Microbiology A Human Perspective 7th Edition Nester Solutions Manual
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Chapter # and Question type	**Question**	**Answer**
Chapter 1 Short answer #1.	How did Louis Pasteur help disprove spontaneous generation?	Pasteur demonstrated that swan necked flasks containing sterile growth medium would remain sterile indefinitely if the bend in the flask did not come in contact with the medium.
Chapter 1 Short answer #2.	Give three reasons why life could not exist without the activities of microorganisms.	• Nitrogen would not be available in a form that humans and plants could use. • The supply of oxygen would be depleted after about 20 years if microorganisms were not available to replenish it. • A wide variety of materials would pile up if microorganisms were not present to degrade them.
Chapter 1 Short answer #3.	List five beneficial applications of bacteria.	• Their role in food and beverage production • Role in pollutant degradation • Synthesis of commercially valuable products • Their importance in synthesizing medically important products, following genetic modification • Their importance as model organisms for the study of universal biological processes
Chapter 1 Short answer #4.	State three reasons why there is a resurgence of infectious diseases today.	• Aging population is more susceptible to disease • Organisms controlled by antimicrobial medications have become resistant to the medications • Children are not being routinely vaccinated against many diseases
Chapter 1 Short answer #5.	Name the prokaryotic groups in the microbial world.	*Bacteria* and *Archaea*

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Chapter 1 Short answer #6.	Name one location where you could isolate members of the Archaea.	The hot springs of Yellowstone National Park
Chapter 1 Short answer #7.	How might you distinguish a prokaryotic cell from a eukaryotic cell?	The prokaryotic cell does not have a nucleus whereas the eukaryotic cell does.
Chapter 1 Short answer #8.	In the designation *Escherichia coli* B, what is the genus? What is the species? What is the strain?	*Escherichia* is the genus; *coli* is the species and *B* is the strain.
Chapter 1 Short answer #9.	Why are viruses not microorganisms?	. Viruses do not have all of the machinery necessary to live and so they must use that of a host cell in order to replicate.
Chapter 1 Short answer #10.	Name three non-living groups in the microbial world and describe their major properties.	• Viruses contain a protein coat and either DNA or RNA. They are obligate intracellular parasites of all forms of life. • Viroids contain only a short RNA molecule. They cause serious plant diseases Prions consist only of protein that is a misfolded version of normal cellular protein found in the brain of animals. They are resistant to the commonly used sterilizing procedures that kill viruses and bacteria. They are responsible for fatal neurological diseases
Chapter 1 Multiple Choice #1	The property of endospores that led to confusion in the experiments on spontaneous generation is their a) small size. b) ability to pass through cork stoppers. c) heat resistance. d) presence in all infusions. e) presence on cotton plugs.	. (C)
Chapter 1 Multiple Choice #2	The "Golden Age of Microbiology" was the time when a) microorganisms were first used to make bread. b) microorganisms were first used to make cheese.	. (C)

	c) most pathogenic bacteria were identified. d) a vaccine against influenza was developed. e) antibiotics became available.	
Chapter 1 Multiple Choice #3	Microorganisms play a role in a) disease. b) biodegradation. c) cheese production. d) nitrogen recycling. e) all of the above.	(E)
Chapter 1 Multiple Choice #4	Which disease was once thought to be due to stress but is now known to be caused by a bacterium? a) smallpox b) peptic ulcers c) AIDS d) plague e) influenza	. (B)
Chapter 1 Multiple Choice #5	The prokaryotic members of the microbial world include 1. algae. 2. fungi. 3. prions. 4. bacteria. 5. archaea. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	(D)
Chapter 1 Multiple Choice #6	The Archaea 1. are microscopic. 2. are commonly found in extreme environments. 3. contain peptidoglycan. 4. contain mitochondria. 5. are most commonly found in the soil. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	(A)
Chapter 1 Multiple Choice #7	Prokaryotes typically do not have a) cell walls. b) flagella. c) a nuclear membrane. d) specific shapes. e) genetic information.	. (C)
Chapter 1 Multiple Choice #8	Nucleoids are associated with 1. genetic information. 2. prokaryotes. 3. eukaryotes. 4. viruses. 5. prions. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	. (A)
Chapter 1 Multiple Choice # 9	Viruses 1. contain both protein and nucleic acid.	(A)

	2. infect all domains of life. 3. can grow in the absence of living cells. 4. are generally the same size as prokaryotes. 5. always kill the cells they infect. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	
Chapter 1 Multiple Choice #10	Antony van Leeuwenhoek could not have observed a) roundworms. b) Escherichia coli. c) yeasts. d) viruses.	(D)
Chapter 1 Applications #1	The American Society for Microbiology is preparing a "Microbe-Free" banquet to emphasize the importance of microorganisms in the diet. What foods could not be on the menu?	. Nothing would be available to eat. Microorganisms are needed for crop production, so vegetables or fruits would not be available to eat. Cattle, chickens, pigs and other animals need microorganisms to assist with the digestion of food. They would be undernourished and not provide quality meat or products adequate for human consumption. Do not look for fish or any other lake or ocean products because these ecosystems are needed for their survival. Milk and alcoholic beverages would be off the menu. Any beverage prepared with water would be unsafe to consume. Water is cleaned and treated to be disease-free with microorganisms.
Chapter 1 Applications #2	If you were asked to nominate one of the individuals mentioned in this chapter for the Nobel Prize, who would it be? Make a statement supporting your choice.	Any answer that is supported.
Chapter 1 Critical Thinking #1	A microbiologist obtained two pure biological samples: one of a virus, and the other of a viroid. Unfortunately, the labels had been lost. The microbiologist felt she could distinguish the two by analyzing for the presence or absence of a single molecule.	Test for proteins.

	What molecule would she search for and why?	
Chapter 1 Critical Thinking #2	Why is the bacterium that causes anthrax such an effective agent of bioterrorism?	Spores, in general, are an effective agent of bioterrorism because they are environmentally tough, "invisible" and can be readily delivered through the air, all of which enables them to potentially infect large numbers of people easily.
Chapter 2		
Chapter 2 Short Answer #1	Differentiate between an atom, a molecule, and a compound.	An atom is the basic unit of all matter. A molecule is composed of two or more atoms joined through chemical bonds. A compound consists of molecules of two or more different elements.
Chapter 2 Short Answer #2	Why is water a good solvent?	Because of its polar nature, water can form hydrogen bonds with all all polar molecules thereby preventing the association of the atoms comprising the molecules.
Chapter 2 Short Answer #3	Which solution is more acidic, one with a pH of 4 or a pH of 5? What is the concentration of H+ ions in each? The concentration of OH- ions?	A pH of 4 is more acidic. A solution of 4 has a H+ concentration of 10-4 and a 10-10 0H- concentration.A solution with a pH of 5 has a H+ concentration of 10-5 and an 0H concentration of 10-9.
Chapter 2 Short Answer #4	Name the subunits of proteins, polysaccharides, and nucleic acids.	Subunits of proteins are amino acids; subunits of polysaccharides are monosaccharides; subunits of nucleic acids are nucleotides
Chapter 2 Short Answer #5	Give an example of dehydration synthesis. Give an example of a hydrolysis reaction. How are these reactions related?	Dehydration synthesis is involved in the joining together of two amino acids with the loss of water in the chemical reaction. Hydrolysis is involved in the splitting part of the two amino acidswith the addition of H+ to one amino acid and OH- to the other. Dehydration synthesis is the reverse of hydrolysis.
Chapter 2 Short Answer #6	List four functions of proteins.	Catalyse enzymatic reactions Move the cell Serve as components of certain cell

		structures Turn genes off and on
Chapter 2 Short Answer #7	What are the four levels of protein structure, and what is the distinguishing feature of each?	Primary structure—The sequence of amino acids comprising the protein Secondary structure—The three--dimensional shape of localized regions Tertiary structure---The three—dimensional shape of the entire molecule Quarternary structure—The three-dimensional shape of a protein molecule consisting of more than one polypeptide chain.
Chapter 2 Short Answer #8	How do the two types of nucleic acids differ from one another in (a) composition, (b) size, and (c) function?	(a) DNA contains deoxyribose; RNA contains ribose. (b)DNA is much longer than RNA (c) DNA codes for all of the genetic information of the cell. RNA is involved in decoding the information in DNA.
Chapter 2 Short Answer #9	What are the two major groups of lipids? Give an example of each group. What feature is common to all lipids?	Simple and compound Fats are simple lipids; phospholipids are compound. All lipids are insoluble in water.
Chapter 2 Short Answer #10	What features do all lipids share?	All lipids are heterogeneous in their chemical composition and insoluble in water but soluble in organic solvents.
Chapter 2 Multiple Choice #1	Choose the list that goes from the lightest to the heaviest: a) proton, atom, molecule, compound, electron. b) atom, proton, compound, molecule, electron. c) electron, proton, atom, molecule, compound. d) atom, electron, proton,	C

	molecule, compound. e) proton, atom, electron, molecule, compound.	
Chapter 2 Multiple Choice #2	The strongest chemical bonds between two atoms in solution are a) covalent. b) ionic. c) hydrogen bonds. d) hydrophobic interactions.	. A
Chapter 2 Multiple Choice #3	Dehydration synthesis is involved in the synthesis of all of the following except a) DNA. b) proteins. c) polysaccharides. d) lipids. e) monosaccharides.	. E
Chapter 2 Multiple Choice #4	The primary structure of a protein relates to its a) sequence of amino acids. b) length. c) shape. d) solubility. e) bonds between amino acids.	A
Chapter 2 Multiple Choice #5	Pure water has all of the following properties except a) polarity. b) ability to dissolve lipids. c) pH of 7. d) covalent joining of its atoms. e) ability to form hydrogen bonds.	. B
Chapter 2 Multiple Choice #6	The macromolecules that are composed of carbon, hydrogen, and oxygen in an approximate ratio of 1:2:1 are a) proteins. b) lipids. c) polysaccharides. d) DNA. e) RNA.	. C
Chapter 2 Multiple Choice #7	In proteins, α helices and β pleatedstructures are associated with the a) primary structure. b)	. B

