

MFEF06
Biology 2400
Final Examination
E. Hoffman

Name: _____

Score: _____ points out of 105

STUDENTS:

- 1. Please use a #2 pencil on the scantron sheet.**
 - 2. Each scantron question has a point value of .75 points.**
 - 3. Record any erasures on the list provided at the front of the room.**
 - 4. Feel free to ask for further information about any of the questions.**
 - 5. The total value of this portion of the examination is 105 points.**
-

1. Which of the following microscopes would be the best, if the only characteristic for making this determination was the resolving power of the microscope?
 - A) Microscope A whose RP was 100 micrometers
 - B) Microscope B whose RP was 10 micrometers
 - C) Microscope C whose RP was 1 micrometer

2. Your microscope is outfitted with a 20X ocular and has a 20X rated objective. The total magnifying capability of the instrument is ___X
 - A) 20
 - B) 40
 - C) 400
 - D) None of these.

3. The type of microscope utilized in our laboratory is considered to be ___ in its nature.
 - A) Concave
 - B) Compound
 - C) Composite
 - D) None of these.

4. One of the factors which determines the resolving power of a microscope is ___.
 - A) Its number of oculars
 - B) Its Optical vibratory patterns
 - C) Refractive index
 - D) None of these.

5. Anton Van Leeuwenhoek first demonstrated ___.
 - A) The existence of microbial metabolism
 - B) That microbes can cause human illness
 - C) The existence of microorganisms
 - D) None of these.

6. Microorganisms were not discovered before the middle of the 1600's because ____.
- A) They did not yet exist
 - B) They were only found in the very deep areas of the world's oceans.
 - C) The technology did not yet exist to see them
 - D) Leeuwenhoek and his findings were not yet linked to metabolism
7. Immersion oil works to ____ the resolving power of your microscope.
- A) Increase
 - B) Decrease
8. A basic stain is characterized by having a ____ electrical charge on its chromophore group.
- A) Negative
 - B) Positive
 - C) Neutral or no electrical charge
9. Heat fixing is usually done when staining bacterial smears ____.
- A) To insure that the cells are of the correct density to absorb the dyes
 - B) To increase the chances of the cells sticking to the slide during the staining procedure.
 - C) To insure the germination of any spores which are in the smear
 - D) None of these.
10. The experimental work of Pasteur provided ____ for the concept of spontaneous generation of microorganisms.
- A) Support
 - B) No support
11. Robert Koch developed his "postulates" during his pioneering studies of the disease ____.
- A) Bubonic plague
 - B) Anthrax
 - C) Cholera
 - D) None of these
12. The above mentioned postulates allow the investigator to ____.
- A) Determine how a microbe causes the symptoms associated with a particular disease.
 - B) Determine if a particular microorganism is the cause of a particular disease
 - C) Determine how an individual contracts a disease causing microbe.
 - D) None of these

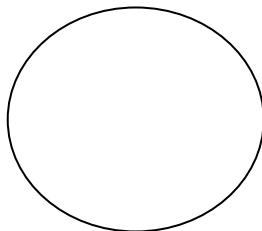
13. The “Golden Age of Microbiology” is most noted for ____.
- A) The determination of the genomes of many disease causing microorganisms
 - B) The determination of the causative agents for many classical diseases such as bubonic plague.
 - C) The determination of the basic chemical workings of many microorganisms
 - D) None of these.
14. There are a total of ____ different currently recognized Domains of life.
- A) 2
 - B) 3
 - C) 4
 - D) None of these.
15. Which of the following bacterial organisms is most likely to be an acid fast positive bacterium? ____
- A) *Escherichia coli*
 - B) *Mycobacterium smegmatis*
 - C) *Clostridium tetani*
 - D) *Staphylococcus aureus*
16. Which of the following bacterial organism is most likely to able to produce endospores (spores)? ____
- A) *Escherichia coli*
 - B) *Mycobacterium smegmatis*
 - C) *Clostridium tetani*
 - D) *Staphylococcus aureus*
17. Which area of the “typical virus” is indicated by the arrow in the sketch shown below?
- A) Envelope
 - B) Coat
 - C) Core
 - D) None of these.
18. In terms of their size, virtually all known viruses can be described as being ____ in nature.
- A) Macroscopic
 - B) Microscopic
 - C) Submicroscopic
 - D) None of these.

