease
4. Drowsiness

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

62. Which of the following statements is **TRUE** regarding the human immunodeficiency virus (HIV)?
    A. It has a (+) ssRNA genome and makes its own reverse transcriptase and DNA polymerase
    B. It has a (-) ssRNA genome and makes its own reverse transcriptase and DNA polymerase
    C. It has a (-) ssRNA genome and makes its own reverse transcriptase.
    D. It has a (+) ssRNA genome and makes its own reverse transcriptase.

63. Which of the following statements is matched correctly with the protein and its function?
    1. Surface Protein (SU): gp120
    2. Transmembrane protein (TM): gp41
    3. Capsid Protein (CA): p24
    4. Capsid Protein (CA): p120

    A. 1, 2 and 3
    B. 1 and 3
    C. 2 and 4
    D. 4 only
    E. All of the above

64. Which of the following correctly describes the transmission of HIV to humans and its pathogenicity?
    A. SIV in Old World Monkeys (**non-pathogenic**) → SIV in chimps (**non-pathogenic**) → HIV in humans (**pathogenic**)
    B. SIV in Old World Monkeys (**pathogenic**) → SIV in chimps (**non-pathogenic**) → HIV in humans (**pathogenic**)
    C. SIV in Old World Monkeys (**pathogenic**) → SIV in chimps (**pathogenic**) → HIV in humans (**pathogenic**)
    D. SIV in Old World Monkeys (**non-pathogenic**) → SIV in chimps (**pathogenic**) → HIV in humans (**pathogenic**)

65. How did the transmission of HIV-1 occur between chimps and humans?
    A. Bushmeat hunting
    B. European colonization
    C. Sexual contact between chimps and humans
    D. Saliva from the chimps

66. How many variants of HIV are out there, and why does this occur?

A. There is only one variant, as the enzyme, reverse transcriptase, is very precise.
B. There are 7 variants, each continent having its own variant due to different geographical locations.
C. There are as many variants as there are infected people, as the enzyme, reverse transcriptase, is very imprecise.
D. There are two variants, one that infects chimps, and one that infects us.

67. The integration of dsDNA made by HIV is a key step. How is it integrated and what are its effects?

A. Integrase makes 3' cuts on both the host and viral genome, and the free 3' OH groups then get ligated together. Integration of the viral dsDNAis a point of no return.
B. Integrase makes blunt cuts on both the host and viral genome. Integration of the viral dsDNA is a point of no return.
C. Integrase makes 3' cuts on both the host and viral genome, and the free 3' OH groups then get ligated together. Integration of the viral dsDNA is not a critical point as the patient can be HIV free later on.
D. Ligase makes 3' cuts on both the host and viral genome, and the free 3' OH groups then get ligated together. Integration of the viral dsDNA is a point of no return.

68. There are many subtypes of the HIV virus, how are these subtypes separated and are there differences in the pathologies of these subtypes?

A. Different forms of HIV are categorized into subtypes based on geographical area. There are no differences in the pathologies.
B. Different forms of HIV are categorized into subtypes based on homology. There are differences in the pathologies, as some subtypes are deadlier.
C. Different forms of HIV are categorized into subtypes based on geographical area. There are differences in the pathologies, as some subtypes are deadlier.
D. Different forms of HIV are categorized into subtypes based on homology. There are no differences in the pathologies.

69. Why was European colonization an accelerator for HIV outbreaks?

A. European colonization introduced the idea of bushmeat hunting.
B. Through urban centres, there were more contacts with sex workers.
C. HIV was brought by Europeans.
D. Colonization did not impact HIV outbreaks.

70. As HIV carries an envelope, what is a possible implication of this?

A. The envelope allows it to be easily detected by host mechanisms.
B. The envelope makes the virus harder to kill using common household cleaning supplies.
C. HIV does not carry an envelope, trick question.
D. It must be transmitted via sexual contact or through blood to blood contact as the envelope is easily destroyed using common household cleaning supplies.

Endogenous Viruses

71. Ebola is an example of a zoonotic disease. What was its original host?

A. Chimps
B. Rats
C. Snakes
D. Bats

72. Which of the following correctly describes endogenous viruses?

A. Endogenous viruses are remnants of old viruses that are present in the somatic cells of an individual only and are likely non-pathogenic.
B. Endogenous viruses are remnants of old viruses that are present in the germ cells of an individual and are likely non-pathogenic.
C. Endogenous viruses are remnants of old viruses that are present in the germ cells of an individual and are likely pathogenic.
D. Endogenous viruses are remnants of old viruses that are present in the somatic cells of an individual only and are likely pathogenic.

73. The Koala retrovirus has been one of the fundamental reasons for the declining Koala population. Why is that?

A. The virus has been causing severe dehydration in Koalas.
B. KoRV makes koala's more susceptible to death by pneumonia.
C. Some of the mothers have problems during gestation leading to early infantile death
D. Lymphomas and leukemias have been on the rise in koala populations, although whether the virus directly causes it is unknown.

74. What is the difference between KoRV-A compared to KoRV-B in terms of pathogenicity and receptor usage?

A. KoRV-A is more pathogenic and uses similar receptors as KoRV-B
B. KoRV-A is more pathogenic and uses different receptors to KoRV-B
C. KoRV-B is more pathogenic and uses different receptors to KoRV-B
D. KoRV-B is more pathogenic and uses similar receptors as KoRV-B