	secondary structure. c) tertiary structure. d) quaternary structure. e) multiprotein complexes.	
Chapter 2 Multiple Choice #8	Complementarity plays a major role in the structure of a) proteins. b) lipids. c) polysaccharides. d) DNA. e) RNA.	D
Chapter 2 Multiple Choice #9	A bilayer is associated with a) proteins. b) DNA. c) RNA. d) complex polysaccharides. e) phospholipids.	D.
Chapter 2 Multiple Choice #10	Isomers are associated with 1. carbohydrates. 2. amino acids. 3. nucleotides. 4. RNA. 5. fatty acids. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	. A
Chapter 2 Applications #1	A group of prokaryotes known as thermophiles thrive at high temperatures that would normally destroy other organisms. Yet these thermophiles cannot survive well at the lower temperatures normally found on the earth. Propose an explanation for this observation.	The enzymes can function well at the high temperatures but function poorly at the lower temperatures.
Chapter 2 Applications #2	Microorganisms use hydrogen bonds to attach to surfaces. Many of the cells lose hold of the surface because of the weak nature of these bonds. Contrast the benefits and disadvantages of using covalent bonds as a means of attaching to surfaces.	The weak hydrogen bonds allow the organisms to detach and reattach very quickly and so the organisms can respond very quickly to changing conditions in the environment. Further, very little energy is required to attach and detach from surfaces.
Chapter 2 Critical Thinking #1	What properties of the carbon atom make it ideal as the key atom for all molecules in organisms?	Carbon is the major building block of all matter because it can form four covalent bonds with other atoms including carbon atoms. Since these bonds can be single, double or triple bonds, with a variety of elements, a wide variety of different molecules can be formed. The bonds can be polar or non polar so a wide variety of molecules with different weak

		bonding properties can be formed.
Chapter 2 Critical Thinking #2	A biologist determined the amounts of several amino acids in two separate samples of pure protein. The data are shown here: **Amino Acid Leucine Alanine Histidine Cysteine Glycine** Protein A 7% 12% 4% 2% 5% Protein B 7% 12% 4% 2% 5% The scientist concluded that protein A and protein B were the same protein. Do you agree with this conclusion? Justify your answer.	No. The amino acids might be arranged differently so the two proteins would be quite different and have different properties.
Chapter 2 Critical Thinking #3	This table indicates the freezing and boiling points of several molecules: **Molecule Freezing Point (°C) Boiling Point (°C)** Water 0 100 Carbon tetrachloride (CCl_4) – 23 77 Methane (CH_4) – 182 – 164 Carbon tetrachloride and methane are non-polar molecules. How does the polarity and non-polarity of these molecules explain why the freezing and boiling points for methane and carbon tetrachloride are so much lower than those for water?	Because of the hydrogen bonding between water molecules, much energy is required in the form of heat to break the bonds and convert the liquid into a gas. If there is no hydrogen bonding between molecules, less energy (a lower temperature) is required. Further, as the temperature drops, weak hydrogen bonds between water molecules are broken less frequently until a crystalline structure (ice) is formed in which hydrogen bonding between molecules is most stable. Molecules that can not form hydrogen bonds between molecules must reach lower temperatures to achieve stability between molecules and form a crystalline structure.
Chapter 3		
Chapter 3 Short Answer #1	Explain why resolving power is important in microscopy.	The resolving power, which is the minimum distance that can exist between two objects when those objects can still be observed as separate entities, determines how much detail actually can be seen.
Chapter 3 Short Answer #2	Explain why basic dyes are used more frequently than	Basic dyes carry a positive charge; opposite charges attract, so these

	acidic dyes in staining.	dyes are drawn to the many negatively charged components of cells, including nucleic acid and many proteins. Acidic dyes carry a negative charge and are repelled by those cell components.
Chapter 3 Short Answer #3	Describe what happens at each step in the Gram stain.	#1 Crystal violet is the primary stain, entering the cytoplasm and imparting a color to all cells that can be stained. #2 Iodine complexes with the crystal violet within the cell, acting as a "mordant" to enhance the affinity of the cellular components for a dye. #3 Acetone/alcohol removes the crystal violet-iodine complex from Gram-negative cells making them colorless. #4 Safranin serves as a counterstain that imparts a pink color to the otherwise colorless Gram-negative cells.
Chapter 3 Short Answer #4	Compare and contrast ABC transport systems with group translocation.	An ABC transport system is an active transport mechanism that requires the energy of ATP to drive the accumulation of molecules against a concentration gradient; the process does not alter the transported molecule. Group translocation chemically alters a molecule during passage, often by phosphorylating it; the energy expended to phosphorylate the molecule can be regained when that sugar is later broken down to provide energy.
Chapter 3 Short Answer #5	Give two reasons why the outer membrane of Gram-negative bacteria is medically significant.	#1 The outer membrane prevents entry of important antimicrobial drugs such as vancomycin. #2 The Lipid A component of lipopolysaccharide (LPS) is responsible for many of the

		symptoms associated with Gram-negative infections, which is why the LPS-containing outer membrane is called endotoxin.
Chapter 3 Short Answer #6	Compare and contrast penicillin and lysozyme.	Penicillin interferes with the synthesis of peptidoglycan; it binds to proteins involved in cell wall synthesis (penicillin-binding proteins). This prevents the cross-linking of adjacent glycan chains. Lysozyme destroys existing bonds in the glycan chain; it breaks the bond that links the alternating *N*-acetylglucosamine and *N*-acetylmuramic acid molecules. Both penicillin and lysozyme result in a weakened cell wall, ultimately causing the cell to lyse. However, penicillin works only on actively growing cells, while lysozyme can cause lysis of both growing and nongrowing cells.
Chapter 3 Short Answer #7	Describe how a plasmid can help a cell.	Plasmids encode genetic characteristics such as antibiotic resistance that may be advantageous in certain situations. However, excess genetic information can slow a cell's replication, which can put the cell at a competitive disadvantage when the information does not provide an advantage.
Chapter 3 Short Answer #8	How is an organ different from tissue?	Cells of plants and animals function in cooperative associations called tissues; examples include muscle, connective, nerve, epithelial, blood and lymphoid. Combinations of various tissues function together to make up larger units, organs, including skin, heart and liver.
Chapter 3 Short Answer #9	How is receptor-mediated endocytosis different from phagocytosis?	Receptor-mediated endocytosis allows cells to internalize relatively small extracellular molecules that

		bind to the cell's receptors. Certain regions of the cell membrane are lined with a protein called clathrin and studded with receptors. These regions are internalized to form an endocytic vesicle, bringing with them the receptors along with their bound ligands. In contrast, phagocytosis allows a cell to bring in relatively large particles, including bacteria. The cells send out arm-like extensions, pseudopods, which surround and enclose extracellular material. This action envelopes the material, bringing it into the cell in an enclosed compartment called a phagosome.
Chapter 3 Short Answer #10	Explain how the Golgi apparatus cooperatively functions with the endoplasmic reticulum.	Macromolecules such as proteins and lipids are synthesized in the endoplasmic reticulum and then transported in vesicles to the Golgi apparatus. There, they are modified, sorted and packaged in vesicles for transport to other cellular locations or to the outside of the cell.
Chapter 3 Multiple Choice #1	Which of the following is most likely to be used in a typical microbiology laboratory? a) Bright-field microscope b) Confocal scanning microscope c) Phase-contrast microscope d) Scanning electron microscope e) Transmission electron microscope	A
Chapter 3 Multiple Choice #2	When a medical technologist wants to determine if a	A

	clinical specimen contains a Mycobacterium species, which should be used? a) Acid-fast stain b)Capsule stain c) Endospore stain d) Gram stain e) Simple stain	
Chapter 3 Multiple Choice #3	When a medical technologist wants to determine if a clinical specimen contains a Mycobacterium species, which should be used? a) Acid-fast stain b)Capsule stain c) Endospore stain d) Gram stain e) Simple stain	E
Chapter 3 Multiple Choice #4	Endotoxin is associated with a) Gram-positive bacteria. b) Gram-negative bacteria. c) the cytoplasmic membrane. d) the endospore.	B
Chapter 3 Multiple Choice #5	The "O157" in the name *E.* coli O157:H7 refers to the type of O antigen. From this information you know that E. coli a) has a capsule. b) is a rod. c) is a coccus. d) is Gram-positive. e) is Gram-negative.	E
Chapter 3 Multiple Choice #6	Eliminating which structure is always deadly to cells? a) Flagella b) Capsule c) Cell wall d) Cytoplasmic membrane e) Fimbriae	D
Chapter 3 Multiple Choice #7	Which of the following do bacterial cells use for attachment? 1.Capsule 2. Pilus 3.Cytoplasmic membrane.	A

	4.Periplasm 5. Peptidoglycan a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	
Chapter 3 Multiple Choice #8	Endocytosis is associated with a) mitochondria. b) prokaryotic cells. c) eukaryotic cells. d) chloroplasts. e) ribosomes.	C
Chapter 3 Multiple Choice #9	Protein synthesis is associated with 1. lysosomes. 2. the cytoplasmic membrane. 3. the Golgi apparatus. 4. rough endoplasmic reticulum. 5. ribosomes. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	D
Chapter 3 Multiple Choice #10	If a eukaryotic cell were treated with a chemical that destroys tubulin, all of the following would be directly affected except a) actin. b) cilia. c) eukaryotic flagella. d) microtubules. e) More than one of these.	A
Chapter 3 Applications #1	You are working in a laboratory producing new antibiotics for human and veterinary use. One compound with potential value inhibits the action of prokaryotic ribosomes. The compound, however, was shown to inhibit the growth of animal cells in culture. What is one possible explanation for its effect on animal cells?	The antibiotic could be entering the cells and acting on the mitochondria. Mitochondria, like bacteria, have 70S ribosomes.
Chapter 3 Applications #2	A research laboratory is investigating environmental factors that inhibit the growth of archaea. They wonder if penicillin would be effective in controlling their growth. Explain the probable	Penicillin interferes with the synthesis of peptidoglycan. The cell walls of archaea do not have peptidoglycan so they are probably not affected by penicillin.

	results of an experiment in which penicillin is added to a culture of archaea.	
Chapter 3 Critical Thinking #1	This graph shows facilitated diffusion of a compound across a cytoplasmic membrane and into a cell. As the external concentration of the compound is increased, the rate of uptake increases until it reaches a point where it slows and then begins to plateau. This is not the case with passive diffusion, where the rate of uptake continually increases. Why does the rate of uptake slow and then eventually plateau with facilitated diffusion?	In facilitated diffusion, transported compounds combine with a transporter or carrier on the outside surface of the cytoplasmic membrane, resulting in translocation of the compound across the membrane. When the external concentration of a compound is low, carrier molecules are readily available; solute molecules can easily "find" a free carrier. When the external concentration is high, competition for free carriers occurs. Eventually, all carriers will become saturated, and the rate of transport will be constant. At this point, the number of carriers and the time it takes the carriers to translocate the compound across the membrane limits transport.
Chapter 3 Critical Thinking #2	Most medically useful antibiotics interfere with either peptidoglycan synthesis or ribosome function. Why would the cytoplasmic membrane be a poor target for antibacterial medications?	The structure of the cytoplasmic membrane of prokaryotes is similar to that of eukaryotes: a phospholipid bilayer. Thus, medications that damage the prokaryotic membrane would likely adversely impact mammalian membranes as well. In contrast, peptidoglycan is unique to prokaryotes, and the prokaryotic ribosome (70S) is different from that of eukaryotic cells (80S) (although it is the same as the mitochondrial ribosomes).
Chapter 4		
Chapter 4 Short Answer #1	Describe a detrimental and a beneficial effect of biofilms.	Detrimental effect — dental plaque. Beneficial effect — bioremediation and sewage treatment
Chapter 4	Define a pure culture.	A population of organisms that are