19. Prions are particles constructed from ____ which can cause disease states in living organisms.
- A) Lipid
 - B) Carbohydrate
 - C) Protein
 - D) None of these.
20. BOD materials are removed from sewage in what is known as the ____ treatment stage.
- A) Primary
 - B) Secondary
 - C) Tertiary
 - D) None of these.
21. Sewage BOD chemicals are ____ in nature.
- A) Organic
 - B) Inorganic
 - C) Isotonal
 - D) None of these.
22. Negative staining is a technique that you would make use of primarily when it was necessary to determine the ____.
- A) Optical density of a bacterium
 - B) Electrical charge on the surface of the bacterium
 - C) Shape of a bacterium
 - D) None of these.
23. Bacterial flagella are considered to be ____ structures.
- A) Variant
 - B) Invariant
24. Since most bacterial cells are really quite small, they exhibit a very ____ surface area to volume ratio.
- A) Small
 - B) Large
25. The cellular arrangement shown below would be considered to be ____ in nature.
- A) Streptococcal
 - B) Staphylococcal
 - C) Isomorphic
 - D) None of these.

26. The arrow is indicating what structure in the bacterial cell?
- A) Glycocalyx
 - B) Plasma membrane
 - C) Mesosome
 - D) None of these.
27. Usually bacterial cell dimensions are given in micrometers. This unit of length in the metric system is equal to ____.
- A) 100 millimeters
 - B) one millionth of a meter
 - C) 10 centimeters
 - D) None of these.
28. It would not be unusual to see bacterial cells exhibiting Brownian motion, if one was viewing a ____.
- A) Negative stain
 - B) Hanging drop
 - C) Acid fast stain
 - D) None of these.
29. The cell walls of the Gram ____ bacterial have the greatest degree of chemical complexity which is to say, they have the greatest number of different chemicals in them.
- A) Positive
 - B) Negative
 - C) Neutral
 - D) None of these.
30. The cell walls of bacteria have, as probably their prime function, the protection of the cell from the effects of ____ solutions.
- A) Hypotonic
 - B) Hypertonic
 - C) Isotonic
 - D) None of these
31. In the case of bacterial organisms, the site within the cell where the majority of the ATP molecules are synthesized is the ____.
- A) Mesosome
 - B) Peptidoglycan layer
 - C) Plasma membrane
 - D) None of these.
32. The diagram that is shown below best describes a (an) ____ chemical reaction.
- A) Hyperbolic
 - B) Anabolic
 - C) Catabolic
 - D) None of these.

33. The 1897 work of the Buchner brothers (for which a Nobel Prize) was awarded demonstrated that ____.
- A) Enzymes are protein molecules
 - B) Yeast cells are required for the conversion of sugar into alcohol and carbon dioxide.
 - C) Yeast juice can cause the fermentation of sugar
 - D) None of these.
34. The idea of the enzyme and “helper molecules” (coenzymes) evolved from the work of Harden and Young in which the process of ____ played a central role.
- A) Oxidation
 - B) Polymerization
 - C) Dialysis
 - D) None of these.
35. The idea of taking a rather nutritionally useless form of an element such as N_2 and converting into a much more useful form such as ammonia, NH_3 is called ____.
- A) Augmentation
 - B) Reduction
 - C) Fixation
 - D) None of these
36. Based on the graph shown below, the optimal temperature for the bacterium is ____.
-
37. ____ is a form of enzymatic inhibition which leads to a change in the shape of the enzyme molecule.
- A) Superanal
 - B) Allosteric
 - C) Reductional
 - D) None of these.

