***Becker's The World of the Cell, 9e* (Hardin/Bertoni/Kleinsmith)**
Chapter 1 A Preview of Cell Biology

1.1 Multiple-Choice Questions

1) Robert Hooke coined the term *cell* when studying thin slices of cork. These _____ were the first cells observed because _____.
A) dead plant cells; the thick cells walls did not require high resolution or magnification to view
B) dead animal cells; they were immobile and did not need to be fixed before viewing
C) compartments; they were actually the result of multiple cells that had merged and died to form large compartments that were easy to view
D) immune cells; they produce antibodies that embed in the cell membrane to make it visible
E) "little rooms"; they were 100 nm in diameter, much larger than most plant cells
Answer: A
Chapter Section: 1.1
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.1
Global LO: G1

2) The Latin phrase *omnis cellula e cellula* refers to a cellular principle. Which of the following statements is the best interpretation of this phrase?
A) Tissues are composed of similar cells.
B) Cells generally are found in clusters.
C) All cells arise only from preexisting cells.
D) Organs are composed of tissues and cells.
E) The cell is the basic unit of structure.
Answer: C
Chapter Section: 1.1
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.1
Global LO: G7

3) _____ improved the original light microscope in the late 1600s, allowing the visualization of _____.
A) Theodor Schwann; the internal structures of cells, such as ribosomes, nuclei, and golgi bodies
B) Robert Hooke; bacteria and viruses
C) Antonie van Leeuwenhoek; sperm cells, bacteria, algae, and other protists
D) Robert Brown; cell structures using fluorescent antibodies
E) Rudolf Virchow; collagen and muscle cells
Answer: C
Chapter Section: 1.1
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G1

4) Which organelle stores most of the DNA in plant and animal cells?
A) Golgi complex
B) mitochondrion
C) chloroplast
D) nucleus
E) lysosome
Answer: D
Chapter Section: 1.2
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.2
Global LO: G1

5) Which of the following statements is *false*?
A) All organisms consist of one or more cells.
B) All cells arise from preexisting cells.
C) The cell is the basic unit of structure for all organisms.
D) All cells have a membrane-bound nucleus.
E) Cells come in a wide variety of sizes and shapes.
Answer: D
Chapter Section: 1.2
Bloom's Taxonomy: Analysis
Learning Outcome: 1.1
Global LO: G7

6) Which of the following is *true* of a nanometer?
A) A nanometer is about the size of a common bacterial cell.
B) A nanometer is one millionth of a meter.
C) A nanometer is equivalent to 10 Angstroms (Å).
D) The nanometer is the most common measurement used in measuring whole cells.
E) None of the above.
Answer: C
Chapter Section: 1.2
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.2
Global LO: G4

7) Which of the following is closest to a micrometer in size?
A) the width of a strand of DNA
B) the length of a plant cell
C) the length of a chicken egg
D) a typical prokaryotic cell
E) the size of a ribosome
Answer: D
Chapter Section: 1.2
Bloom's Taxonomy: Application
Learning Outcome: 1.2
Global LO: G4

8) Cell biology emerged from which of the following fields of biology?
A) biochemistry
B) cytology
C) genetics
D) biochemistry, cytology, and genetics
E) cytology and biochemistry
Answer: D
Chapter Section: 1.2
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.1
Global LO: G1

9) Which of the following is smallest?
A) ribosome
B) virus
C) protein
D) mitochondrion
E) prokaryote
Answer: C
Chapter Section: 1.2
Bloom's Taxonomy: Application
Learning Outcome: 1.2
Global LO: G4

10) Early microscopes did not allow clear visualization of cells because they were limited by
A) magnification.
B) number of kernels.
C) resolution.
D) refraction.
E) both magnification and resolution.
Answer: E
Chapter Section: 1.1
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.2
Global LO: G4

