1. **Multiple Choice: A Pasteur flask has a(n)**

   Success: 147 questions added as a copy.

   **Question**
   A Pasteur flask has a(n)

   **Answer**
   - swan neck to prevent particulate matter from getting into the main body of the flask.
   - double neck so two substances may be added at the same time.
   - secondary opening at the base to allow for drainage.
   - inverted upper edge to prevent spillage while swirling.

2. **Multiple Choice: A colony on a Petri plate arises from...**

   **Question**
   A colony on a Petri plate arises from a single cell. How many cells does a typical bacterial colony contain?

   **Answer**
   - $10^1$
   - $10^3$
   - $10^5$
   - $10^7$

   **Correct Feedback**
   Correct!

   **Incorrect Feedback**
   Incorrect. Your answer should consider that bacterial cells are very small and only very large numbers of cells can be seen by the naked eye.

3. **Multiple Choice: A microbial cell's membrane is consid...**

   **Question**
   A microbial cell's membrane is considered ________, because its internal constituents are maintained within the cell. However, it also imports and exports other molecules in response to its environment.

   **Answer**
   - differential
   - microselective
   - rigid
   - semipermeable

4. **Multiple Choice: A pure culture**

   **Question**
   A pure culture

   **Answer**
   is sterile.
is a population of identical cells.
is made of a clearly defined chemical medium.
contains one microbial cell.

5. True/False: According to our present understanding, each of the three major domains has what is known as its own universal ancestor.

Answer: True

6. Multiple Choice: All life on Earth can be divided into...

Question: All life on Earth can be divided into three main Domains, the Bacteria, the Archaea, and the Eukarya, based on the similarities of their ________.

Answer: ribosomal RNA

Correct Feedback: Correct!
Incorrect Feedback: Incorrect!

7. True/False: All microorganisms require molecular ...

Question: All microorganisms require molecular oxygen to carry on life functions.

Answer: True

8. Multiple Choice: Although the existence of microorganisms was surmised long before, their discovery depended upon a technological development (the microscope) in order for scientists to ________.

Answer: make direct observations of microbes

Correct Feedback: Correct!
Incorrect Feedback: Incorrect!

9. Multiple Choice: An ecosystem includes ________ along ...

Question: An ecosystem includes ________ along with ________.

Answer: macroorganisms / microorganisms

Correct Feedback: Correct!
Incorrect Feedback: Incorrect!

Points: 10

Points: 10

Points: 10

Points: 5

Points: 5

Points: 10

Points: 5

Points: 10
10. **Essay:** An investigator attempting to replicate Pasteur’s swan-necked flask experiment has boiled a hay infusion for 1 hour. However, she observes growth in the flask after 1 day (even when undisturbed). What is the likely explanation for this result?

**Answer:** The most likely explanation is that bacterial endospores were present in the sample. Some soil bacteria (like *Bacillus subtilis*) produce heat-resistant endospores. Vegetative microbial cells are rapidly killed by boiling. However, the endospores are able to survive extended exposure to high temperatures. Once the culture temperature drops, the surviving endospores will germinate and begin to multiply in the culture medium.

11. **Multiple Choice:** Applied microbiology deals with important problems in medicine, agriculture, industry, medicine, agriculture, and industry.

**Answer:** medicine, agriculture, and industry.

12. **Multiple Choice:** Approximately two billion years ago, ________ were primarily responsible for initially oxygenating Earth.

**Answer:**
- algae
- *Archea*
- cyanobacteria
- purple sulfur bacteria

13. **Multiple Choice:** *Archea* and Bacteria are unified as prokaryotes in lacking ________ which *Eukarya* contain, such as golgi.

**Answer:**
- membranes
- nuclei
- membrane-enclosed organelles
- nuclei and membrane-enclosed organelles

14. **Multiple Choice:** *Bacillus anthracis* deficient in its ability to differentiate would not be able to chemotax towards growth substrates.

**Answer:**
- create vesicles.
- form endospores.
- grow without additional supplemented nutrients.

15. **Multiple Choice:** Bacteria can have positive, neutral, or negative effects on humans and other macroorganisms. Which of the following would be a negative association?

**Answer:** cellulose degraders in the cow rumen, nitrogen fixing bacteria in a soybean root.
sulfur oxidizing bacteria in soil

Correct Feedback: Correct!
Incorrect Feedback: Incorrect!

16. Essay: Based upon the properties of life, do you think that viruses are alive or not? What evidence supports your opinion?

Answer: Most scientists regard viruses as nonliving entities. Although they are able to reproduce and their genetic material may evolve over time, they require the host cell’s machinery to do so. In addition, viruses lack their own metabolism and protein synthesis machinery, are not motile, and neither communicate nor differentiate during growth. Furthermore, viruses are acellular microbes. All known living organisms are composed of cells.

17. Multiple Choice: Basic microbiology can be used to

Answer: probe the fundamental processes of life, study characteristics of cells of multicellular organisms, model our understanding of cellular processes in multicellular organisms, including humans.

18. Multiple Choice: Bioremediation ________ by introducing pollutant-consuming microorganisms or specific nutrients that help microorganisms degrade pollutants.

Answer: accelerates the natural cleanup process, exploits genetic exchange mechanisms, invokes microbial evolution, uses chemotaxis of biodegrading microorganisms.

19. True/False: Both environmental conditions and nutrient resources strongly influence the composition of a microbial community.

Answer: True

20. Multiple Choice: Chemolithotrophy involves

Answer: oxidation of organic compounds, oxidation of inorganic compounds, reduction of organic compounds, metabolic autotrophy.

21. Essay: Compare and contrast the functions mi...
### 22. Essay: Compare and contrast the leading causes of death...

**Question:** Compare and contrast the leading causes of death in 1900 with the leading causes of death today. What roles have microbiologists played in the dramatic changes that are evident?

**Answer:** Answers will vary, but should focus on how pathogens that killed people in the early 1900s are now treatable due to knowledge learned from microbiologists.

### 23. Essay: Compare and contrast the works of Louis Pasteur and Robert Koch...

**Question:** Compare and contrast the works of Louis Pasteur and Robert Koch in terms of both applied and basic science.