38. The use of an external final electron acceptor, which is not O₂, is indicative of ____ respiration.
- A) Aerobic respiration
 - B) Anaerobic respiration
 - C) Fermentation
 - D) None of these.
39. The following reaction would be considered to represent ____ phosphorylation.
- A) Substrate level
 - B) Oxidative
 - C) Positional
 - D) None of these.
- $\text{PEP} + \text{ADP} \rightarrow \text{ATP} + \text{Pyruvic acid}$
40. You would expect to generate the greatest number of ATP molecules from the ____ of a single molecule of glucose.
- A) Fermentation
 - B) Aerobic respiration
41. The chemiosmotic theory is an attempt to explain the ____.
- A) Nature of the osmotic nature of the bacterial cell
 - B) Production of ribosomal proteins by the average bacterial cell
 - C) Production of ATP molecules by cells
 - D) None of these.
42. The above concept (#41) contends that ____.
- A) Mitochondria contain inner membranes
 - B) Protons are transferred across biological membranes
 - C) Flagella are constructed from protein
 - D) None of these,
43. The absence of which of the following enzymes was cited as probably playing a central role in mandating that certain bacteria function as strict anaerobes?
- A) Hexose kinase
 - B) Superoxide dismutase
 - C) Sucrase
 - D) None of these
44. Which of the following colonies is most likely to be a “blow in”?



45. The deamination is a type of chemical reaction which you would expect to find occurring when ___ molecules are metabolized to produce ATP.
- A) Lipid
 - B) Carbohydrate
 - C) Protein
 - D) None of these.
46. The biochemical pathway known as beta oxidation is involved with the metabolism of certain ___ molecules for the purpose of producing ATP.
- A) Lipid
 - B) Carbohydrate
 - C) Protein
 - D) None of these.
47. The process of anoxygenic photosynthesis is carried out by ___.
- A) Protozoans
 - B) Some bacteria
 - C) Eucaryotic algae
 - D) None of these.
48. The two products of the light reactions of photosynthesis are ___.
- A) ATP and glucose
 - B) ATP and NADPH
 - C) ATP and Oxygen
 - D) None of these.
49. *Thiobacillus thiooxidans* derives its energy from the oxidation of sulfur and uses carbon dioxide as its carbon source. This bacterium would be classed as being a ___.
- A) Photoautotroph
 - B) Photoheterotroph
 - C) Chemoautotroph
 - D) None of these.
50. The PCR reaction is a set of chemical reactions, which are used to ___.
- A) Produce biologically useful protein molecules
 - B) Produce many large quantities of DNA from a very small amount of this material.
 - C) Generate very large amounts of ATP
 - D) None of these.
51. MPN testing is normally associated with ___.
- A) Testing for antibiotic resistance in bacteria
 - B) Testing water to determine its microbial safety
 - C) Testing meats for the presence of *Salmonella* bacteria
 - D) None of these.

70. Ultra violet light is a fairly common form of radiation that is used to sterilize materials. UV light is known to have ____.
- A) Very poor penetrating capability
 - B) Very high penetrating capability
71. During the genetic transfer mechanism known as transduction, the gene that is being transferred is carried to its target by a ____.
- A) Endospore
 - B) Antibody
 - C) Bacterial virus
 - D) None of these.
72. During the laboratory dealing with transduction, you attempted to insert a genetic trait into ____.
- A) *Enterococcus faecalis*
 - B) *Pseudomonas fluorescens*
 - C) *Bacillus cereus*
 - D) None of these.
73. Plaques are ____.
- A) Very dangerous viruses
 - B) Holes in a bacterial lawn
 - C) Another name that is given to prions
 - D) None of these.
74. What area of a virus is indicated by the arrow?
- A) The coat
 - B) The core
 - C) The envelope
 - D) None of these..
75. Which process is associated with the exit of a virus from an infected host cell?
- A) Transdetermination
 - B) Budding
 - C) Flocculation
 - D) None of these.
76. The first virus that was viewed under the electron microscope was that which causes ____.
- A) Polio
 - B) Anemia
 - C) Tobacco mosaic disease
 - D) None of these.