11) You are working on a project that involves the direct observation of DNA molecules. The microscope that would give you the best information at this time would be the
A) light microscope.
B) phase-contrast microscope.
C) transmission electron microscope.
D) digital video microscope.
E) fluorescent microscope.
Answer: C
Chapter Section: 1.2
Bloom's Taxonomy: Analysis
Learning Outcome: 1.2
Global LO: G4

12) The limit of resolution can best be defined as
A) the distance that an object must be moved to be distinguished from its background.
B) the inverse of the wavelength of light; it is greatest for black light.
C) the distance that two objects must be apart to be distinguished as separate objects.
D) the solvent that must be available to remix a solution.
E) the magnification power of a microscope.
Answer: C
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

13) How does brightfield microscopy allow images to be visualized?
A) Specimens are illuminated with white light.
B) Electrons strike the specimen being examined.
C) Specimens are fixed and have bright fluorescent molecules attached to them.
D) Specimens are illuminated with blue light to visualize internal features of cells smaller than 100 nm.
E) Specimens are viewed under phased light to improve magnification.
Answer: A
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G7

14) Which of the following is an application of immunofluorescence microscopy?
A) Visualization of the natural fluorescence of a specimen under UV light.
B) Identification of specific components of the immune system.
C) Identifying which organelle or cellular compartment contains a particular protein.
D) Visualization of the surface structures of a specimen.
E) Construction of three-dimensional images of structures smaller than 10 nm.
Answer: C
Chapter Section: 1.2
Bloom's Taxonomy: Application
Learning Outcome: 1.2
Global LO: G1

15) Which type of microscopy enhances and amplifies slight changes in the phase of transmitted light?
A) differential interference contrast microscopy
B) digital video microscopy
C) fluorescence microscopy
D) phase-contrast microscopy
E) both differential interference contrast microscopy and phase-contrast microscopy
Answer: E
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G1

16) Which type of microscopy has the greatest resolving power?
A) electron microscopy
B) phase-contrast microscopy
C) fluorescence microscopy
D) digital video microscopy
E) confocal scanning microscopy
Answer: A
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

17) Which of the following can *only* be viewed by electron microscopy?
A) frog eggs
B) DNA
C) nuclei
D) mitochondria
E) prokaryotes
Answer: B
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

18) Which of the following types of light microscopy improves the resolution of thick specimens by illuminating one plane of the specimen at a time?
A) fluorescence microscopy
B) phase-contrast microscopy
C) confocal microscopy
D) differential interference contrast microscopy
E) brightfield microscopy
Answer: C
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

19) A scientist is examining motile protist. He wishes to determine their direction of movement. Which of the following microscopic techniques is *least* likely to be used to view these cells?
A) light microscopy
B) electron microscopy
C) differential interference contrast microscopy
D) fluorescence microscopy
E) phase-contrast microscopy
Answer: B
Chapter Section: 1.2
Bloom's Taxonomy: Application
Learning Outcome: 1.2
Global LO: G2

20) Scanning electron microscopy (SEM) is especially suited to
A) observing living specimens.
B) examining internal cellular structure.
C) creating a sense of depth.
D) both observing living specimens and creating a sense of depth.
E) simultaneously observing living specimens, examining internal cellular structure, and creating a sense of depth.
Answer: C
Chapter Section: 1.2
Bloom's Taxonomy: Application
Learning Outcome: 1.2
Global LO: G2

21) Melvin Calvin and his colleagues used which of the following to deduce the steps in the Calvin cycle?
A) negative staining
B) *Drosophila melanogaster*
C) electron microscopy
D) ultracentrifugation
E) radioisotopes
Answer: E
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G1

22) A microtome is used to
A) view microscopic organisms.
B) slice thin sections of specimens.
C) focus short wavelengths of light.
D) manipulate tiny objects.
E) dissect cellular organelles.
Answer: B
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

23) The classic work of Friedrich Wöhler (1828) that united the fields of biology and chemistry was based on the
A) discovery of yeast ferments.
B) production of urea in the laboratory.
C) discovery of ATP.
D) identification of nucleotide bases.
E) analysis of gene segregation.
Answer: B
Chapter Section: 1.2
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.2
Global LO: G1