**Answer:** Answers will vary, but should highlight the differences between basic scientific research in which fundamental ideas are discovered opposed to the usage of microbiological principles to solve larger questions. Examples of Pasteur's basic science contributions are his work showing that fermentation was mediated by microorganisms and the preferential metabolism of particular optical isomers by microbes. Pasteur also applied his ideas to develop sterilization techniques. Robert Koch focused more on the application of microbiology to identify the cause of tuberculosis by developing pure culturing techniques and the four postulates to link microbes to a disease.

### 24. Multiple Choice: Consider the following two statements...

**Question:** Consider the following two statements about microorganisms and their environments: I. Aerobic organisms maintain oxygen in their environment. II. Some microorganisms consume the waste products of another population as nutrients.

**Answer:**

- Only statement I is correct.
- Only statement II is correct.
- Both statements I and II are correct.
- Neither statement I nor II is correct.

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. The interplay of organisms in the environment is complex and dynamic.

### 25. Multiple Choice: Consider the following two statements...

**Question:** Consider the following two statements: I) Ecosystems are influenced by microbial activities. II) Microbial ecosystems remain constant over time.

**Answer:**

- Only statement I is correct.
- Both statements I and II are correct.
- Neither statement I nor II is correct.

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. You should consider the major impact microorganisms have on the environment.

### 26. Multiple Choice: Consider the following two statements...

**Question:** Consider the following two statements: I. Most bacterial species cause disease. II. Infectious diseases are the leading causes of death in the United States today.

**Answer:**

- Only statement I is correct.
- Both statements I and II are correct.
- Neither statement I nor II is correct.

**Correct Feedback:** Correct!
27. Multiple Choice: Control of infectious diseases currently is the result of all of the following EXCEPT __________.

Question: Control of infectious diseases currently is the result of all of the following EXCEPT __________.

Answer:
- increased understanding of disease processes
- the use of antimicrobial agents
- eradication of hundreds of pathogens
- improved sanitary and public health practices

Correct Feedback
Correct!
Incorrect Feedback
Incorrect. You should consider in your answer all of the health initiatives implemented in the 21st century.

28. Multiple Choice: Cyanobacteria and purple bacteria both obtain energy from light. However, only the ________ are capable of releasing ________.

Question: Cyanobacteria and purple bacteria both obtain energy from light. However, only the ________ are capable of releasing ________.

Answer:
- cyanobacteria / organic compounds
- cyanobacteria / oxygen
- purple bacteria / organic compounds
- purple bacteria / oxygen

Correct Feedback
Correct!
Incorrect Feedback
Incorrect. You should consider in your answer all of the health initiatives implemented in the 21st century.

29. Multiple Choice: Deduce why viruses are excluded from the ribosomal RNA-based tree of life.

Question: Deduce why viruses are excluded from the ribosomal RNA-based tree of life.

Answer:
- Some viruses contain multiple strands of RNA.
- Their genetic elements cannot be sequenced.
- They can infect other organisms, which complicates the genetic comparisons.
- They lack ribosomal RNA.

Correct Feedback
Correct!
Incorrect Feedback
Incorrect. You should consider in your answer all of the health initiatives implemented in the 21st century.

30. Essay: Describe beneficial and harmful ways in which microorganisms interact with agricultural crops.

Question: Describe beneficial and harmful ways in which microorganisms interact with agricultural crops.

Answer: Certain microbes are beneficial to crops when they produce nutrients (e.g., NH4+, SO42−) usable by a crop from a substrate that was unusable. Other microbes can cause diseases in plants, much like pathogens cause disease in humans.

31. Essay: Describe two capabilities of microbes that exemplify their dynamic nature.

Question: Describe two capabilities of microbes that exemplify their dynamic nature.

Answer: Answers could possibly include cell-cell communication, ability to move (motility), ability to differentiate, and exchange of materials (any two).

32. Multiple Choice: Determine which outcome is LEAST likely for a microorganism being motile.

Question: Determine which outcome is LEAST likely for a microorganism being motile.

Answer:
- avoidance of predation by bacteriovores
- maintaining osmotic balance within a salt gradient
- movement towards growth substrates

Correct Feedback
Correct!
Incorrect Feedback
Incorrect. You should consider in your answer all of the health initiatives implemented in the 21st century.
33. Multiple Choice: Developments in the fields of immunology and medical microbiology were practical extensions of the work of

- Sergei Winogradsky.
- Antoni van Leeuwenhoek.
- Joseph Lister.
- Robert Koch.

34. Multiple Choice: Differential selection and reproduction of phenotypes occurs during a process called

- cellular differentiation.
- evolution.
- growth.
- transformation.

35. True/False: Differentiation occurs only in multicellular organisms.

Answer: True

36. Essay: Explain how you would use Robert Koch's postulates to determine that *Streptococcus pyogenes* is the causative agent of streptococcal pharyngitis (“strep throat”).

Answers will vary but will need to detail how *S. pyogenes* will be subjected to all four postulates.

37. Essay: Explain the nature and function of an enrichment culture.

Answers will vary, but an enrichment culture uses media, chemicals, or culture conditions to select for or encourage the growth of organisms with specific characteristics. An answer could describe providing only carbon dioxide as a source of carbon to select for autotrophs, for example.

38. Essay: Explain why infectious diseases are much less lethal in developed countries than in underdeveloped countries.

Answers will vary but should emphasize ways in which increased knowledge about microbial pathogenesis has influenced preventative care (e.g., sanitation) and treatment (e.g., antimicrobial drugs).

39. Essay: Explain why microbial cells are excellent models for understanding cell function in higher organisms.

Answers will vary but should include commonality of function, biochemical and genetic similarities, and ease and speed with which they can be grown in large quantities.

40. Essay: Explain why only anaerobic bacteria inhabited Earth for the first two billion years of its existence.
41. **Multiple Choice: Fannie Hesse is credited with giving** ...