77. One of the major characteristics that sets viruses apart from other types of microorganisms is ____.
- A) Their lack of proteins
 - B) Their inability to undergo mutation
 - C) Their small size that requires the use of the electron microscope to actually see them.
 - D) None of these.
78. Mutations involve changes in the ____ of DNA.
- A) Phosphate groups
 - B) Sugar molecules
 - C) Nitrogenous base sequence
 - D) None of these.
79. A mutation that results in the production of exactly the same protein as the original is referred to as a ____ mutation.
- A) Reference
 - B) Incipient
 - C) Silent
 - D) None of these
80. The antibiotic sensitivity test that you carried out in the laboratory would be an example of an ____ test.
- A) In vitro
 - B) In vivo
 - C) In Viticum
 - D) None of these.
81. To determine the sensitivity of the microbe to the antibiotic being tested (by the procedure mentioned above, you would need to ____.
- A) Have access to a microscope
 - B) Have access to a reference table
 - C) Have access to a membrane filter assembly
 - D) None of these
82. The most commonly used alternative host for cultivating human influenza viruses is the ____.
- A) Pig
 - B) Chicken egg
 - C) Leopard frog
 - D) None of these

83. Bacterial organisms such as *E. coli* can defend themselves against viral invasion by the use of a group of enzymes known as ____.
- A) transaminases
 - B) ATPases
 - C) Restriction endonucleases
 - D) None of these.
84. Viroids can be described as being ____.
- A) Very dangerous viruses
 - B) Small protein molecules
 - C) Small RNA molecules
 - D) None of these
85. If a RNA triplet in m-RNA was ACA, the corresponding triplet on the (+) strand of DNA would be ____.
- A) ACA
 - B) TGT
 - C) ACC
 - D) None of these
86. You would expect to make use of a Durham tube if you were conducting a (an) ____ test.
- A) Indol
 - B) Starch hydrolysis
 - C) Sugar fermentation test
 - D) None of these
87. In the ELISA procedure conducted in the laboratory, a positive result was indicated by the ____.
- A) Development of a gas bubble in the inner tube
 - B) Development of a blue color in the test well
 - C) Agglutination of the latex beads
88. The discovery of the bacterial transformation process grew out of studies involving the bacterium ____.
- A) *Bacillus subtilis*
 - B) *Staphylococcus aureus*
 - C) *Streptococcus pneumoniae*
 - D) None of these
89. The person who is given credit for the discovery of the process of bacterial transformation is ____.
- A) J.D. Watson
 - B) F. Pierce
 - C) G. Beadle
 - D) None of these.

90. The trait that was received by the bacteria mentioned in question #89 was ____.
- A) The ability to generate endospores
 - B) The ability to produce endotoxin
 - C) The ability to produce a capsule
 - D) None of these
91. In the ELISA procedure, the ____ antibody carries the enzyme.
- A) Primary
 - B) Secondary
 - C) Tertiary
 - D) None of these
92. You were introduced to the term, defined medium. These are microbial growth media ____.
- A) Which are used to grow highly pathogenic bacteria
 - B) For which you know the qualitative and quantitative chemical make up
 - C) Which can be used to cultivate viral organisms
 - D) None of these
93. The catalase test is positive when you observe the presence of ____.
- A) A red color in the medium
 - B) A blackening in the medium
 - C) Bubbles after the addition of the test reagent
 - D) None of these.
94. The F factor noted in the discussion of the process of conjugation is really a type of ____.
- A) Enzyme
 - B) Antibody
 - C) Plasmid
 - D) None of these
95. In the situation where there is conjugation between a F⁺ and F⁻ cell, you would expect the F⁻ to exit the process as a ____ cell.
- A) F⁺
 - B) F⁻
 - C) F⁰
 - D) None of these.
96. In the case of the Hfr cell, the F factor is located in the ____ of the cell.
- A) Pilus
 - B) Septum
 - C) Plasma membrane
 - D) None of these.