24) You wish to obtain a purified sample of mitochondria from lysed cells. The best way to obtain this sample would be
A) centrifugation.
B) chromatography.
C) polyacrylamide gel electrophoresis.
D) agarose gel electrophoresis.
E) both centrifugation and polyacrylamide gel electrophoresis.
Answer: A
Chapter Section: 1.2
Bloom's Taxonomy: Evaluation
Learning Outcome: 1.2
Global LO: G2, G7

25) 1 mm = _____ nm
A) 1,000,000
B) 1000
C) 10
D) 1/1000
E) 1/1,000,000
Answer: A
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

26) The outcome of the joining of cytology and biochemistry yielded a better understanding of the cell by
A) identification of cellular structures.
B) identification of cellular biochemical pathways.
C) creating bioinformatics.
D) identification of cellular structures and biochemical pathways.
E) identification of biochemical pathways and creating bioinformatics.
Answer: D
Chapter Section: 1.2
Bloom's Taxonomy: Synthesis
Learning Outcome: 1.1
Global LO: G1

27) Wöhler revolutionized biology through his demonstration that biological molecules are governed by the ordinary laws of physics and chemistry. He demonstrated this principle by
A) synthesizing urea in the laboratory from ammonium cyanate.
B) developing techniques for isolating, purifying, and analyzing subcomponents of cells.
C) defining the laws of heredity.
D) discovering active agents in cell extracts that were specific biological catalysts that have since come to be called enzymes.
E) inventing mass spectrometry which is commonly used to determine the size and composition of individual proteins.
Answer: A
Chapter Section: 1.2
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.1
Global LO: G1

28) Gregor Mendel was most influential in which field of biology?
A) genetics
B) chromatography
C) biochemistry
D) prokaryotic transformation
E) cytology
Answer: A
Chapter Section: 1.2
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.1
Global LO: G1

29) The scientific work that established DNA, rather than protein, as the molecule of heredity was performed prior to
A) Mendel's work on heredity.
B) the elucidation of the double helix structure of DNA.
C) Antonie van Leeuwenhoek's observation of internal cell structures.
D) the description of the enzymatic steps of glycolysis.
E) the formation of the chromosome theory of heredity.
Answer: B
Chapter Section: 1.2
Bloom's Taxonomy: Synthesis
Learning Outcome: 1.1
Global LO: G1

30) Jacques Monod and François Jacob deduced the mechanism responsible for the regulation of prokaryotic gene expression. They are, therefore, responsible for launching the era of
A) the scientific method.
B) molecular genetics.
C) biochemistry.
D) light microscopy.
E) radioisotopes.
Answer: B
Chapter Section: 1.2
Bloom's Taxonomy: Synthesis
Learning Outcome: 1.1
Global LO: G1

31) Which of the following biochemical techniques uses an electrical field to separate macromolecules based on their mobility through a semisolid gel?
A) light microscopy.
B) ultracentrifugation.
C) chromatography.
D) electrophoresis.
E) mass spectrometry.
Answer: D
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G1

32) To which of the following do Mendel's observations relate?
A) thermodynamics
B) gravity
C) ideal gas laws
D) heredity
E) diffusion
Answer: D
Chapter Section: 1.2
Bloom's Taxonomy: Synthesis
Learning Outcome: 1.1
Global LO: G1

33) The steps of the scientific method, in the correct order, are
A) design experiments, draw conclusions, collect data, interpret results, make observations, and test the hypothesis.
B) make observations, formulate the hypothesis, design experiments, collect data, interpret results, and draw conclusions.
C) collect data, interpret results, test the hypothesis, design experiments, make observations, and draw conclusions.
D) collect data, interpret results, test the hypothesis, make observations, and design experiments.
E) none of the above.
Answer: B
Chapter Section: 1.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.3
Global LO: G1