<table>
<thead>
<tr>
<th>Question</th>
<th>Fannie Hesse is credited with giving ______ the idea to use agar as a solidifying agent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>Louis Pasteur</td>
</tr>
<tr>
<td></td>
<td>Ferdinand Cohn</td>
</tr>
<tr>
<td></td>
<td>Robert Koch</td>
</tr>
<tr>
<td></td>
<td>Sergei Winogradsky</td>
</tr>
</tbody>
</table>

42. **Multiple Choice: Groups of cells derived from a single...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Groups of cells derived from a single parent cell by successive cell divisions are known as microbial ______ and which live in environments known as microbial ______.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>communities / habitats</td>
</tr>
<tr>
<td></td>
<td>communities / ecosystems</td>
</tr>
<tr>
<td></td>
<td>populations / habitats</td>
</tr>
<tr>
<td></td>
<td>populations / ecosystems</td>
</tr>
</tbody>
</table>

43. **Essay: How would the presence of endospores ...**

<table>
<thead>
<tr>
<th>Question</th>
<th>How would the presence of endospores in Louis Pasteur's nutrient solutions have affected his conclusions about spontaneous generation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>Answers will vary, but ultimately this could have confounded Pasteur if the endospores sometimes went into a vegetative growth phase and other times no growth was observed.</td>
</tr>
</tbody>
</table>

44. **Multiple Choice: In what/which domain(s) of life i...**

<table>
<thead>
<tr>
<th>Question</th>
<th>In what/which domain(s) of life is/are microorganisms represented?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>Archaea</td>
</tr>
<tr>
<td></td>
<td>Bacteria</td>
</tr>
<tr>
<td></td>
<td>Eukarya</td>
</tr>
<tr>
<td></td>
<td>✔️ Archaea, Bacteria, and Eukarya</td>
</tr>
</tbody>
</table>

45. **Multiple Choice: Koch’s postulates cannot always be us...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Koch’s postulates cannot always be used to satisfy __________.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>✔️ lethal infectious diseases that only occur in humans</td>
</tr>
<tr>
<td></td>
<td>any lethal infectious diseases</td>
</tr>
<tr>
<td></td>
<td>infectious diseases that are caused by viruses</td>
</tr>
<tr>
<td></td>
<td>infectious diseases that are caused by fungi</td>
</tr>
</tbody>
</table>

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. Your answer should consider the limitations of culturing some microbes in a laboratory setting.

46. **Multiple Choice: Like all forms of life on Earth, all ...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Like all forms of life on Earth, all microbial cells perform three major types of activities: __________.</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️ Answer</td>
<td>The key idea is an anoxic environment will not allow aerobic organisms to survive.</td>
</tr>
</tbody>
</table>
47. Essay: List three contributions of Ferdinand Cohn to the development of microbiology

Question: List three contributions of Ferdinand Cohn to the development of microbiology.

Answer: Answers could possibly include: founding bacteriology as a separate science, studying Beggiatoa, discovering the genus *Bacillus* (along with its endospore formation and its life cycle), and devising methods to prevent contamination.

48. Multiple Choice: Louis Pasteur developed the vaccine(s) for...

Question: Louis Pasteur developed the vaccine(s) for...

Answer: anthrax, fowl cholera, rabies.

49. Multiple Choice: Louis Pasteur developed vaccines for...

Question: Louis Pasteur developed vaccines for all of the following diseases EXCEPT _________.

Answer: smallpox, anthrax, rabies, fowl cholera.

50. Multiple Choice: Louis Pasteur's most famous success was his work on...

Question: Louis Pasteur's most famous success was his work on...

Answer: *Mycobacterium tuberculosis*, the rabies vaccine.

51. Multiple Choice: Major classes of macromolecules present in all living microorganisms include...

Question: Major classes of macromolecules present in all living microorganisms include...

Answer: amino acids, carbohydrates, lipids, and nucleic acids.
genes, proteins, and vitamins.
inorganic and organic compounds.

52. **Multiple Choice: Martinus Beijerinck was the first to ...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Martinus Beijerinck was the first to isolate green algae. certain nitrogen-fixing root nodule bacteria. certain sulfate-reducing bacteria. green algae, certain nitrogen-fixing root nodule bacteria, and certain sulfate-reducing bacteria.</th>
</tr>
</thead>
</table>

53. **True/False: Metabolism is a unifying characteristic...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Metabolism is a unifying characteristic of all cellular organisms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>True False</td>
</tr>
</tbody>
</table>

54. **Multiple Choice: Microbes evolve specific traits that ...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Microbes evolve specific traits that increase their fitness in specific environments. Martinus Beijerinck developed the enrichment culture technique to isolate microbes from complex natural samples, like soil and water, by manipulating the __________.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>organism’s genes medium to be either a solid or a liquid oxygen content of the culture culture conditions and nutrients</td>
</tr>
<tr>
<td>Correct Feedback</td>
<td>Correct!</td>
</tr>
<tr>
<td>Incorrect Feedback</td>
<td>Incorrect!</td>
</tr>
</tbody>
</table>

55. **Multiple Choice: Microbes playing a role in nitrogen f...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Microbes playing a role in nitrogen fixation in plants live in ________, while those playing a role in the digestive tract of certain herbivores live in ________.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>rumens / nodules nодules / rumens</td>
</tr>
</tbody>
</table>

56. **Essay: Microbes were first formally observed...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Microbes were first formally observed during the mid-1600s, but the cell theory was not enunciated until 1839. Write a brief essay explaining why microbiology did not become a formally recognized science until Louis Pasteur’s and Robert Koch’s time.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>Answers will vary, but a theme should be the lack of powerful microscopy tools. Without sufficient microscopes individual cells could not be seen, but the activities of microorganisms could be observed, such as the production of ethanol in Louis Pasteur’s experiments on fermentation.</td>
</tr>
</tbody>
</table>

57. **Multiple Choice: Microbial biochemistry involves the d...**

<table>
<thead>
<tr>
<th>Question</th>
<th>Microbial biochemistry involves the discovery of microbial ________ and the ________ they perform.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>Points: 10 Points: 10 Points: 10 Points: 10 Points: 10 Points: 10</td>
</tr>
</tbody>
</table>

58. Multiple Choice: Microbial cells first evolved on Earth approximately ________ billion years ago.

Question: Microbial cells first evolved on Earth approximately ________ billion years ago.