97. It was noted in class that plasmids are of significant concern to the medical community because of ____.
- A) Their association with the process of endospore formation
 - B) Their association with antibiotic resistance in many bacteria
 - C) Their association with the SOD enzyme in a number of bacterial species
 - D) None of these.
98. If you were to receive a gamma globulin injection, you would be receiving ____.
- A) Antigens
 - B) Antibodies
 - C) Antibiotics
 - D) None of these.
99. The agent which moves genes between donor and receiver cell in transduction is a ____.
- A) Virus
 - B) Viroid
 - C) Prion
 - D) None of these
100. In the case of specialized transduction, the receiver cell is playing host to a ____.
- A) Lytic phage
 - B) Limpet phage
 - C) Lysogenic phage
 - D) None of these.
101. In specialized transduction, the above-mentioned phage is activated by a process known as ____.
- A) Lysis
 - B) Lysogenic transdetermination
 - C) Induction
 - D) None of these.
102. The above-mentioned process would most likely be triggered by ____.
- A) Exposure to steam
 - B) The presence of calcium chloride CaCl_2
 - C) Ultra violet light exposure
 - D) None of these
103. You were introduced to the Ames test. This procedure is normally used as a screening test to determine if there is a possibility that a chemical might be ____.
- A) Toxic
 - B) Carcinogenic
 - C) Saline
 - D) None of these.

104. When conducting an Ames test, one normally uses bacteria which belong to the genus, ____.
- A) *Proteus*
 - B) *Pseudomonas*
 - C) *Streptococcus*
 - D) None of these.
105. The mutants looked for in Ames testing are identified by ____.
- A) Their ability to grow on minimal medium
 - B) Their ability to grow on complete medium
 - C) Their ability to hydrolysis starch
 - D) None of these.
106. Replica plating is a technique that is used to ____.
- A) Induce mutations in bacterial cells
 - B) Remove mutant DNA from bacterial cells
 - C) Identify mutant bacteria
 - D) None of these.
107. In the replica plating procedure noted in class, mutant bacteria ____ on minimal medium.
- A) Could grow
 - B) Could not grow
108. Wool Sorter's Disease was cited as an example of a disease that is acquired via the ____ route.
- A) Direct contact
 - B) Ingestion (eating and drinking)
 - C) Inhalation
 - D) None of these
109. The above-mentioned condition would be called ____ by today's medical community.
- A) Cholera
 - B) Typhoid fever
 - C) Inhalation anthrax
 - D) None of these.
110. The passage of an infectious microbe from an adult female vector to one of her fertilized eggs is spoken of as ____.
- A) Transdetermination
 - B) Transovarian passage
 - C) Hyperinfection
 - D) None of these.

111. Alternative hosts for a microbe (ground squirrels in the case of bubonic plague) which act to complicate the process of the control of these diseases are referred to as ____ hosts for the microbes.
- A) Special
 - B) Intermediate
 - C) Reservoir
 - D) None of these.
112. A nosocomial infection refers to an infection that is ____.
- A) Caused by an unknown microbe
 - B) Lethal in nature
 - C) Acquired by a person while in the hospital
 - D) None of these.
113. The ancient and well-known disease, cholera, “gets to us humans” by the ____ route.
- A) Vector
 - B) Inhalation
 - C) Ingestion
 - D) None of these.
114. Some time was spent discussing a parasitic condition known as schistosomiasis. The schistosomes which cause this condition in many belong to a group of organisms known as ____.
- A) Roundworms
 - B) Blood flukes
 - C) Cladophorians
 - D) None of these.
115. The above-mentioned parasite gains entrance to the human body by ____.
- A) The bite of an infected mosquito
 - B) Being ingested with food
 - C) Penetrating directly through our skin
 - D) None of these.
116. The person who is usually given credit for developing the concept of controlling microbial infections with the use of chemicals (magic bullets) is ____.
- A) Flemming
 - B) Ehrlich
 - C) Domack.
 - D) None of these
117. Endotoxins are usually associated with Gram ____ bacteria.
- A) Positive
 - B) Negative
 - C) Neutral
 - D) None of these.