Short Answer #2		descended from a single cell.
Chapter 4 Short Answer #3	Explain what occurs during each of the five phases of growth.	Lag phase — the "tooling-up" period during which cells synthesize DNA, amino acids, and enzymes necessary for cell growth. Log phase — the period of active growth. Stationary phase — cells are synthesizing compounds that make them more resistant to certain environmental conditions but they are dying as fast as they are dividing. Death phase — cells are dying faster than they are dividing. Phase of prolonged decline – very gradual decrease in the number of viable cells on the population.
Chapter 4 Short Answer #4	Explain how the environment of a colony differs from that of cells growing in a liquid broth.	In a liquid broth, the population of cells is exposed to uniform conditions. Cells in a colony are exposed to different conditions, depending on the location of the cell within the colony. Cells multiplying on the edge of the colony have little competition and can use O_2 in the air and obtain nutrients from the agar medium. In the center the high density of cells rapidly depletes available O_2 and nutrients.
Chapter 4 Short Answer #5	List the five categories of optimum temperature, and describe a corresponding environment in which a representative might thrive.	Psychrophile — glacier lake. Psychrotroph – refrigerated food. Mesophile — surface of the human body. Thermophile — compost heap. Extreme thermophile — hydrothermal vent.
Chapter 4 Short Answer #6	Why would botulism be a concern with canned foods?	Obligate anaerobes can grow in improperly canned foods. To the canning industry, the most important obligate anaerobe is

		Clostridium botulinum, which causes the disease botulism.
Chapter 4 Short Answer #7	Explain why O2-containing atmospheres kill some microbes.	Reactive oxygen species (ROS) including superoxide anion (O_2^-)and hydrogen peroxide are damaging to cells. Many organisms have enzymes that detoxify these compounds. Bacteria that cannot survive in aerobic atmospheres generally lack these enzymes.
Chapter 4 Short Answer #8	Explain why photoautotrophs are primary producers.	Using sunlight for energy and CO_2 as a carbon source, photoautotrophs synthesize organic compounds that other forms of life require; without primary producers, humans and other animals could not exist.
Chapter 4 Short Answer #9	Distinguish between a selective medium and a differential medium.	A selective medium contains an ingredient that inhibits the growth of undesired organisms; a differential medium contains an ingredient that allows for the visual differentiation of two species. A medium can be both selective and differential.
Chapter 4 Short Answer #10	If the number of microorganisms in lake water were determined using both a direct microscopic count and a plate count, which method would most likely give a higher number? Why?	The direct microscopic count would likely give the highest number because most environmental bacteria cannot be grown in culture and therefore would not be accounted for with the plate count.
Chapter 4 Multiple Choice #1	If there are 103 cells per ml at the middle of log phase, and the generation time of the cells is 30 minutes, how many cells will there be 2 hours later? a) 2 × 103 b) 4 × 103 c) 8 × 103 d) 1.6 × 104 e) 1 × 107	D
Chapter 4 Multiple Choice #2	Compared with their growth in the laboratory, bacteria in nature generally grow a) more slowly. b) faster.	A

	c) at the same rate.	
Chapter 4 Multiple Choice #3	Cells are most sensitive to penicillin during which phase of the growth curve? a) Lag b) Exponential c) Stationary d) Death e) More than one of these.	B
Chapter 4 Multiple Choice #4	Lactic acid is a primary metabolite. If a company wants to harvest this compound from a bacterial culture, the cells should be in which growth phase? a) Lag b) Exponential c) Stationary d) Death e) More than one of these.	B
Chapter 4 Multiple Choice #5	E. coli, a facultative anaerobe, is grown for 24 hours on the same solid medium, but under two different conditions: one aerobic, the other anaerobic. The size of the colonies would be a) the same under both conditions. b) larger when grown under aerobic conditions. c) larger when grown under anaerobic conditions.	B
Chapter 4 Multiple Choice #6	The generation time of a bacterium was measured at two different temperatures. Which results would be expected of a thermophile? a) 20 minutes at 10°C; 220 minutes at 37°C b) 220 minutes at 10°C; 20 minutes at 37°C c) no growth at 10°C; 20 minutes at 37°C d) 20 minutes at 45°C; 220 minutes at 65°C e) 220 minutes at 37°C; 20	E

	minutes at 65°C	
Chapter 4 Multiple Choice #7	Which of the following is false? a) E. coli grows faster in nutrient broth than in glucose-salts medium. b) Organisms require nitrogen to make amino acids. c) Some eukaryotes can fix N2. d) An organism that grows on ham is osmotolerant. e) Blood agar is used to detect hemolysis.	C
Chapter 4 Multiple Choice #8	If the pH indicator were left out of MacConkey agar, the medium would be a) complex. b) differential. c) defined. d) defined and differential. e) complex and differential.	A
Chapter 4 Multiple Choice #9	A soil sample is placed in liquid and the number of bacteria in the sample determined in two ways: (1) colony count and (2) direct microscopic count. How would the results compare? a) Methods 1 and 2 would give approximately the same results. b) Many more bacteria would be estimated by method 1. c) Many more bacteria would be estimated by method 2. d) Depending on the soil sample, sometimes method 1 would be higher and sometimes method 2 would be higher.	C
Chapter 4 Multiple Choice #10	The concentration of E.coli in a broth is between 104	B

	and 106 cells per ml. To determine the precise number of living cells in the sample, it would be best to a) use a counting chamber. b) plate out an appropriate dilution of the sample on nutrient agar. c) determine cell number by using a spectrophotometer. d) Any of these three methods would be satisfactory. e) None of these three methods would be satisfactory.	
Chapter 4 Applications #1	You are a microbiologist working for a pharmaceutical company and discover a new metabolite that can serve as a medication. You now must oversee its production. What are some factors you must consider if you need to grow 5,000-liter cultures of bacteria?	The goal is to get the bacteria to provide as much metabolite as possible in a short period of time. If possible it might be best to isolate a mutant that over-expresses the compound of interest. An important factor to consider in production is whether the compound is a primary or secondary metabolite. Primary metabolites are synthesized in log phase growth whereas secondary metabolites are synthesized in late log and stationary phases. Other factors to consider include how to sterilize 5000 L of media, and how to avoid contamination of the growing culture. An additional concern if the bacterium is Gram-negative, is to ensure that the final product is not contaminated with endotoxin.
Chapter 4 Applications #2	High-performance boat manufacturers know that microbes can collect on a boat, ruining its hydrodynamic properties. A boat-manufacturing facility	The best strategy would be to find ways to coat the surface of a boat with a material that prevents biofilm formation. You can try to develop a paint or resin that is toxic to the bacteria and does not leak out

	recently hired you to help with this problem because of your microbiology background. What strategies other than routine cleaning would you pursue to come up with a long-term remedy for the problem?	too much to harm other organisms. It is also possible to come up with a material that bacteria do not readily adhere to and thus prevent a biofilm from forming.
Chapter 4 Critical Thinking #1	This figure shows a growth curve plotted on a non-logarithmic, or linear, scale. Compare this with figure 4.6. In both figures, the number of cells increases dramatically during the log or exponential phase. In this phase, the cell number increases more and more rapidly (this effect is more apparent in the accompanying figure). Why should the increase be speeding up?	At any point on the curve during log phase, the number of new cells being produced will depend on the number of cells present. The more cells present, the greater the increase or "jump" in cell population size. At the early part of this phase, relatively few cells are present and the increase is relatively slow. At later times, when the population size is greater, the "jumps" will be greater and the cell number increases faster.
Chapter 4 Critical Thinking #2	In question 1, how would the curve appear if the availability of nutrients were increased?	If more nutrients were available, reproduction should be more rapid since the materials necessary to synthesize molecules for new cells are more available. In this case the growth curve should rise more quickly. Moreover, the stationary phase should be at a higher level since a greater number of cells would be produced in the nutrient medium.
Chapter 5		
Ch5 Short Answer #1	How is preservation different from pasteurization?	Preservation inhibits the growth of microorganisms whereas pasteurization significantly decreases the number of spoilage microbes.
Ch5 Short Answer #2	What is the most chemically resistant non-spore-forming bacterial pathogen?	*Mycobacterium species*; the species that is of greatest concern medically is *M. tuberculosis.*
Ch5 Short Answer #3	Explain why it takes longer to kill a population of 109	Death of microbes occurs at a constant rate; it takes more time to

	cells than it does to kill a population of 103 cells.	kill a large population of bacteria than it does to kill a small population because only a fraction of organisms die during a given time interval.
Ch5 Short Answer #4	What is the primary reason that wine is pasteurized?	To destroy microorganisms that could spoil the wine.
Ch5 Short Answer #5	What is the primary reason that milk is pasteurized?	To destroy pathogens in milk that might otherwise cause disease.
Ch5 Short Answer #6	When canning, why are low-acid foods processed at higher temperatures than high-acid foods?	In low-acid foods, the endospores of *Clostridium botulinum* must be destroyed because otherwise those spores can germinate and the vegetative cells grow, producing the toxin that causes botulism. *C. botulinum* cannot germinate/grow in high acid foods (low pH) so processing methods do not need to destroy their endospores.
Ch5 Short Answer #7	How are heat-sensitive liquids sterilized?	Filtration
Ch5 Short Answer #8	How does microwaving a food product kill bacteria?	Microwaves do not kill bacteria directly but by the heat generated in the object being microwaved
Ch5 Short Answer #9	How is an iodophore different from a tincture of iodine?	In an iodophore, the iodine is linked to a carrier molecule so that free (unbound) iodine is released slowly; in a tincture, iodine is dissolved in alcohol. An iodophore is less irritating to the skin than a tincture.
Ch5 Short Answer #10	Name two products commonly sterilized using ethylene oxide gas.	Any of the following are posssible answers: Pillows, mattresses, electrical equipment, plastic Petri dishes and pipettes, and implantable devices such as pacemakers and artificial hips.
Ch 5 Multiple Choice #1	Unlike a disinfectant, an antiseptic a) sanitizes objects rather than sterilizes them. b) destroys all microorganisms. c) is non-toxic enough to be	C

	used on human skin. d) requires heat to be effective. e) can be used in food products.	
Ch 5 Multiple Choice #2	The D value is defined as the time it takes to kill a) all bacteria in a population. b) all pathogens in a population. c) 99.9% of bacteria in a population. d) 90% of bacteria in a population. e) 10% of bacteria in a population.	D
Ch 5 Multiple Choice #3	Which of the following is the most resistant to destruction by chemicals and heat? a) Bacterial endospores b) Fungal spores c) Mycobacterium tuberculosis d) E. coli e) HIV	A
Ch 5 Multiple Choice #4	Ultraviolet light kills bacteria by a) generating heat. b) damaging DNA. c) inhibiting protein synthesis. d) damaging cell walls. e) damaging cytoplasmic membranes.	B
Ch 5 Multiple Choice #5	Which concentration of alcohol is the most effective germicide? a) 100% b) 75% c) 50% d) 25% e) 5%	B
Ch 5 Multiple Choice #6	Which of the following can most reliably be used as a sterilant? a) Alcohol b) Phenolic compounds c) Ethylene oxide gas d) Iodine	C