34) Scientists use various terms to describe conclusions reached through the scientific method. Which of the following terms conveys the least degree of certainty?
A) theory
B) hypothesis
C) law
D) both hypothesis and theory
E) both theory and law
Answer: B
Chapter Section: 1.3
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.3
Global LO: G1

35) Once a scientific theory becomes a law, it
A) cannot be changed.
B) cannot be challenged.
C) becomes static.
D) is subject to modification.
E) is irrefutable.
Answer: D
Chapter Section: 1.3
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.3
Global LO: G1

36) You are studying the response of macrophages infected with the intracellular bacterium *Brucella*, specifically by examining which gene products are being expressed. You would be studying the macrophage _____ to obtain this information.
A) proteome
B) genome
C) transciptome
D) amplicon
E) metabolome
Answer: C
Chapter Section: 1.2
Bloom's Taxonomy: Application
Learning Outcome: 1.2
Global LO: G1

37) Which of the following is an important characteristic for a model organism?
A) marginally characterized
B) difficult to manipulate in the laboratory
C) prone to random changes that alter primary characteristics
D) widely studied
E) all of the above
Answer: D
Chapter Section: 1.3
Bloom's Taxonomy: Comprehension
Learning Outcome: 1.3
Global LO: G1

38) All of the following are model organisms, *except*
A) *Saccharomyces cerevisiae.*
B) *Drosophila melanogaster.*
C) *Caenorhabditis elegans.*
D) *Arabidopsis thialana.*
E) *Homo sapiens.*
Answer: E
Chapter Section: 1.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.3
Global LO: G1

39) In studying osteoporosis in humans, you wish to test a newly designed treatment for efficacy. Your best choice for a model organism would be
A) *Escherichia coli.*
B) *Mus musculus.*
C) *Caenorhabditis elegans.*
D) *Arabidopsis thaliana.*
E) *Pisum sativum.*
Answer: B
Chapter Section: 1.3
Bloom's Taxonomy: Application
Learning Outcome: 1.3
Global LO: G1

40) Which of the following is mismatched?
A) *Escherichia coli* - genetics
B) *Drosophila melanogaster* - embryogenesis
C) *Mus musculus* - immunology
D) *Caenorhabditis elegans* - photosynthesis
E) *Arabidopsis thaliana* - plant gene function
Answer: D
Chapter Section: 1.3
Bloom's Taxonomy: Analysis
Learning Outcome: 1.3
Global LO: G1

1.2 Matching Questions

Match each scientist or group of scientists on the left with the appropriate phrase to the right.

A) fruit fly
B) DNA double helix
C) cell theory
D) transfer RNA
E) Calvin cycle
F) "one gene—one enzyme"
G) transformation
H) translation
I) chromosome theory of heredity
J) embryonic bacteria
K) "ferments" of yeast
L) oral prokaryotes
M) urea
N) hereditary factors
O) pollen grain
P) dog saliva
Q) transcription

1) Gregor Mendel
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

2) Walter Sutton
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

3) Matthias Schleiden
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

4) Oswald Avery, Colin MacLeod, and Maclyn McCarty
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

5) George Beadle and Edward Tatum
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

6) James Watson and Francis Crick
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

7) Thomas Hunt Morgan
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

8) Friedrich Wöhler
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

9) Louis Pasteur
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

Answers: 1) N 2) I 3) C 4) G 5) F 6) B 7) A 8) M 9) K

Match the type of microscopy with the appropriate characteristic.