Answer:
- 1.6 to 1.8
- 3.8 to 3.9
- 5.4 to 5.6
- 7.0 to 7.2

59. Multiple Choice: Microbial control in wastewaters would most logically be a part of

Question: Microbial control in wastewaters would most logically be a part of

Answer:
- microbial genetics
- aquatic microbiology
- medical microbiology
- bacterial energetics

60. Multiple Choice: Microbial ecology is the study of

Question: Microbial ecology is the study of

Answer:
- microbial processes in the rhizosphere that benefit plant growth
- the diversity and activities of microorganisms
- the grouping and classifying of microorganisms
- microorganisms in their natural environments

61. Multiple Choice: Microbial sterilization is used to

Question: Microbial sterilization is used to

Answer:
- decrease the possibility of contaminants growing in a culture
- kill bacteria but not necessarily viruses or other microbes
- kill all microbes in or on objects
- clean a work area

62. Multiple Choice: Microorganisms play key roles in the cycling of important nutrients in plant nutrition, particularly those of

Question: Microorganisms play key roles in the cycling of important nutrients in plant nutrition, particularly those of

Answer:
- carbon
- nitrogen
63. True/False: Most microorganisms are pathogenic.

Question: Most microorganisms are pathogenic.
Answer: True

64. Multiple Choice: Most prokaryotic cells reside

Question: Most prokaryotic cells reside
Answer: on Earth’s surface.
in lakes, rivers, and oceans.
in and on nonprokaryotic organisms (including humans and other animals).
in the oceanic and terrestrial subsurfaces.

65. Multiple Choice: Mycobacterium tuberculosis is very difficult to stain because of the

Question: Mycobacterium tuberculosis is very difficult to stain because of the
Answer: presence of ribosomes in the cytoplasm.
location of the DNA within the cell.
large amounts of a waxy lipid present in its cell wall.
lack of a cell wall.

66. Essay: Name at least three limitations of Koch’s postulates that might limit their ability to identify the causative agent of a microbial disease.

Answer: Some microbial pathogens may be carried asymptomatically by individuals. For example, MRSA affects immunocompromised people but not healthy people. Some microbes cannot be cultivated in pure culture on laboratory media. For example, Mycobacterium leprae cannot be grown on any known laboratory medium today. Animal models of microbial infections are not available for some pathogens, and direct infection of human volunteers is not practical.

67. Essay: Not all microbes are pathogens! Give...

Question: Not all microbes are pathogens! Give four examples of food or beverages at the grocery store that involve microorganisms.
Answer: There are a wide variety of examples of microbially produced foodstuffs. Here is a brief list of candidates: beer, wine, distilled alcohols, yogurt, kefir, blue cheese, sourdough bread, raised breads, cheese, salami, sauerkraut, tempeh, miso, and soy sauce.

68. True/False: Not only do some microorganisms tolerate extremely hot temperatures, some actually require high temperatures for optimal growth.

Question: Not only do some microorganisms tolerate extremely hot temperatures, some actually require high temperatures for optimal growth.
Answer: True

69. Multiple Choice: Of the following evolutionary milestones, which occurred earlier than oxygenation of Earth’s atmosphere?

Question: Of the following evolutionary milestones, which occurred earlier than oxygenation of Earth’s atmosphere?
Answer: appearance of shelled invertebrates
development of algal diversity
appearance of eukaryotes

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. The evolution of these "simple" organisms was necessary for oxygen to be released and create Earth's atmosphere.

70. Multiple Choice: Pasteur's experiments refuting ...
Question: Pasteur's experiments refuting the theory of spontaneous generation were crucial to the advancement of the field of microbiology because they led to the development of all EXCEPT which of the following?
Answer:
- optical isomers
- food preservation
- the germ theory of disease
- sterile technique

Correct Feedback: Correct!
Incorrect Feedback: Incorrect!

71. Multiple Choice: Predict how Pasteur's conclusions on ...
Question: Predict how Pasteur’s conclusions on spontaneous generation with swan flasks would have changed if he worked with and maintained the flasks in a sterile laminar flow hood.
Answer:
- Sterilization of the swan flask solutions would not have been necessary to reject spontaneous generation. If he did sterilize the flasks, the spontaneous generation hypothesis would have been supported.
- His incubation times would not have been sufficient to refute spontaneous generation.
- Pasteur’s flasks never would have putrefied, and the experiment would not have refuted spontaneous generation.
- Viruses would have still been present, and his conclusion would have been unchanged.

72. Multiple Choice: Protein catalysts involved in the acc...
Question: Protein catalysts involved in the acceleration of the rate of chemical reactions are called
Answer:
- catalytic converters.
- growth agents.
- evolutionary molecules.
- enzymes.

73. Essay: Provide evidence supporting the state...
Question: Provide evidence supporting the statement that an ecosystem is controlled by microbial activities.
Answer: Answers will vary, but one example could be oxygen depletion, where a loss of oxygen would then favor anaerobic microorganisms.

74. Multiple Choice: Regarding early life on Earth,
Question: Regarding early life on Earth,
Answer: microbial life existed for billions of years before plant and animal life.
microbial life existed long before animals but has been around for about the same amount of time as plants.

microbial life, plant life, and animal life all appeared at about the same time.

it is impossible to determine which type of life first appeared.

75. Multiple Choice: Robert Koch contributed to the field of microbiology by being the first person to

a. develop the tuberculin test.

b. formulate four postulates for definitively linking a specific microorganism to a specific disease.

c. use agar as a solidifying agent in growth media.

d. develop the tuberculin test, formulate four postulates for definitively linking a specific microorganism to a specific disease, and use agar as a solidifying agent in growth media.

76. Multiple Choice: Robert Koch received the 1905 Nobel Prize in Physiology or Medicine for

a. developing a smallpox vaccination.

b. identifying *Mycobacterium tuberculosis* as the causative agent of tuberculosis.

c. making an effective rabies vaccine.

d. developing a smallpox vaccination, identifying *Mycobacterium tuberculosis* as the causative agent of tuberculosis, and making an effective rabies vaccine.