Ch 5 Multiple Choice #7	All of the following are routinely used to preserve foods except a) high concentrations of sugar. b) high concentrations of salt. c) benzoic acid. d) freezing. e) ethylene oxide.	E
Ch 5 Multiple Choice #8	Aseptically boxed juices and cream containers are processed using which of the following heating methods? a) Canning b) High-temperature–short-time (HTST) method c) Low-temperature–long-time (LTLT) method d) Ultra-high-temperature (UHT) method	D
Ch 5 Multiple Choice #9	Commercial canning processes are designed to ensure destruction of which of the following? a) All vegetative bacteria b) All viruses c) Endospores of Clostridium botulinum d) E. coli e) Mycobacterium tuberculosis	C
Ch 5 Multiple Choice #10	Which of the following is false? a) A high-level disinfectant cannot be used as a sterilant. b) Critical items must be sterilized before use. c) Low numbers of endospores may remain on semicritical items. d) Standard sterilization procedures do not destroy prions. e) Quaternary ammonium compounds can be used to disinfect food preparation surfaces.	A

Ch 5 Applications #1	An agriculture extension agent is preparing pamphlets on preventing the spread of disease. In the pamphlet, he must explain the appropriate situations for using disinfectants around the house. What situations should the agent discuss?	The kitchen is the most appropriate area for carrying out disinfection. Food is the major source of infectious microorganisms in the household. Kitchen surfaces can harbor microbes from contaminated foods, food residues, skin and respiratory fluids. A buildup of these organisms can be transmitted to prepared food. Other situations for disinfection do arise. The bedding and toiletries of people with infectious conditions should be disinfected.
Ch 5 Applications #2	As a microbiologist representing a food corporation, you have been asked to serve on a health food panel to debate the need for chemical preservatives in foods. Your role is to prepare a statement that compares the benefits of chemical preservatives and the risks. What points must you bring up that indicate the benefits of chemical preservatives?	The strongest argument is that without preservatives, the incidence of food harboring and transmitting dangerous disease increases dramatically. It should be discussed that the illnesses associated with foodborne disease carry more consequences than the health effects of even nitrate and nitrite preservatives.
Ch 5 Critical Thinking #1	This graph shows the time it takes to kill populations of the same microorganism under different conditions. What conditions would explain the differences in lines a, b, and c?	Population “b” was killed more quickly than population “a”. Because the two populations started with the same number of organisms and they are the same kind of organism, population “b” must have been subjected to more destructive or toxic conditions than population “a”. These could have been a higher temperature, greater concentration of germicide, or greater intensity of destructive radiation. Populations “a” and “c” are dying at the same rate so they are under equally toxic conditions. The difference is that population “c” started with a smaller number of organisms and was reduced to a zero cell number

		in a shorter time period.
Ch 5 Critical Thinking #2	This diagram shows the filter paper method used to evaluate the inhibitory effect of chemical agents, heavy metals, and antibiotics on bacterial growth. A culture of a test bacterium is spread uniformly over the surface of an agar plate. Small filter paper discs containing the material to be tested are then placed on the surface of the medium. A disc that has been soaked in sterile distilled water is sometimes added as a control. After incubation, a lawn (film of growth) will cover the plate, but a clear zone will surround those discs that contain an inhibitory compound. The size of the zone reflects several factors, one of which is the effectiveness of the inhibitory agent. What are two other factors that might affect the size of the zone of inhibition? What is the purpose of the control disc? If a clear area were apparent around the control disc, how would you interpret the observation?	The concentration and the molecular weight of the inhibitory compound affect the size of the zone of inhibition (compounds with a low molecular weight will diffuse farther from the disc more rapidly). The purpose of the control is to check for the effects of any variables other than those being tested. The researcher needs to show that there were no unknown materials in the filter paper that affected bacterial growth because these would otherwise give misleading information about the effectiveness of the substances being tested. If a clear area of inhibition is observed, then some unknown material is affecting bacterial growth and the results of the experiment are therefore not reliable.
Chapter 6		
Ch 6 Short Answer #1	Explain the difference between catabolism and anabolism.	Catabolism breaks down compounds to release their energy; anabolism uses energy to make compounds.
Ch 6 Short Answer #2	How does ATP serve as a carrier of free energy?	It has unstable phosphate bonds that are easily broken; cells have enzymes that help break those bonds to release the energy.
Ch 6 Short Answer #3	How do enzymes catalyze chemical reactions?	They hold substrates in a way that lowers the activation energy of a

		specific reaction.
Ch 6 Short Answer #4	Explain how precursor molecules serve as junctions between catabolic and anabolic pathways.	They have two potential fates - they can be broken down to release energy, or they can serve as the carbon skeleton for biosynthesis.
Ch 6 Short Answer #5	How do cells regulate enzyme activity?	Regulated enzymes are allosteric; when a molecule binds to the allosteric site, the enzyme changes shape, with alters its activity.
Ch 6 Short Answer #6	Why do the electrons carried by FADH2 result in less ATP production than those carried by NADH?	$FADH_2$ has a higher affinity for electrons that NADH does, so the electrons it carries must be transferred to an even higher affinity molecule; it's electrons are transferred to Complex II of the electron transport chain, which is "downstream" or "downstairs" of Complex I (the complex to which NADH transfers its electrons).
Ch 6 Short Answer #7	Name three food products produced with the aid of microorganisms.	Many options are possible here, including yogurt, cheese, pickles, kimchee, bread, sausage, chocolate, etc.
Ch 6 Short Answer #8	In photosynthesis, what is encompassed by the term “light-independent reactions”?	Carbon fixation
Ch 6 Short Answer #9	Unlike the cyanobacteria, the anoxygenic photosynthetic bacteria do not produce O2. Why not?	They do not strip electrons from water.
Ch 6 Short Answer #10	What is the role of transamination in amino acid biosynthesis?	The amino group is removed from one amino acid and donated to another, generating a different amino acid.
Ch 6 Multiple Choice #1	Which of these factors does not affect enzyme activity? a) Temperature b) Inhibitors c) Coenzymes d) Humidity e) pH	D
Ch 6 Multiple Choice #2	Which of the following statements is false? Enzymes a) bind to substrates. b) lower the energy of activation.	C

	c) convert coenzymes to products. d) speed up biochemical reactions. e) can be named after the kinds of reaction they catalyze.	
Ch 6 Multiple Choice #3	Which of these is not a coenzyme? a) FAD b) Coenzyme A c) NAD+ d) ATP e) NADP+	D
Ch 6 Multiple Choice #4	What is the end product of glycolysis? a) Glucose b) Citrate c) Oxaloacetate d) α-Ketoglutarate e) Pyruvate	E
Ch 6 Multiple Choice #5	The major pathway(s) of central metabolism are a) glycolysis and the TCA cycle only. b) glycolysis, the TCA cycle, and the pentose phosphate pathway. c) glycolysis only. d) glycolysis and the pentose phosphate pathway only. e) the TCA cycle only.	B
Ch 6 Multiple Choice #6	Which of these pathways gives a cell the potential to produce the most ATP? a) TCA cycle b) Pentose phosphate pathway c) Lactic acid fermentation d) Glycolysis	A
Ch 6 Multiple Choice #7	In fermentation, the terminal electron acceptor is a) oxygen (O2). b) hydrogen (H2). c) carbon dioxide (CO2). d) an organic compound.	D
Ch 6 Multiple Choice #8	In the process of oxidative phosphorylation, the energy of proton motive force is used to generate	D

	a) NADH. b) ADP. c) ethanol. d) ATP. e)glucose.	
Ch 6 Multiple Choice #9	In the TCA cycle, the carbon atoms contained in acetate are converted into a) lactic acid. b) glucose. c) glycerol. d) CO2.n e) all of these.	D
Ch 6 Multiple Choice #10	Degradation of fats as an energy source involves all of the following except a) β-oxidation. b) acetyl-CoA. c) glycerol. d) lipase. e) transamination.	E
Ch 6 Applications #1	A worker in a cheese-making facility argues that whey, a nutrient-rich by-product of cheese, should be dumped in a nearby pond where it could serve as fish food. Explain why this proposed action could actually kill the fish by depleting the O2 in the pond.	Aerobic microorganisms would use the whey as an energy source, breaking it down to CO_2 and using O_2 as a terminal electrons acceptor. This would deplete the dissolved O_2 in the water; without adequate O_2, the fish would die.
Ch 6 Applications #2	Scientists working with DNA in vitro often store it in solutions that contain EDTA, a chelating agent that binds magnesium (Mg2+). This is done to prevent enzymes called DNases from degrading the DNA. Explain why EDTA would interfere with enzyme activity.	DNases require magnesium as a cofactor. By binding magnesium, EDTA scavenges the available cofactor, preventing enzyme activity
Ch 6 Critical Thinking #1	A student argued that aerobic and anaerobic respiration should produce the same amount of ATP. He reasoned that they both use basically the same process; only the terminal electron acceptor is different. What is the primary error in this student's argument?	The nature of the electron acceptor will make a major difference in the amount of energy produced. A compound such as nitrate has a lower affinity for electrons than oxygen. As a consequence, electron can "fall further" before being accepted by O_2 and be used to generate more energy in the form of ATP.