118. The 1918 flu virus was used to illustrate the ability of a microbe to function as a (an) ____.
- A) Exotoxin
 - B) Lysogenic agent of destruction
 - C) Superantigen
 - D) None of these
119. In discussing reservoir host, the Ebola virus was cited. It is currently believed that this virus probably uses the ____ as a reservoir host.
- A) Bats
 - B) Birds
 - C) Tsetse flies
 - D) None of these
120. Which of the following toxin types is the most potent?
- A) Endotoxin
 - B) Flavotoxin
 - C) Exotoxin
 - D) None of these
121. Siderophores were mentioned in connection with the ability of some microbes to ____.
- A) Poison their hosts
 - B) Steal food from their hosts
 - C) Destroy the tissues of their hosts
 - D) None of these.
122. Some time was spent discussing a bacterium by the name of *Listeria monocytogenes*. This bacterium can move about the body by ____.
- A) The use of its well developed polar flagella
 - B) The use of pseudopodia
 - C) Entering certain of the white blood cells of the blood stream.
 - D) None of these.
123. One of the major reasons for the presence of compromised immune systems that was noted in class was ____.
- A) The widespread use of pesticides
 - B) Cancer and its treatment
 - C) The widespread appearance of antibiotic resistance in recent years
 - D) None of these.
124. Toll like receptors are involved in a ____.
- A) System that leads to the production of antibiotics by the human body
 - B) System which detects the presence of microbes and then alerts the appropriate components of the immune system to deal with the invaders
 - C) System to lead to the production of F⁺ cells by the body's immune system
 - D) None of these.

125. Fimbriae and pili are structures, which play a role in the ability of bacteria to ____.
- A) Produce Exotoxins
 - B) Attach to tissues
 - C) Produce Lysozyme
 - D) None of these.
126. You would not expect to find a normal flora in ____.
- A) Intestinal tract of man
 - B) On the skin of man
 - C) The very end of the urethra
 - D) None of these.
127. Diapedesis is associated with ____.
- A) The production of lysosomes by white blood cells
 - B) The production of bacterial toxins
 - C) The exit of white blood cells from capillaries
 - D) None of these.
128. The “Father of Phagocytosis” is ____.
- A) Pasteur
 - B) Metchnikoff
 - C) Ringer
 - D) None of these.
129. The acid in the stomach that is responsible for the rather low pH that is found within this organ is ____.
- A) Sulfuric acid H_2SO_4
 - B) Nitric acid HNO_3
 - C) Hydrochloric acid HCl
 - D) None of these.
130. Skin and chemical barriers are considered to be part of our ____ defenses against microbial invasion.
- A) Specific
 - B) Nonspecific
131. The cells of the reticuloendothelial system make use of their ability to conduct ____ to aid the defense of the body.
- A) Antibody production
 - B) Hydrochloric acid production
 - C) Phagocytosis
 - D) None of these
132. Antibody molecules are ____ in nature.
- A) Lipid
 - B) Protein
 - C) Carbohydrate
 - D) None of these

140. It is generally felt that the work of ____ is the first study in the modern era that led to the idea of treating our drinking water supplies.

- A) Wilson
- B) Pasteur
- C) Snow
- D) None of these.

Name: _____ Score _____ points out of 20pts

Laboratory Calculations:

1. The total value of these problems is 20pts
 2. Each problem has its point value indicated
-
1. Show by means of a labeled dilution scheme, how you would produce a 100,000,000 dilution of the milk. (4pts)



2. Indicate the dilution factors that should be placed on each of the Petri dishes in the scheme shown below. (4pts)



3. The following is the “formula” for the preparation of Spirit Blue Agar. Add 35gm of Spirit Blue Agar and 25gm gm of lipase reagent to 1000ml of distilled water. How would you prepare 2.5liters of this agar? (4pts). **Please show all of your work and place the answers into the table provided.**

Spirit Blue Agar	Grams
Lipase reagent	Grams
Distilled water	Milliliters

4. Given the information shown below, what is the length of the bacterium? (4pts)

Place the answer in the box provided →

Place answer in here

5. You are beginning with a culture, which contains 40 bacteria. These bacteria can reproduce every 20 minutes. How many would you expect to have, if you cultured these bacteria for a period of 10 hours. Show you “work” and place your answer into the box provided for that purpose. (4pts)

Place answer in here.