77. True/False: Sergei Winogradsky worked with bacteria involved in cycling nitrogen and sulfur.

a. True

b. False

78. Multiple Choice: Some bacteria can carry out interesting and important metabolisms not found in any macroorganism. Many of these reactions are crucial to life on Earth because

a. they recycle elements needed by living organisms

b. they prevent disease

c. they build soil for plant growth

d. they provide energy for macroorganisms

79. Multiple Choice: Some microorganisms can undergo

a. differentiation

b. genetic exchange

c. maturation
80. **True/False: The bubonic plague was caused by Yers...**

**Question:** The bubonic plague was caused by *Yersinia pestis*, a highly pathogenic virus.

**Answer:**
- **True**
- **False**

81. **True/False: The discipline of microbiology is int...**

**Question:** The discipline of microbiology is intimately associated with biochemistry and genetics, because cells are both biochemical catalysts and genetic coding devices.

**Answer:**
- **True**
- **False**

82. **Multiple Choice: The discovery of antibiotics and othe...**

**Question:** The discovery of antibiotics and other important chemicals led to the field of

**Answer:**
- industrial microbiology.
- agricultural microbiology.
- marine microbiology.
- aquatic microbiology.

83. **Multiple Choice: The disease anthrax is caused by the ...**

**Question:** The disease anthrax is caused by the pathogenic bacterium ________, which produces heat-resistant structures known as ________.

**Answer:**
- *Azotobacter chroococcum* / endospores
- *Azotobacter chroococcum* / plasmids
- **Bacillus anthracis** / endospores
- **Bacillus anthracis** / plasmids

84. **True/False: The environment in which a microbial ...**

**Question:** The environment in which a microbial population lives is its habitat.

**Answer:**
- **True**
- **False**

85. **Essay: The explosive chemical trinitrotoluen...**

**Question:** The explosive chemical trinitrotoluene (TNT) can remain in soils after use and is hazardous to humans. Propose an experiment in which TNT-degrading microorganisms could be isolated for purposes of bioremediation. Also indicate what experimental evidence would be useful to isolate TNT-degrading microorganisms.

**Answer:**
Experimental designs will vary, but one example would be to use the enrichment culture technique with soil from an ammunition site. While adding TNT to the enrichment culture, a key piece of experimental evidence could be the loss of TNT in the culture to initiate isolation attempts.

86. **Multiple Choice: The first documented description of a...**

**Question:** The first documented description of a microorganism was of a ________ by ________.

**Answer:**
- bacterium / Ferdinand Cohn
- fungus / Robert Koch
87. Multiple Choice: The largest mass of living material on Earth comes from

Question: The largest mass of living material on Earth comes from

Answer: microorganisms.
- plants.
- animals.
- plants and animals together.

88. Multiple Choice: The microbiologists who discovered bacteria living deep in the -13°C brine of Lake Vida in Antarctica think that the bacteria are metabolizing carbon compounds that have been sealed in the ice with them for millennia, since there do not appear to be any other energy sources, like light, available. This idea concerning the source of energy for these bacteria is __________.

Answer: a theory
- a hypothesis
- a fact
- an anecdote

Correct Feedback: Correct!
Incorrect Feedback: Incorrect!

89. Multiple Choice: The person who described the "wee animalcules" was

Question: The person who described the "wee animalcules" was

Answer: Robert Hooke.
- Antoni van Leeuwenhoek.
- Louis Pasteur.
- Ferdinand Cohn.

90. Multiple Choice: The plaque (microbial biofilm) that forms between your teeth is a highly anaerobic (oxygen-free) environment, even though the mouth is one of the most aerobic habitats in the body and most of the bacteria living there can use oxygen if it is available. Why is there no oxygen in the plaque between your teeth?

Answer: The bacteria living between the teeth have used up the oxygen.
- The teeth absorbed the oxygen.
- Bacteria cannot live in the absence of oxygen.
- The area between the teeth never had any oxygen.

Correct Feedback: Correct!
Incorrect Feedback: Incorrect!

91. Multiple Choice: The process whereby microorganisms ar...
The process whereby microorganisms are used to help clean up pollution created by human activities is known as

Answer

- bioaugmentation.
- biodegradation.
- bioengineering.
- bioremediation.

92. Multiple Choice: The production of human proteins (e.g., insulin) by genetically engineered microorganisms is an example of ________, a subdiscipline of microbiology.

Answer

- applied microbiology
- biotechnology
- industrial microbiology
- molecular microbiology

93. Multiple Choice: The science of grouping and classifying microorganisms is known as ________.

Answer

- microbial physiology
- proteomics
- metabolomics
- microbial systematics

94. Multiple Choice: The step in Koch’s postulates that most critically enabled him to determine that a particular microbe was the cause, and not an effect, of a particular disease was ________.

Correct Feedback
Correct!

Incorrect Feedback
Incorrect!

95. Multiple Choice: The structure that confers structural strength on the cell is known as the ________.

Answer

- cytoplasmic membrane
- cell wall
- ribosome
- cytoplasm
96. Essay: The text states that antibiotics are derived from microorganisms. What is the benefit to an antibiotic-producing microorganism of producing an antibiotic in its natural habitat?

Answer: Answers will vary, but it must first be stated the antibiotic-producing microbe would need to be resistant to the antibiotic. This should then follow into a discussion on how antibiotic production could be viewed as a way to persist in the environment, such as maintaining dominance in a community over others.

97. Multiple Choice: The theory of spontaneous generation was refuted by the work of

Answer: Louis Pasteur.

98. True/False: Today, the enrichment culture technique developed over a century ago by Martinus Beijerinck remains a feasible approach to discovering bacteria capable of degrading pollutants.

Answer: True

99. Multiple Choice: Transparent double-sided dishes used for growing microbes are most commonly called

Answer: Petri dishes.

100. True/False: Treponema pallidum, a bacterium associated with syphilis, is not considered a pathogen because to date it remains unculturable in the lab, and, therefore, Koch's postulates are unable to be fulfilled.

Answer: False

101. Essay: Using specific examples, explain why it is sometimes impossible to satisfy Robert Koch’s postulates.

Answer: Answers will vary, but one issue is the consideration for a model animal host that will react to the (human) pathogen in the same manner as in a human host. For example, a chicken would not show flu-like symptoms when infected with the influenza virus. Another issue is the inability to cultivate some microorganisms outside of the host.

102. Multiple Choice: What are the crop plants called that form symbiotic relations with the bacteria that convert nitrogen gas into ammonia?