Ch 6 Critical Thinking #2	Chemolithotrophs near hydrothermal vents support a variety of other life-forms there. Explain how their role is analogous to that of photosynthetic organisms in terrestrial environments.	The chemolithotrophs oxidize the reduced inorganic compounds that spew from the vents, using the energy to fuel CO_2 fixation. The organic compounds they then produce can be used as an energy source by chemoorganotrophs in the vent community.
Chapter 7:		
Ch 7 Short Answer #1	Explain what the term semiconservative means with respect to DNA replication.	In the two new molecules generated, each has one new strand and one original strand.
Ch 7 Short Answer #2	What is an origin of replication?	The site at which replication originates.
Ch 7 Short Answer #3	Why are primers required in DNA replication but not in transcription?	DNA polymerase can only add nucleotides to an existing fragment; RNA polymerase can start synthesis without a primer.
Ch 7 Short Answer #4	What is polycistronic mRNA?	It carries the information for more than one gene.
Ch 7 Short Answer #5	Explain why knowing the orientation of a promoter is critical when determining the amino acid sequence of an encoded protein.	The promoter orients the RNA polymerase in one of two directions. By doing so, it also determines which strand is the template for the transcript.
Ch 7 Short Answer #6	What is the function of a sigma factor?	It is the portion of RNA polymerase that recognizes the promoter
Ch 7 Short Answer #7	What is the fate of a protein that has a signal sequence?	The signal sequence directs secretion.
Ch 7 Short Answer #8	Explain how some bacteria sense the density of cells in their own population.	They use quorum sensing. Cells secrete a signaling molecule, and the concentration of this molecule reflects the density of the population.
Ch 7 Short Answer #9	Compare and contrast regulation by a repressor and an activator.	Repressors bind to the operator (downstream of the promoter), blocking the progress of RNA polymerase. Activators bind to the activator-binding site (upstream of the promoter) facilitating the progress of RNA polymerase.
Ch 7 Short Answer #10	Explain why it is sometimes difficult to locate genomic regions that encode a protein.	There are six possible reading frames to consider (3 on each DNA strand), and only one encodes the

		protein.
Ch 7 Multiple Choice #1	All of the following are involved in transcription except a) polymerase. b) primer. c) promoter. d) sigma factor. e) uracil.	B
Ch 7 Multiple Choice #2	All of the following are involved in DNA replication except a) polysome. b) gyrase. c) polymerase. d) primase. e) primer.	A
Ch 7 Multiple Choice #3	All of the following are directly involved in translation except a) promoter. b) ribosome. c) start codon. d) stop codon. e) tRNA.	A
Ch 7 Multiple Choice #4	Using the DNA strand shown here as a template, what will be the sequence of the RNA transcript? 5′ GCGTTAACGTAGGC 3′ −→ promoter 3′ CGCAATTGCATCCG 5′ a) 5′ GCGUUAACGUAGGC 3′ b) 5′ CGGAUGCAAUUGCG 3′ c) 5′ CGCAAUUGCAUCCG 3′ d) 5′ GCCUACGUUAACGC 3′	A
Ch 7 Multiple Choice #5	A ribosome binds to the following mRNA at the site indicated by the dark box. At which codon will translation likely begin? 5′ ■ GCCGGAAUGCUGCU GGC a) GCC b) GGC	C

	c) AUG d) AAU	
Ch 7 Multiple Choice #6	Which of the following statements about gene expression is false? a) More than one RNA polymerase can be transcribing a specific gene at a given time. b) More than one ribosome can be translating a specific transcript at a given time. c) Translation begins at a site called a promoter. d) Transcription stops at a site called a terminator. e) Some amino acids are coded for by more than one codon.	C
Ch 7 Multiple Choice #7	An enzyme used to synthesize the amino acid tryptophan is most likely a) constitutive. b) inducible. c) repressible. d) a and b.	C
Ch 7 Multiple Choice #8	Under which of the following conditions will transcription of the lac operon occur? a) Lactose present/glucose present b) Lactose present/glucose absent c) Lactose absent/glucose present d) Lactose absent/glucose absent e) a and b	B
Ch 7 Multiple Choice #9	All of the following are characteristics of eukaryotic gene expression except a) 5′ cap is added to the mRNA. b) a poly A tail is added to the 3′ end of mRNA. c) introns must be removed	D

	to create the mRNA that is translated. d) the mRNA is often polycistronic. e) translation begins at the first AUG.	
Ch 7 Multiple Choice #10	Which of the following statements is false? a) A derivative of lactose serves as an inducer of the lac operon. b) Signal transduction provides a mechanism for a cell to sense the conditions of its external environment. c) Quorum sensing allows bacterial cells to sense the density of like cells. d) An example of a two-component regulatory system is the lactose operon, which is controlled by a repressor and an activator. e) An ORF is a stretch of DNA that may encode a protein.	D
Ch 7 Applications #1	A graduate student is trying to identify the gene coding for an enzyme found in a bacterial species that degrades trinitrotoluene (TNT). The student is frustrated to find that the organism does not produce the enzyme when grown in nutrient broth, making it difficult to collect the mRNA needed to help identify the gene. What could the student do to potentially increase the amount of the desired enzyme?	The enzyme may be inducible. The student should try to grow the organism in a culture with TNT as a nutritional substrate. Expression could also require specific environmental conditions. The graduate student might try using anaerobic conditions; TNT might be used as a terminal electron acceptor. Eliminating other nitrogen sources might be another strategy.
Ch 7 Applications #2	A student wants to remove the introns from a segment of	The student could isolate mature mRNA from the cytoplasm of a

	DNA coding for protein X. Devise a strategy to do this.	cell; this is the mRNA from which the cell has removed the introns. Reverse transcriptase, the enzyme that synthesizes DNA from an RNA template, can then by used to generate a copy of intron-free DNA.
Ch 7 Critical Thinking #1	The study of protein synthesis often uses a cell-free system where cells are ground with an abrasive to release the cell contents and then filtered to remove the abrasive. These materials are added to the system, generating the indicated results: Materials Added Results Radioactive amino acids Radioactive protein produced Radioactive amino acids No radioactive protein produced and RNase (an RNA-digesting enzyme) What is the best interpretation of these observations?	The most straightforward interpretation is that RNA is necessary to translate the information from DNA to protein (a sequence of amino acids) because when the RNA is destroyed, no protein is produced. How the information is translated is not apparent from this experiment alone, only that RNA must play some role in the translation.
Ch 7 Critical Thinking #2	In a variation of the experiment in the previous question, the following materials were added to three separate cell-free systems, generating the indicated results: Materials Added Results Radioactive amino acids Radioactive protein produced Radioactive amino acids Radioactive protein produced and DNase (a DNA-digesting enzyme) Several hours after grinding: Radioactive amino acids No	The basic issue here is why does the protein continue to be produced even after the DNA is destroyed. The information in DNA must persist, at least for a few hours, after the DNA is destroyed. The most likely way this could occur is in mRNA. Any mRNA already synthesized will continue to direct protein synthesis, but the mRNA eventually degrades. No new RNA is available (because the DNA has been destroyed) so protein synthesis stops.

	radioactive protein produced and DNase What is the best interpretation of these observations?	
Chapter 8		
Ch 8 Short Answer #1	How is an auxotroph different from a prototroph?	An auxotroph requires an organic growth factor in order to grow. A prototroph has no such requirement
Ch 8 Short Answer #2	Why is deleting one nucleotide generally more detrimental than deleting three?	Deleing one nucleotide results in frame shift , resulting in a change of all amino acids translated beyond the deletion. Deleting three nucleotides results in only the deletion of one amino acid.
Ch 8 Short Answer #3	What type of mutation in an operon is most likely to affect the synthesis of more than one protein?	Frame shift mutation
Ch 8 Short Answer #4	What is meant by "proofreading" with respect to DNA polymerase?	The removal of an incorrect base and the incorporation of the correct base in its place.
Ch 8 Short Answer #5	Why would a cell use SOS repair, considering that it introduces mutations?	Without SOS repair, the cell would not be able to multiply
Ch 8 Short Answer #6	Why is replica plating used to isolate an auxotrophic mutant from a prototrophic parent?	Because there is no medium on which the auxotroph will grow and the prototroph will not. Therefore, direct selection is not possible.
Ch 8 Short Answer #7	What is transduction?	The transfer of bacterial DNA enclosed in a phage head from one bacterium to another
Ch 8 Short Answer #8	How is an F+ strain different from an Hfr strain?	The F+ cell has a transferable plasmid whereas the Hfr cell has the plasmid integrated into the chromosome of the cell.
Ch 8 Short Answer #9	Name four mobile genetic elements.	Plasmids, bacteriophage, transposons, genomic islands
Ch 8 Short Answer #10	Why are R plasmids important?	Because they carry genes conferring resistance to various antibiotics and can be readily transferred to other bacteria
Ch 8 Multiple Choice #1	A culture of E. coli is irradiated with ultraviolet (UV) light. Answer questions	(C)

	1 and 2 based on this statement. The UV light specifically a) joins the two strands of DNA together by covalent bonds. b) joins the two strands of DNA together by hydrogen bonds. c) forms covalent bonds between thymine molecules on the same strand of DNA. d) forms covalent bonds between guanine and cytosine. e) deletes bases.	
Ch 8 Multiple Choice #2	The highest frequency of mutations would be obtained if, after irradiation, the cells were immediately a) placed in the dark. b) exposed to visible light. c) shaken vigorously. d) incubated at a temperature below their optimum for growth. e) The frequency would be the same no matter what the environmental conditions are after irradiation.	(A)
Ch 8 Multiple Choice #3	Penicillin enrichment of mutants works on the principle that a) only Gram-positive cells are killed. b) cells are most sensitive to antimicrobial medications during the lag phase of growth. c) most Gram-negative cells are resistant to penicillin. d) penicillin kills only growing cells. e) penicillin inhibits formation of the lipopolysaccharide layer.	(D)
Ch 8 Multiple Choice #4	Repair mechanisms that occur during DNA synthesis are 1. mismatch repair.	(A)

	2. proofreading by DNA polymerase. 3. light repair. 4. SOS repair. 5. excision repair. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	
Ch 8 Multiple Choice #5	You are trying to isolate a mutant of wild-type E. coli that requires histidine for growth. This can best be done using 1. direct selection. 2. replica plating. 3. penicillin enrichment. 4. a procedure for isolating conditional mutants. 5. reversion. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	(B)
Ch 8 Multiple Choice #6	The properties that all plasmids share are that they 1. all carry genes for antimicrobial resistance. 2. are self-transmissible to other bacteria. 3. always occur in multiple copies in the cells. 4. code for non-essential functions. 5. replicate in the cells in which they are found. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	(D)
Ch 8 Multiple Choice #7	The addition of DNase to a mixture of donor and recipient cells will prevent gene transfer via a) DNA transformation. b) chromosome transfer by conjugation. c) plasmid transfer by conjugation. d) generalized transduction.	(A)
Ch 8	An F pilus is essential for	(B)