A) amplifies variations in density
B) light passes directly through specimen
C) detects electrons deflected from the surface of the specimen
D) shows specific molecules
E) uses a laser to view a single plane of a specimen
F) detects electrons passing through a specimen

10) brightfield
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

11) fluorescence
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

12) phase-contrast
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

13) confocal
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

14) transmission electron microscopy
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

15) scanning electron microscopy
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

Answers: 10) B 11) D 12) A 13) E 14) F 15) C

1.3 Short Answer Questions

1) To be useful to scientists, a hypothesis must be _____; in other words, the hypothesis must be able to be confirmed or discredited.
Answer: testable
Chapter Section: 1.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.3
Global LO: G1

2) A scientific _____ must be so thoroughly confirmed that virtually no doubt remains about its accuracy.
Answer: law
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.3
Global LO: G1

3) Glycolysis is also called the _____ pathway after the scientists who did most of the work to define it.
Answer: Embden-Meyerhof
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

4) _____ synthesized urea in the laboratory from inorganic starting materials. Much of what is now called _____ dates from this discovery.
Answer: Friedrich Wöhler; biochemistry
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

5) Melvin Calvin used _____, a specific _____, to deduce the Calvin cycle of photosynthesis.
Answer: ^{14}C; radioisotope
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

6) A(n) _____ is an instrument used to separate subcellular structures and macromolecules on the basis of size, shape, and density. _____ developed this instrument in Sweden during the period 1925–1930.
Answer: ultracentrifuge; Theodor Svedberg
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G1

7) Around 1914, _____ determined that DNA was an important component in _____ by using a staining technique that is still in use today.
Answer: Robert Feulgen; chromosomes
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

8) Because of the low penetration power of electrons, samples for transmission electron microscopy must be extremely thin. A(n) _____ is able to cut sections as thin as 20 nm.
Answer: ultramicrotome
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

9) In 1880, Walther Flemming identified _____, threadlike bodies seen in dividing cells.
Answer: chromosomes
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1

10) The _____ was developed in the late 1920s by Theodore Svedberg. He originally used it to determine the sedimentation rate of proteins.
Answer: ultracentrifuge
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G1

11) _____ is a biochemical technique that allows one to separate biological molecules based on size, shape, and/or affinity for specific molecules or functional groups.
Answer: Chromatography
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G1

12) The total protein content of the cell is called the _____.
Answer: proteome
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G1

13) _____ is the ability to distinguish two objects that are close together as separate. In any microscope, this ability is determined by _____.
Answer: Resolution; wavelength
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.2
Global LO: G4

1.4 Inquiry

Scientific discoveries have had great impact in human history. The people who make these discoveries and the circumstances that surround these discoveries are very important to our understanding of science. Can you identify the individuals as they might have described themselves?

A) Antonie van Leeuwenhoek
B) Melvin Calvin
C) Alfred Hershey and Martha Chase
D) Theodor Svedberg
E) Friedrich Wöhler
F) Robert Hooke
G) James Watson and Francis Crick

1) I am a seventeenth-century shopkeeper from Holland. My hobby involves hand-polishing glass to make lenses, some of which can magnify almost 300-fold. I was the first to observe living cells and am known as the "Father of Microbiology."
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1, G7

2) I was the Curator of Instruments for the Royal Society of London in 1665. I developed a microscope that could magnify around 30-fold. I examined plant material and observed many small chambers that I called cells.
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1, G7

3) At the University of California, Berkeley, I worked with radioisotopes. In the late 1940s and early 1950s, I used 14C to identify the most common pathway for photosynthetic carbon metabolism.
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1, G7

4) We worked out the double helix model of DNA structure in 1953. We later received the Nobel Prize for this work.
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1, G7

5) I am a nineteenth-century German chemist. By synthesizing an organic molecule from inorganic components, I dispelled the idea that biological processes were exempt from the laws of chemistry.
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1, G7

6) My colleague and I worked with bacterial viruses. We were able to demonstrate that DNA–not protein–was the genetic material of the cell.
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1, G7

7) I am a Swedish scientist. I developed the ultracentrifuge to determine sedimentation rates of proteins. The ultracentrifuge was later used to isolate subcellular fractions.
Chapter Section: 1.2
Bloom's Taxonomy: Knowledge
Learning Outcome: 1.1
Global LO: G1, G7

Answers: 1) A 2) F 3) B 4) G 5) E 6) C 7) D

8) The following paragraph describes the activities of hypothetical scientists. After reading this paragraph, list the steps of the scientific method, and list the activities that correspond to the steps of the scientific method.