Answer: legumes
Some bacteria form symbiotic relations with clover, alfalfa, and soybeans to fix nitrogen.

103. Multiple Choice: What are these microorganisms, whose illustrations were first published by Robert Hooke in 1665?

- endospores
- bacteria
- virus
- mold

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. You should consider which microorganisms grow on leather.

104. Multiple Choice: What did supporters of the theory of spontaneous generation declare was needed for life to arise that Pasteur's swan-necked flasks accommodated?

- fresh air
- sunlight
- time
- heat

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. Pasteur's swan-necked flasks consisted of a long, curved, open neck.

105. Multiple Choice: What important biochemical process takes place within these structures found on the roots of legumes?

- carbon fixation
- biodegradation of toxic chemicals
- methane production

Correct Feedback
Incorrect Feedback
106. Multiple Choice: What is chemolithotrophy?

Question: What is chemolithotrophy?

Answer:  
- the oxidation of inorganic compounds linked to energy conservation within a cell
- the incorporation of cellular carbon from CO₂
- the utilization of light energy as a mechanism of energy conservation within a cell
- the oxidation of organic compounds linked to energy conservation within a cell

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. Your answer should explain how energy is obtained in these cells.

107. Multiple Choice: What is the hypothesis called by which cells originated from nonliving matter?

Question: What is the hypothesis called by which cells originated from nonliving matter?

Answer:  
- spontaneous generation
- biogenesis
- natural purification
- organic evolution

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. This choice is not the term that describes the hypothesis.

108. Multiple Choice: What is the immediate environment called where a microbial population lives?

Question: What is the immediate environment called where a microbial population lives?

Answer:  
- landscape
- ecosystem
- biome
- habitat

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. Microorganisms live in interacting populations that are influenced by, and can change, the chemical and physical properties of their environment.

109. Multiple Choice: What is the method called that uses selective culture media and incubation conditions to isolate specific microorganisms from natural samples?

Question: What is the method called that uses selective culture media and incubation conditions to isolate specific microorganisms from natural samples?

Answer:  
- dilution culture
- anaerobic culture
- enrichment culture
- streaking

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. Martinus Beijerinck developed this technique to study many soil and aquatic organisms.
110. **Multiple Choice: What is the name of the process in which cells take up nutrients from the environment and convert them into new cell structures and waste products?**

**Question**
What is the name of the process in which cells take up nutrients from the environment and convert them into new cell structures and waste products?

**Answer**
- evolution
- differentiation
- metabolism
- cell signaling

**Correct Feedback**
Correct!

**Incorrect Feedback**
Incorrect. This process describes a summary of all chemical processes found in microbial cells.

111. **Multiple Choice: What is the second of Koch's postulates?**

**Question**
What is the second of Koch's postulates?

**Answer**
- The organism must be re-isolated and cultured again from the newly infected animal and verified as the same as the original organism.
- The isolated organism must cause the same disease when inoculated into healthy susceptible animals.
- The organism must initially be cultivated in pure culture away from the animal body.
- The pathogen must always be present in animals suffering from the disease but not in healthy animals.

**Correct Feedback**
Correct!

**Incorrect Feedback**
Incorrect. Koch's postulates are the "gold standard" for establishing cause and effect for pathogenic organisms.

112. **Multiple Choice: What kinds of cells do NOT have a cell wall?**

**Question**
What kinds of cells do NOT have a cell wall?

**Answer**
- algal cells
- animal cells
- bacterial cells
- fungal cells

**Correct Feedback**
Correct!

**Incorrect Feedback**
Incorrect. Your answer should consider which cells have only a cytoplasmic membrane that separates the external environment from the cytoplasm.

113. **Multiple Choice: What plantlike characteristic do chemolithotrophs possess?**

**Question**
What plantlike characteristic do chemolithotrophs possess?

**Answer**
- They are autotrophs.
- They contain chlorophyll.
- Cell division involves mitosis.
- They have cell walls made of cellulose.

**Correct Feedback**
Correct!

**Incorrect Feedback**
Incorrect. Chemolithotrophs obtain their carbon from carbon dioxide.

114. **Multiple Choice: What type of glassware was used to settle the controversy surrounding spontaneous generation?**

**Question**
What type of glassware was used to settle the controversy surrounding spontaneous generation?
115. **Multiple Choice: When considering the properties of all cellular life, what two ways can be used to define cells?**

<table>
<thead>
<tr>
<th>Answer</th>
<th>Erlenmeyer flask</th>
<th>Side-armed flask</th>
<th>Swan-necked flask</th>
<th>Volumetric flask</th>
</tr>
</thead>
</table>

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. Your answer should consider which of the flasks allowed the liquid medium to stay sterile while allowing air to enter.

116. **Multiple Choice: When does evidence suggest that life first arose on Earth?**

<table>
<thead>
<tr>
<th>Answer</th>
<th>~ 3.8 × 10^3 years ago</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>~ 3.8 × 10^6 years ago</td>
</tr>
<tr>
<td></td>
<td>~ 3.8 × 10^9 years ago</td>
</tr>
<tr>
<td></td>
<td>~ 3.8 × 10^12 years ago</td>
</tr>
</tbody>
</table>

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. Microbial life on Earth is ancient.

117. **Multiple Choice: Which early microbiologist studied the large filamentous sulfur bacterium, later called Beggiatoa?**

<table>
<thead>
<tr>
<th>Answer</th>
<th>Robert Hooke</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Antoni van Leeuwenhoek</td>
</tr>
<tr>
<td></td>
<td>Ferdinand Cohn</td>
</tr>
<tr>
<td></td>
<td>Robert Koch</td>
</tr>
</tbody>
</table>

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. The correct microbiologist was a German botanist who was a contemporary of Pasteur.

118. **Multiple Choice: Which of the following are the correct sequential processes involved in protein synthesis?**

<table>
<thead>
<tr>
<th>Answer</th>
<th>Translation and transcription</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Replication and transcription</td>
</tr>
<tr>
<td></td>
<td>Replication and translation</td>
</tr>
</tbody>
</table>
transcription and translation

**Correct Feedback**
Correct!

**Incorrect Feedback**
Incorrect. First gene information for the synthesis of a specific protein is copied from DNA to messenger RNA (mRNA); mRNA is then decoded by ribosomes.