Multiple Choice #8	1. DNA-mediated transformation. 2. chromosome transfer by conjugation. 3. plasmid transfer by conjugation. 4. generalized transduction. 5. cell movement. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	
Ch 8 Multiple Choice #9	A plasmid that can replicate in E. coli and Pseudomonas is most likely a/an a) broad host range plasmid. b) self-transmissible plasmid. c) high-copy-number plasmid. d) essential plasmid. e) low-copy-number plasmid.	(A)
Ch 8 Multiple Choice #10	The frequency of transfer of an F' molecule by conjugation is closest to the frequency of transfer of a) chromosomal genes by conjugation. b) an F plasmid by conjugation. c) an F plasmid by transformation. d) an F plasmid by transduction. e) an R plasmid by DNA transformation.	(B)
Ch 8 Applications #1	Some bacteria may have higher mutation rates than others following exposure to UV light. Discuss a reason why this might be the case. What experiments could you do to determine whether this is a likely possibility?	The lower mutation rate may be a result of the cells lacking an SOS repair system. Cells lacking this system should undergo a greater rate of killing following treatment with UV light. Thus, treat the two strains of bacteria in an identical fashion with UV light. Compare the number of survivors as well as the number of mutants.
Ch 8	A pharmaceutical researcher	Determine that the ingredient is

Applications #2	is disturbed to discover that the major ingredient of a new drug formulation causes frameshift mutations in bacteria. What other information would the researcher want before looking for a substitute chemical?	carcinogenic in animals
Ch 8 Critical Thinking #1	You have the choice of different kinds of mutants for use in the Ames test to determine the frequency of reversion by suspected carcinogens. You can choose a deletion, a point mutation, or a frameshift mutation. Would it make any difference which one you chose? Explain.	Yes, it would make a difference because different mutagens cause different types of mutations and a reversion results from a mutation.
Ch 8 Critical Thinking #2	You have isolated a strain of E. coli that is resistant to penicillin, streptomycin, chloramphenicol, and tetracycline. You also observe that when you mix this strain with cells of E. coli that are sensitive to the four antibiotics, they become resistant to streptomycin, penicillin, and chloramphenicol but remain sensitive to tetracycline. Explain what is going on.	The resistance to the first three antibiotics is likely encoded on a plasmid that is transferred to the sensitive strain thereby conferring resistance to the three antibiotics. Resistance to tetracycline is not encoded on the plasmid.
Chapter 9		
Ch 9 Short Answer #1	Why are restriction enzymes useful in biotechnology?	They cut DNA in a predictable and controllable manner. In addition, some generate "sticky ends".
Ch 9 Short Answer #2	Describe three general uses of genetically engineered bacteria.	1) Produce medically important proteins, 2) DNA (for sequencing), and 3) research (determining gene function)
Ch 9 Short Answer #3	Describe the function of a reporter gene.	It is used to detect expression of a given gene.
Ch 9 Short Answer #4	Describe three uses of genetically engineered	1) Generate a plant that is insect resistance (plant produces

	plants.	insecticide); 2) generate a plant that is resistant to the effects of a biodegradable herbicide; 3) improve plant nutritional value; 4) potential for producing edible vaccines.
Ch 9 Short Answer #5	What is a DNA library?	A collection of clones that together contain the entire genome of an organism
Ch 9 Short Answer #6	What is cDNA? Why is it used when cloning eukaryotic genes?	DNA synthesized from an mRNA template. It does not contain introns
Ch 9 Short Answer #7	How many different temperatures are used in each cycle of the polymerase chain reaction?	Three
Ch 9 Short Answer #8	Explain how PCR eventually generates a discrete-sized fragment from a much longer piece of DNA.	The 5' end of DNA molecule made from a full-length template is primer DNA. When that molecule is then used as a template, both the 5' and 3' ends of the new molecule will be primer, so this is the PCR product that will eventually be amplified exponentially.
Ch 9 Short Answer #9	Describe the function of a probe.	It binds to specific sequences of DNA, allowing those sequences to be detected.
Ch 9 Short Answer #10	How does a DNA microarray function as a set of probes?	The array can be used to detect specific mRNA sequences (generally using cDNA).
Ch 9 Multiple Choice #1	What is the function of a vector? a) Destroys cells that do not contain cloned DNA b) Allows cells to take up foreign DNA c) Carries cloned DNA, allowing it to replicate in cells d) Encodes herbicide resistance e) Encodes Bt toxin	C
Ch 9 Multiple Choice #2	The Ti plasmid of Agrobacterium tumefaciens is used to genetically	C

	engineer which of the following cell types? a) Animals b) Bacteria c) Plants d) Yeast e) All of these	
Ch 9 Multiple Choice #3	Which of the following can be used to generate a DNA library? a) PCR b) Sequencing c) Colony blotting d) Microarrays e) Cloning	E
Ch 9 Multiple Choice #4	An ideal vector has all of the following except a) an origin of replication. b) a gene encoding a restriction enzyme. c) a gene encoding resistance to an antibiotic. d) a multiple-cloning site. e) the lacZ′ gene.	B
Ch 9 Multiple Choice #5	Which of the following describes the function of the lacZ′ gene in a cloning vector? a) Means of selecting for cells that contain vector sequences b) Means of distinguishing cells that have taken up recombinant molecules c) Site required for the vector to replicate d) Mechanism by which cells take up the DNA e) Gene for a critical nutrient required by transformed cells	B
Ch 9 Multiple Choice #6	Which is used for cloning eukaryotic genes but not prokaryotic genes? a) Restriction enzymes b) DNA ligase c) Reverse transcriptase d) Vector e) Selectable marker	C
Ch 9 Multiple Choice #7	Which of the following does a dideoxynucleotide lack?	B

	a) 5′PO4 b) 3′OH c) 5′OH d) 3′PO4 e) c and d	
Ch 9 Multiple Choice #8	In a sequencing reaction, the dATP was left out of the tube. What would be the result of this error? a) No synthesis would occur. b) Synthesis would never continue past the first A. c) Synthesis would not stop until the end of the template. d) Synthesis would terminate randomly, regardless of the nucleotide incorporated. e) The error would have no effect.	B
Ch 9 Multiple Choice #9	The polymerase chain reaction uses Taq polymerase rather than a DNA polymerase from E. coli, because Taq polymerase a) introduces fewer errors during DNA synthesis. b) is heat-stable. c) can initiate DNA synthesis at a wider variety of sequences. d) can denature a double-stranded DNA template. e) is easier to obtain.	B
Ch 9 Multiple Choice #10	The polymerase chain reaction generates a fragment of a distinct size even when an intact chromosome is used as a template. What determines the boundaries of the amplified fragment? a) The concentration of one particular deoxynucleotide in the reaction b) The duration of the elongation step in each cycle c) The position of a termination sequence, which causes the Taq polymerase to	D

	fall off the template d) The sites to which the primers anneal e) The temperature of the elongation step in each cycle	
Ch 9 Applications #1	Two students in a microbiology class are arguing about the origins of biotechnology. One student argued that biotechnology started with the advent of genetic engineering. The other student disagreed, saying that biotechnology was as old as ancient civilization. What was the rationale for the argument by the second student?	By definition, biotechnology is the use of microbiological and biochemical techniques to solve practical problems. The first student is looking at a limited view of biotechnology, seeing biotechnology in its modern applications. The second student is including fermentation of beverages, production of cured meats, and bread-making technologies used by ancient civilizations. These classical types of biotechnology are still used today in a similar fashion as was conducted then. However, they have been modified using modern instrumentation and more precise information about genetics.
Ch 9 Applications #2	A student wants to clone gene X. On both sides of the gene are the recognition sequences for AluI and BamHI (look at table 9.2). Which enzyme would be easier to use for the cloning experiment and why?	BamHI would be far easier to use because it generates sticky ends. These will anneal, making it easier to ligate the vector and insert. AluI can be used, but it generates blunt ends, which are far more difficult to ligate.
Ch 9 Critical Thinking #1	Discuss some potential issues regarding gene therapy, the use of genetic engineering to correct genetic defects.	Gene therapy could potentially enhance the life of some people and extend the life of others. By providing a permanent cure for an individual's disease, it could eventually decrease health care costs. If gene therapy does not correct the germ-line cells, however, then an individual's defective genes could be passed to their children, meaning that they, too, would require gene therapy.

Ch 9 Critical Thinking #2	An effective DNA probe can sometimes be developed by knowing the amino acid sequence of the protein encoded by the gene. A student argued that this is too time-consuming since the complete amino acid sequence must be determined in order to create the probe. Does the student have a valid argument? Why or why not?	Actually, only a portion of the amino acid sequence would need to be determined. As long as a segment of the nucleotide sequence can be identified, a sequence that is long enough to hybridize with that particular DNA molecule could be generated. Even though this segment would code for only a part of the protein, it might be sufficiently unique so that the probe would hybridize with the DNA only at that site.
Chapter 10		
Chapter 10 Short answer #1.	Name and describe each of the areas of taxonomy.	Identification — the process of characterizing organisms. Classification — the process of arranging organisms into similar or related groups. Nomenclature — the assignment of names.
Chapter 10 Short answer #2	Compare and contrast the five-kingdom and three-domain systems of classification.	The 5-kingdom system separates living organisms into five groups (plants, fungi, animals, protists and prokaryotes). The 3-domain system separates organisms into 3 groups (Eucarya, Archaea and Bacteria). Thus, the 5-kingdom system separates the eukaryotes into 4 groups and lumps the prokaryotes together, whereas the 3-domain system lumps the eukaryotes together and separates the prokaryotes into two groups.
Chapter 10 Short answer #3	Describe how a dichotomous key is used when identifying bacteria.	A dichotomous key is essentially a flow chart of tests that give either a positive or negative result. Based on the results of a battery of tests, the organism can be identified.
Chapter 10 Short answer #4	Describe the difference between using a probe and using PCR to detect a specific sequence.	A probe hybridizes to a specific sequence and, by doing so, tags that sequence with a detectable label. PCR is used to amplify a specific sequence; the amplified fragment

		can be detected using gel electrophoresis.
Chapter 10 Short answer #5	Explain how signature sequences are used in bacterial identification.	Signature sequences are nucleotide sequences in ribosomal RNA genes that are shared by certain groups of bacteria. Primers that anneal to those sequences can be used to amplify the nucleotide regions that lie between them.
Chapter 10 Short answer #6	Describe the function of PulseNet.	PulseNet catalogues the restriction fragment length polymorphisms (RFLPs) of foodborne bacterial pathogens and monitors these organisms. Laboratories from around the country can submit RFLP patterns to a computer database and quickly receive information about other isolates showing the same patterns. Using this database, multistate foodborne disease outbreaks can more readily be recognized and traced.
Chapter 10 Short answer #7	Describe how the GC content of DNA can be measured.	The GC content can be measured by determining the temperature at which the double-stranded DNA melts. Monitoring the optical density of a solution of DNA as it is heated does this.
Chapter 10 Short answer #8	Explain why DNA sequences are evolutionary chronometers.	They provide a relative measure of the time elapsed since the organisms emerged from a common ancestor. This is because random mutations cause sequences to change over time. The more time that has elapsed since two organisms diverged, the greater the differences in the sequences of their DNA.
Chapter 10 Short answer #9	What is a phylogenetic tree?	A "family tree" that traces the evolutionary heritage of organisms.
Chapter 10 Short answer #10	Why should a classification scheme reflect the phylogeny of organisms?	A phylogenetic classification scheme is less prone to the bias of human perceptions. It also makes it easier to classify newly recognized organisms and allows scientists to make predictions.