A rancher noticed that several grazing animals had become sick after grazing in a new area. The rancher asked a team of scientists to analyze this problem. They visited the area and found that the food available to the animals was similar to the food they had been eating. The water supply in the area was adequate but limited to a single spring. Some of the scientists felt that the water might be contaminated with a pathogen. Therefore, they collected water samples from the spring in the new area and compared them with water samples taken from previous grazing sites. The scientists noticed that water from the new area was cloudier than water obtained from other areas. Culturing this water revealed that a pathogenic strain of bacteria was present. This bacterial strain was found to be identical to a strain obtained from sick animals. This strain was not present in healthy animals. They concluded that a contaminated water supply in the new area was responsible for the problem and instructed the rancher to avoid the water supply. The disease was not found in the rancher's livestock again.
Answer: (Answers may vary.)
Observation. The rancher and the scientists made initial observations regarding the food and water that the livestock consumed.
Hypothesis. The water supply was contaminated with a pathogen.
Experimentation. Water was collected, examined, and cultured.
Collect data. The turbidity of the water was examined. The cultures were positive for a pathogenic strain of bacterium.
Interpret results. The data was compared to other water samples. The cultures were compared to those obtained from livestock.
Draw conclusion. The water was contaminated and responsible for the outbreak.
Chapter Section: 1.3
Bloom's Taxonomy: Evaluation
Learning Outcome: 1.3
Global LO: G1

9) A number of different types of microscopy exist. Each type of microscopy has advantages and disadvantages. Can you identify the microscope that would be most advantageous for the situations below?
a. A cell biologist wishes to visualize the ribosomes of a cell.
b. A microbiologist wishes to examine the motility of a bacterium.
c. An immunologist wishes to determine if a lymphocyte possesses a certain surface protein.
d. A virologist is trying to determine the three-dimensional shape of a virus.
e. A pathologist is trying to examine the cytoplasm of a cell for changes that result from viral infection.
Answer: (Answers may vary.)
a. Electron microscopy, preferably transmission electron microscopy, should be used.
b. Phase contrast or differential-interference-contrast would be most helpful.
c. Fluorescence microscopy is often used.
d. Scanning electron microscopy should be used.
e. Transmission electron microscopy will enable the pathologist to visualize the interior.
Chapter Section: 1.2
Bloom's Taxonomy: Evaluation
Learning Outcome: 1.2
Global LO: G4

10) You have identified a new molecule associated with the immune system that drastically reduces cell division by tumor cells in vivo. Develop a hypothesis and design an experiment to test your hypothesis using a model organism. Include an explanation as to why it is the best model for your experiment.
Answer: Answers will vary; however, the hypothesis would indicate the utility of the cytokine for lymphoma treatment. The obvious model organism would be the mouse model. It shares a great many similarities to humans at the cellular, anatomical, and physiological levels. It is well characterized, and the genome has been sequenced. Further, there is a mouse model of lymphoma currently available. Mice are easy to care for and require a relatively small amount of space to maintain.
Chapter Section: 1.3
Bloom's Taxonomy: Synthesis
Learning Outcome: 1.3
Global LO: G1

11) You have been given a sample of *Mimivirus*, which has the largest capsid diameter of all currently known viruses (600 nm) and has the form of a 20-sided polyhedron (an icosahedron). Based on your knowledge of microscopes, what would you be able to see/determine about mimiviral structure using each of the following microscopes?
a. simple compound (light) microscope
b. fluorescent microscope using fluorescently labeled antibodies to a novel capsid protein
c. scanning electron microscope
Answer:
a. Light microscope: will be able to see basic viral shape, especially if particles are stained
b. Fluorescent microscope: should illuminate the outside of the viral particles
c. Scanning electron microscope: would allow imaging of the surface structure of the virus
Chapter Section: 1.2
Bloom's Taxonomy: Analysis
Learning Outcome: 1.2
Global LO: G4