### 119. Multiple Choice: Which of the following attributes make some microorganisms ideal model systems for studying life's basic processes?

<table>
<thead>
<tr>
<th>Question</th>
<th>They have low mutation rates.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>Their limited diversity allows thorough characterization of basic processes.</td>
</tr>
<tr>
<td>Correct Feedback</td>
<td>Correct!</td>
</tr>
<tr>
<td>Incorrect Feedback</td>
<td>Incorrect. These characteristics make scientific studies easier and faster to perform.</td>
</tr>
</tbody>
</table>

### 120. Multiple Choice: Which of the following cellular properties is NOT found in all cells?

<table>
<thead>
<tr>
<th>Question</th>
<th>Which of the following cellular properties is NOT found in all cells?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>differentiation</td>
</tr>
<tr>
<td></td>
<td>metabolism</td>
</tr>
<tr>
<td></td>
<td>evolution</td>
</tr>
<tr>
<td></td>
<td>growth</td>
</tr>
<tr>
<td>Correct Feedback</td>
<td>Correct!</td>
</tr>
<tr>
<td>Incorrect Feedback</td>
<td>Incorrect. This property is common to all cells. Certain cells have specialized functions.</td>
</tr>
</tbody>
</table>

### 121. Multiple Choice: Which of the following characteristics was found in the earliest cellular organisms?

<table>
<thead>
<tr>
<th>Question</th>
<th>Which of the following characteristics was found in the earliest cellular organisms?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>photosynthesis</td>
</tr>
<tr>
<td></td>
<td>anaerobic metabolism</td>
</tr>
<tr>
<td></td>
<td>membrane-bound nucleus</td>
</tr>
<tr>
<td></td>
<td>multicellularity</td>
</tr>
<tr>
<td>Correct Feedback</td>
<td>Correct!</td>
</tr>
<tr>
<td>Incorrect Feedback</td>
<td>Incorrect. You should consider Earth's early atmospheric conditions.</td>
</tr>
</tbody>
</table>

### 122. Multiple Choice: Which of the following discoveries by Louis Pasteur came first?

<table>
<thead>
<tr>
<th>Question</th>
<th>Which of the following discoveries by Louis Pasteur came first?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>the significance of optical isomers</td>
</tr>
<tr>
<td></td>
<td>the defeat of the theory of spontaneous generation</td>
</tr>
<tr>
<td></td>
<td>the role of microorganisms in fermentation</td>
</tr>
<tr>
<td></td>
<td>the development of a vaccine for rabies</td>
</tr>
<tr>
<td>Correct Feedback</td>
<td>Correct!</td>
</tr>
<tr>
<td>Incorrect Feedback</td>
<td>Incorrect. Pasteur was first a chemist who then applied what he learned about chemistry to solve biological problems.</td>
</tr>
</tbody>
</table>
123. **Multiple Choice: Which of the following habitats is home to the largest percentage of microbial biomass on Earth?**

**Question:** Which of the following habitats is home to the largest percentage of microbial biomass on Earth?

- marine subsurface
- terrestrial subsurface
- freshwater lakes
- surface soil

**Answer:** marine subsurface

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. Most microbes are found where essential nutrients are available and where there is space to grow.

124. **Multiple Choice: Which of the following is NOT a characteristic of the last universal common ancestor (LUCA)?**

**Question:** Which of the following is NOT a characteristic of the last universal common ancestor (LUCA)?

- Its proteins were synthesized on ribosomes.
- Its genes were composed of RNA.
- Its cells were bound by a lipid membrane.
- It used ATP as a common energy currency.

**Answer:** Its genes were composed of RNA.

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. This is true. The LUCA had traits that are common to all life.

125. **Multiple Choice: Which of the following is NOT a major phylogenetic lineage (or “domain”)?**

**Question:** Which of the following is NOT a major phylogenetic lineage (or “domain”)?

- Eukarya
- Viridae
- Archaea
- Bacteria

**Answer:** Viridae

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. Viridae is one of the three domains.

126. **Multiple Choice: Which of the following is NOT a new subdiscipline that has been created from the study of genomes?**

**Question:** Which of the following is NOT a new subdiscipline that has been created from the study of genomes?

- proteomics
- metabolomics
- transcriptomics
- ribosomics

**Answer:** transcriptomics

**Correct Feedback:** Correct!

**Incorrect Feedback:** Incorrect. New advances in genomics focus on exploration of RNA, proteins, and microbial metabolism.

127. **Multiple Choice: Which of the following is NOT an accomplishment of Louis Pasteur?**

**Question:** Which of the following is NOT an accomplishment of Louis Pasteur?

- determined that the alcohol-making process was mediated by microbial fermentation and thus refuted the theory of spontaneous generation

**Answer:** determined that the alcohol-making process was mediated by microbial fermentation and thus refuted the theory of spontaneous generation
developed enrichment culture techniques
developed heat sterilization techniques that involved the creation of a specialized swan-necked flask
developed the first rabies vaccine and treated thousands of individuals

128. Multiple Choice: Which of the following is NOT an important infectious disease in the developing world today?

Question
Which of the following is NOT an important infectious disease in the developing world today?

Answer
- cholera
- tuberculosis
- Alzheimer's disease
- malaria

Correct Feedback
Correct!

Incorrect Feedback
Incorrect. This organism causes an infectious disease. Infectious diseases are caused by microorganisms.

129. Multiple Choice: Which of the following is/are characteristic of ALL cellular organisms?

Question
Which of the following is/are characteristic of ALL cellular organisms?

Answer
- communication
- evolution
- motility
- communication, evolution, and motility

130. Multiple Choice: Which of the following organisms was studied by Robert Koch to help him develop his famous postulates?

Question
Which of the following organisms was studied by Robert Koch to help him develop his famous postulates?

Answer
- Vibrio cholerae
- Bacillus anthracis
- Escherichia coli
- Mycobacterium tuberculosis

Correct Feedback
Correct!

Incorrect Feedback
Incorrect. Koch initially studied a disease caused by an endospore forming bacterium.