Ch 10 Multiple Choice #1	Which of the following is the newest taxonomic unit? a) Strain b) Family c) Order d) Species e) Domain	E
Ch 10 Multiple Choice #2	An acid-fast stain can be used to detect which of the following organisms? a) Cryptococcus neoformans b) Mycobacterium tuberculosis c) Neisseria gonorrhoeae d) Streptococcus pneumoniae e) Streptococcus pyogenes	B
Ch 10 Multiple Choice #3	The "breath test" for Helicobacter pylori infection determines the presence of which of the following? a) Antigens b) Catalase c) Hemolysis d) Lactose fermentation e) Urease	E
Ch 10 Multiple Choice #4	The "O157:H7" of E. coli O157:H7 refers to the a) biotype. b) serotype. c) phage type. d) ribotype. e) antibiogram.	B
Ch 10 Multiple Choice #5	PulseNet catalogs which of the following? a) Biotype b) Serotype c) Phage type d) RFLP e) Antibiogram	D
Ch 10 Multiple Choice #6	Which of the following is an example of an evolutionary chronometer? a) Ability to form endospores b) 16S ribosomal RNA sequence c) Sugar degradation d) Motility	B
Ch 10 Multiple Choice #7	If the GC content of two organisms is 70%, which of the following is true? a) The organisms are definitely related. b) The organisms are definitely not related.	C

	c) The AT content is 30%. d) The organisms likely have extensive DNA homology. e) The organisms likely have many characteristics in common.	
Ch 10 Multiple Choice #8	Which of the molecular methods of assessing similarity gives the crudest approximation of relatedness? a) DNA hybridization b) PCR c) 16S rDNA sequencing d) DNA base composition	D
Ch 10 Multiple Choice #9	The sequence of which ribosomal genes are most commonly used for establishing phylogenetic relatedness? a) 5S b) 16S c) 23S d) All of these are commonly used.	B
Ch 10 Multiple Choice #10	All of the following statements are correct except a) Tropheryma whipplei could be identified before it had been grown in culture. b) the GC content of DNA can be measured by determining the temperature at which double-stranded DNA melts. c) sequence differences between organisms can be used to assess their relatedness. d) based on DNA homology studies, members of the genus Shigella should be in the same species as Escherichia coli. e) gel electrophoresis is used to determine the serotype of an organism.	E
Ch 10 Applications #1	Microbiologists debate the use of biochemical	Microbiologists in favor of using biochemical differences and cell

	similarities and cell features as a way of determining the taxonomic relationships among prokaryotes. Explain why some microbiologists believe these similarities and differences are a powerful taxonomic indicator, whereas others think they are not very useful for that purpose.	features for taxonomy are supported by the knowledge that creatures expressing similar growth characteristics probably share genetic similarities and origins. Those opposing this view site evidence that unrelated microorganisms living in similar environments may take on similar characteristics by natural selection.
Ch 10 Applications #2	A researcher interested in investigating the genetic relationship of mitochondria to bacteria must decide on the best method to study this. What advice would you give the researcher?	Mitochondria most likely lost many of their ancestral biochemical characteristics because of their long relationship of inhabiting the eukaryotic cell. An analysis of its genome would probably provide most information. Its genome can then be compared to the genomes of other bacteria to see which it correlates with the most.
Ch 10 Critical Thinking #1	In figure 10.15, how would the curve appear if the GC content of the DNA sample were increased? How would the curve appear if the AT content were increased?	When the GC content increases, the melting point will increase due to the greater number of hydrogen bonds between G and C compared to the number between A and T. The whole curve will shift to the right, to higher temperatures. When the AT content increases, the melting point decreases and the whole curve would shift to the left.
Ch 10 Critical Thinking #2	When DNA probes are used to detect specific sequence similarities in bacterial DNA, the probe is heated and the two strands of DNA are separated. Why must the probe DNA be heated?	The probe must bind to the target DNA molecule by base pairing. If the probe is in the double-stranded form, this base pairing cannot occur. Both the target DNA and the probe must be single-stranded for the base pairs to recognize each other.
Chapter 11		
Chapter 11 Short answer #1	What kind of bacteria might compose the subsurface scum of polluted ponds?	Anoxygenic phototrophs.

Chapter 11 Short answer #2	What kind of bacterium might be responsible for plugging the pipes in a sewage treatment facility?	Filamentous sulfur oxidizers such as *Thiothrix* and *Beggiatoa.*
Chapter 11 Short answer #3	Give three examples of energy sources used by chemolithotrophs.	Hydrogen gas (H_2), hydrogen sulfide (H_2S), and ammonia (NH_3).
Chapter 11 Short answer #4	Name two genera of endospore-forming bacteria. How do they differ?	*Clostridium*, which are obligate anaerobes, and *Bacillus*, which are either aerobes or facultative anaerobes.
Chapter 11 Short answer #5	How is the life cycle of Epulopiscium species unusual?	Rather than undergoing binary fission, they enlarge considerably, finally lysing to release up to seven daughter cells.
Chapter 11 Short answer #6	What unique motility structure characterizes the spirochetes?	Endoflagella.
Chapter 11 Short answer #7	In what way does the metabolism of Streptococcus species differ from that of Staphylococcus species?	*Streptococcus* species are obligate fermenters; they cannot respire even when growing in the presence of O_2. *Staphylococcus* species are facultative anaerobes; they respire when O_2 is available but ferment when it is not.
Chapter 11 Short answer #8	How have species of Streptomyces contributed to the treatment of infectious diseases?	They are the natural source of many medically important antibiotics.
Chapter 11 Short answer #9	What characteristics of Azotobacter species protect their nitrogenase enzyme from inactivation by O2?	They have a high respiratory rate and thus consume O_2 so rapidly that an anaerobic environment is produced inside the cell. In addition, a protein in the cell binds nitrogenase, thereby protecting it from O_2 damage.
Chapter 11 Short answer #10	Compare and contrast the relationships of Agrobacterium and Rhizobium species with plants.	*Agrobacterium* and *Rhizobium* both derive nutrients from plants. However, *Agrobacterium* does this by harming the plant (causing a tumor) whereas *Rhizobium* provides a benefit to the plant (nitrogen fixation).
Ch 11 Multiple Choice #1	A catalase-negative colony growing on a plate that was	E

	incubated aerobically could be which of these genera? a) Bacillus b) Escherichia c) Micrococcus d) Staphylococcus e) Streptococcus	
Ch 11 Multiple Choice #2	All of the following genera are spirochetes except a) Borrelia. b) Caulobacter. c) Leptospira. d)Spirochaeta. e) Treponema.	B
Ch 11 Multiple Choice #3	Which of the following genera would you most likely find growing in acidic runoff from a coal mine? a) Clostridium b) Escherichia c) Lactic acid bacteria d) Thermus e) Acidithiobacillus	E
Ch 11 Multiple Choice #4	The dormant forms of which of the following genera are the most resistant to environmental extremes? 1. Azotobacter 2. Bacillus 3. Clostridium 4. Myxobacteria 5. Streptomyces a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	B
Ch 11 Multiple Choice #5	Members of which of the following genera are coliforms? a) Bacteroides b) Bifidobacterium c) Clostridium d) Escherichia e) Streptococcus	D
Ch 11 Multiple Choice #6	Which of the following genera preys on other bacteria? a) Bdellovibrio b)Caulobacter c) Hyphomicrobium d) Photobacterium e) Sphaerotilus	A
Ch 11 Multiple Choice #7	All of the following genera are obligate intracellular	D

	parasites except a) Chlamydia. b) Coxiella. c) Ehrlichia. d) Mycoplasma. e) Rickettsia.	
Ch 11 Multiple Choice #8	Which of the following genera are known to fix nitrogen? 1. Anabaena 2. Azotobacter 3. Deinococcus 4.Mycoplasma 5. Rhizobium a) 1, 3, 4 b) 1, 2, 5 c) 2, 3, 5 d) 2, 4, 5 e) 3, 4, 5	B
Ch 11 Multiple Choice #9	Which of the following archaea would most likely be found coexisting with bacteria? a) Nanoarchaeum b) Halobacterium c) Methanococcus d) Picrophilus e) Sulfolobus	C
Ch 11 Multiple Choice #10	Thermoplasma and Picrophilus grow best in which of the following extreme conditions? a) Low pH b) High salt c) High temperature d) a and c e) b and c	D
Ch 11 Applications #1	A student argues that it makes no sense to be concerned about coliforms in drinking water because they are harmless members of our normal microbiota. Explain why regulatory agencies are concerned about coliforms.	While it is true that coliforms generally do not cause disease (with the exception of certain strains of *E. coli*), their presence in drinking water indicates that the water is likely contaminated with fecal pollution. Intestinal pathogens, such as *Salmonella*, *Shigella*, and many viruses are passed in feces and therefore might be present in the water. Rather than trying to detect each and every intestinal pathogen, regulatory agencies look for organisms that are commonly found in feces and are easy to detect.
Ch 11 Applications #2	A friend who has lakefront property and cherishes her lush green lawn complains of	The green scum is probably due to overgrowth of cyanobacteria. The fertilizer she applies to her lawn,

	the green foul-smelling scum on the lake each summer. Explain how her lawn might be contributing to the problem.	which is probably high in nitrogen and phosphate, might be leaching into the lake and enhancing the growth of the photosynthetic bacteria.
Ch 11 Critical Thinking #1	Soil often goes through periods of extreme dryness and extreme wetness. What characteristics of Clostridium species make them well suited for these conditions?	Endospores of *Clostridium* survive the dry periods in the soil. When soil becomes saturated with water, however, conditions often turn anaerobic because the diffusion of gases is limited. Under these anaerobic conditions, *Clostridium* endospores can germinate and thrive, without competition from obligate aerobes.
Ch 11 Critical Thinking #2	Some organisms use sulfur as an electron donor (a source of energy), whereas others use sulfur as an electron acceptor. How can this be if there must be a difference between the electron affinity of electron donors and acceptors for an organism to obtain energy?	The same organism could not use sulfur as both an electron acceptor and donor. Any species that uses sulfur as a donor will use a material such as oxygen that has a much greater affinity for electrons as an acceptor. Any species that uses sulfur as an acceptor will use a material such as H_2, which has much less affinity for electrons as a donor.
Chapter 12		
Chapter 12 Short answer #1	What are the major differences between a prokaryotic cell and a eukaryotic cell?	Eukaryotes have a true nucleus surrounded by a double membrane as well as other membrane-bound organelles. They may contain mitochondria and chloroplasts. Prokaryotes do not have a membrane-bound nucleus and do not contain other membrane-bound organelles.
Chapter 12 Short answer #2	What are the differences among a yeast, a mold, and a mushroom?	Yeasts are single-celled fungi that reproduce by binary fission or budding. Molds are filamentous fungi composed of a collection of hyphae known as a mycelium. Mushrooms are the macroscopic reproductive structures of some members of the Basidiomycetes.