131. Multiple Choice: Which of the following statements is FALSE?

Question
Which of the following statements is FALSE?

Answer
- Microbial cells exist as single cells.
- Microbial cells carry out their life processes of growth independently.
- Microbial cells include both bacteria and viruses.
- Microbial cells exclude the cells of plants and animals.

132. Multiple Choice: Which of the following terms describes a group of cells derived from one “parental” cell?

Question
Which of the following terms describes a group of cells derived from one “parental” cell?

Answer
habitat
Correct Feedback
Incorrect Feedback
Incorrect. This term describes the interaction of one group of cells with other organisms or the environment.

133. Multiple Choice: Which of the following would be an example of applied microbial research?

Question: Which of the following would be an example of applied microbial research?

Answer:
- Experiments that test a hypothesis concerning cell-cell communication
- Studies on the mechanisms of endospore formation
- Studies about how cells control DNA replication
- Experiments that test a hypothesis to improve wastewater treatment

Correct Feedback
Incorrect Feedback
Incorrect. Applied research focuses on how microbial processes can benefit society and Earth; in comparison, basic research focuses on the fundamental processes of life.

134. Multiple Choice: Which of the following would be an example of basic microbiology research?

Question: Which of the following would be an example of basic microbiology research?

Answer:
- Experiments that test a hypothesis about improved cheese production
- Studies on how cells respond to DNA damage by triggering a repair pathway
- Studies on how to prevent the loss of soil fertility due to the activity of microorganisms
- Experiments that produce a novel vaccine to prevent tuberculosis

Correct Feedback
Incorrect Feedback
Incorrect. Basic research focuses on the fundamental processes of life, whereas applied research focuses on how microbial processes can benefit society and Earth.

135. Multiple Choice: Which of the following would be an example of bioremediation of an oil spill in a marine environment?

Question: Which of the following would be an example of bioremediation of an oil spill in a marine environment?

Answer:
- Adding nutrients that stimulate indigenous microorganisms to degrade the oil
- Burning the oil
- Physically removing the oil by binding it to absorbent chemicals
- Skimming the surface of the water and collecting the oil

Correct Feedback
Incorrect Feedback
Incorrect. Beneficial microbes can degrade the chemicals in oil when limiting chemicals are provided.

136. Multiple Choice: Which of the following would generally not be considered a subdiscipline of applied microbiology?

Question: Which of the following would generally not be considered a subdiscipline of applied microbiology?

Answer:
- Biotechnology
- Agricultural microbiology
- Medical microbiology
- Microbial systematics

Correct Feedback

Points: 5
137. Multiple Choice: Which scientific objective is LEAST related to microbial genetics?

Question: Which scientific objective is LEAST related to microbial genetics?

Answer:
- determining the ancestral origin of a recently discovered bacterium
- identifying mutations in a bacterial population
- identifying quorum sensing interactions among bacteria
- manipulating a microorganism for bioremediation

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. Applied microbiology generally focuses on solving specific problems or in synthesizing commercial products from microbial sources.

138. Multiple Choice: Which statement is TRUE?

Question: Which statement is TRUE?

Answer:
- Populations are assemblages of microbial communities.
- Microbial communities are assemblages of populations.
- Habitats are assemblages of microbial communities.
- Populations are assemblages of habitats.

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. Populations are assemblages of organisms, not microbial communities.

139. Multiple Choice: Which types of organisms are the most important for the maintenance of life on Earth?

Question: Which types of organisms are the most important for the maintenance of life on Earth?

Answer:
- microorganisms
- plants
- animals
- humans

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. Your answer should take into consideration what organism maintains nutrient levels and assists in the recycling of waste products.

140. Multiple Choice: Who isolated in pure culture the first nitrogen-fixing bacterium?

Question: Who isolated in pure culture the first nitrogen-fixing bacterium?

Answer:
- Winogradsky
- Cohn
- Beijerinck
- Koch

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. This first nitrogen-fixing organism was a strict anaerobe and was isolated by a Russian microbiologist.

141. Multiple Choice: Who showed that viruses were filterable agents that were smaller than bacteria?

Question: Who showed that viruses were filterable agents that were smaller than bacteria?

Answer:
- Beijerinck

Correct Feedback: Correct!
Correct Feedback: Correct!
Incorrect Feedback: Incorrect. You should consider which of these scientists were working to isolate the infectious agent of tobacco mosaic disease.

142. Multiple Choice: Who was the amateur microscopist who first published drawings of bacteria?

Question: Who was the amateur microscopist who first published drawings of bacteria?
Answer: ✔️ Antoni van Leeuwenhoek

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. The first drawings of bacteria were published in the proceedings of the Royal Society of London in the late seventeenth century.

143. Multiple Choice: Who was the scientist that discovered endospores?

Question: Who was the scientist that discovered endospores?
Answer: ✔️ Cohn

Correct Feedback: Correct!
Incorrect Feedback: Incorrect. You should consider which of the scientists was interested in heat resistant bacteria.

144. Essay: Why is it incorrect to say that an object is partially sterile?

Question: Why is it incorrect to say that an object is partially sterile?
Answer: Sterile means the absence of all living organisms. Something is either sterile or it is not. Other terms are used to describe objects that have been cleaned but are not sterile, such as disinfected.

145. Multiple Choice: _______ produced by microbial fermentation of glucose from cellulose or cornstarch is becoming a more important component of biofuels in the United States, and specialized _______ are needed to make this a commercially available product.

Question: _______ produced by microbial fermentation of glucose from cellulose or cornstarch is becoming a more important component of biofuels in the United States, and specialized _______ are needed to make this a commercially available product.
Answer: ✔️ Biodiesel / biotechnologists

146. Multiple Choice: _______ was the first to describe microorganisms, while _______ was the first person to see bacteria.

Question: _______ was the first to describe microorganisms, while _______ was the first person to see bacteria.
147. **Multiple Choice:** ________ was the first to identify a new form of autotrophy in which energy is obtained from oxidizing inorganic compounds called ________.

- Martinus Beijerinck / heteroautotrophy
- Martinus Beijerinck / chemolithotrophy
- Sergei Winogradsky / heteroautotrophy
- **Sergei Winogradsky / chemolithotrophy**

Points: 10