Chapter 12 Short answer #3	How do mycorrhizas improve the growth of a green plant?	Mycorrhizas increase the plant's ability to absorb water and minerals due to the large surface area of filamentous hyphae. They also break down organic molecules in the soil, releasing nitrogen and phosphorus.
Chapter 12 Short answer #4	In what ways are fungi economically important?	Some fungi, such as mushrooms, are eaten, while others are used in the production of foods such as beer, wine, and bread. Fungi produce many of the common antibiotics. Some fungi are used as tools for genetic studies. Fungi have been genetically engineered to produce important hormones such as insulin and somatostatin, the human growth hormone. Since there are fungi that can grow on almost any organic material, fungi destroy large amounts of food products and other materials. Fungi also cause some major diseases of plants, especially food crop plants.
Chapter 12 Short answer #5	What is a mycosis? Give an example.	A mycosis is a disease caused by growth of a fungus. Examples are athlete's foot (tinea), candidiasis, histoplasmosis, coccidioidomycosis, cryptococcal meninoencephalitis, and histoplasmosis.
Chapter 12 Short answer #6	What characteristics do all algae have in common?	All algae are photosynthetic, but lack the vascular systems of plants, and have relatively simple reproductive structures.
Chapter 12 Short answer #7	Compare and contrast the organisms that cause malaria and African sleeping sickness and their transmission.	Malaria is caused by protozoan apicomplexan species of *Plasmodium* spread by *Anopheles* mosquitoes. The organism replicates in red blood cells of the host and are released in waves that result in cyclic presentation of symptoms. African sleeping sickness is caused by protozoan kinetoplastid species of

		Trypanosoma spread by tsetse flies of the genus *Glossina.* They also produce waves of symptoms as the organisms switch antigen surface proteins.
Chapter 12 Short answer #8	Name a disease for which humans are an intermediate host and another for which humans are a definitive host. Give an example of a disease in which humans are a dead-end host.	Humans are an intermediate host in malaria, African sleeping sickness, and plague. Humans are a definitive host in schistosomiasis and some tapeworm diseases. Humans are a dead-end host in "swimmer's itch."
Chapter 12 Short answer #9	Describe the life cycle of Schistosoma mansoni.	Sexual reproduction takes place in humans where the organisms cause schistosomiasis. Larvae released into water can infect an intermediate host, a type of snail. A swimming form is released from the snail and attaches to a human where it completes the life cycle.
Chapter 12 Short answer #10	Explain how a fly might act as a mechanical vector for one disease and a biological vector for another.	A fly might act as a mechanical vector when it transmits any pathogen from an environmental location to a host. For example, it might transmit bacteria that cause *E. coli* gastroenteritis by carrying the organism on its feet and landing on food that a person is about to eat. The fly might also act as a biological vector by housing a form of the pathogen during part of its life cycle, as in the case of African sleeping sickness.
Ch 12 Multiple Choice #1	Members of this group have chitinous cell walls. a) Algae b) Protozoa c) Fungi d) Helminths e) Arthropods	C
Ch 12 Multiple Choice #2	Members of this group are photosynthetic. a) Algae b) Protozoa c) Fungi d) Helminths e) Arthropods	A
Ch 12 Multiple Choice #3	This group helps produce many of the foods that we eat. a) Algae b) Protozoa c) Fungi	C

	d) Helminths e) Arthropods	
Ch 12 Multiple Choice #4	Protozoa reproduce asexually by a) schizogony. b) fragmentation. c) meiosis. d) polymorphism.	A
Ch 12 Multiple Choice #5	Which of the following is mismatched? a) Plasmodium—malaria b) Trypanosomes—dysentery c) Dinoflagellates—paralytic shellfish poisoning d) Nematode—trichinellosis	B
Ch 12 Multiple Choice #6	Which of the following is mismatched? a) Trematode—fluke b) Tick—arachnid c) Baker's yeast—algae d) Apicomplexan—protozoa	C
Ch 12 Multiple Choice #7	Body lice a) can act as a vector to transmit disease. b) are not infectious. c) have eight legs and sucking mouthparts. d) are more closely related to ticks than they are to mosquitoes.	A
Ch 12 Multiple Choice #8	All algae have a) chlorophyll a. b) cell walls that contain agar. c) holdfasts. d) red tides.	A
Ch 12 Multiple Choice #9	Which of the following statements regarding protists is false? a) They include both autotrophic and heterotrophic organisms. b) They include both microscopic and macroscopic organisms. c) They often act as vectors	C

	in disease transmission. d) They include algae and protozoa.	
Ch 12 Multiple Choice #10	Which of the following statements regarding tapeworms is false? a) They absorb nutrients from the host through their body wall. b) They complete their life cycles in a single host. c) They can form cysts in the tissue of their host. d) They cannot be transmitted from human to human.	B
Ch 12 Applications #1	A molecular biologist working for a government-run fishery in Vietnam is interested in controlling Pfisteria in fish farms. Pfisteria produces toxins that stun the fish and then causes the skin to slough off, allowing the dinoflagellates to dine on the tissues of the fish. He needs to develop a treatment that kills Pfisteria without harming the fish or the beneficial green algae that serve as food for the young fish. What strategy should the biologist consider for developing a selective treatment?	The compound must be specific enough to kill the algae without killing any organisms related to it. So, one consideration is to first try treatments that affect the chloroplast. Treatments altering the function of chloroplasts would not harm the fish and protists. Next, the treatment must select the specific photosynthetic pigments used by *Pfisteria*. Many of the beneficial algae have chloroplasts that differ from those of *Pfisteria* and will not be affected by the treatments.
Ch 12 Applications #2	Paper recycling companies refuse to collect paper products that are contaminated with food or have been sitting wet for a day. A college sorority member who is running a recycling program on campus wishes to know the reason for this. What reason did the chemist who works	Decaying food and wet paper are very likely to be contaminated with fungi. Many of the fungi found on food and wet paper produce enzymes capable of breaking down cellulose and other strengthening components of paper. Recycled paper is not treated in any way that kills the fungal spores. Any treatments used to destroy fungal spores would be expensive or

	for the recycling company probably give her for this policy?	potentially dangerous for users of the recycled paper products. Any spores that make their way into recycled paper products would ultimately germinate and decay the product or could contaminate anything packaged in the product.
Ch 12 Critical Thinking #1	If you discover a new type of nucleated cell in a lake near your home, how would you determine whether the cell is from a fungus, an alga, a protozoan, or a water mold?	A fungus would have a chitinous cell wall. An alga would contain chlorophyll. A protozoan would lack both a cell wall and chlorophyll. A water mold would contain cellulose in the cell wall (like the alga), but would not contain chlorophyll.
Ch 12 Critical Thinking #2	Fungi are known for growing and reproducing in a wide range of environmental extremes in temperature, pH, and osmotic pressure. What does this tolerance for extremes indicate about fungal enzymes?	Fungal enzymes must be highly resistant to denaturation at extremes of pH, temperature, and salt concentrations that would denature enzymes of other organisms. If this were not the case, fungal enzymes would be denatured under such conditions, as are almost all other enzymes, and the organism could not survive.
Chapter 13		
Chapter 13 Short answer #1	Why are naked viruses generally more resistant to disinfectants than are enveloped viruses?	Disinfectants damage the lipid bilayer of the envelope
Chapter 13 Short answer #2	How is the replication cycle of lambda phage different from that of T4?	The genome of lambda phage can integrate in the bacterial genome and replicate in concert with the bacterial DNA. T4 can not do this but undergoes a replication cycle that results in cell lysis.
Chapter 13 Short answer #3	What is lysogenic conversion?	The modification of certain properties of a bacterial cell as a result of carrying a temperate phage in its genome. The new properties are encoded in the phage DNA.
Chapter 13 Short answer #4	How is specialized transduction different from generalized transduction?	In specialized transduction, only genes near the site on the bacterial chromosome where the phage has integrated can be transduced. In generalized transduction, any gene

		of the bacterial genome can be transduced.
Chapter 13 Short answer #5	How does the CRISPR system protect bacteria from phage infection?	By incorporating a piece of DNA from a previously entering DNA molecule into its genome. If the same DNA sequence later enters the cell, it is tagged for destruction, probably by a type of RNA interference.
Chapter 13 Short answer #6	Why must (–) strand but not (+) strand RNA viruses bring their own replicase into a cell?	The (-) stand can not be translated into any required virus proteins whereas the (+) strand can act as mR
Chapter 13 Short answer #7	Why are RNA viruses and retroviruses more error-prone in their replication than DNA viruses?	Because the enzymes that are involved in replication of the RNA have no proof-reading ability.
Chapter 13 Short answer #8	What is the role of a prophage in persistent infections?	The prophage can be activated and once again cause disease
Chapter 13 Short answer #9	How do oncogenes differ from proto-oncogenes?	Oncogenes are in the virus; proto-oncogenes are in the animal host. The nucleotide sequences of both are very similar.
Chapter 13 Short answer #10	Describe how prions propagate.	The abnormal prion protein binds to the normal cellular normal prion protein and converts it to the abnormal form.
Ch 13 Multiple Choice #1	Capsids are composed of a) DNA. b) RNA. c) protein. d) lipids. e) polysaccharides.	C
Ch 13 Multiple Choice #2	The tail fibers on phages are associated with a) attachment. b) penetration. c) transcription of phage DNA. d) assembly of virus. e) lysis of host.	A
Ch 13 Multiple Choice #3	Classification of viruses is based on all of the following except a) type of nucleic acid. b) shape of virus. c) size of virus.	C

	d) host infected. e) strandedness of nucleic acid.	
Ch 13 Multiple Choice #4	Temperate phages can do all of the following except a) lyse their host cells. b) change properties of their hosts. c) integrate their DNA into the host DNA. d) bud from their host cells. e) become prophages.	B
Ch 13 Multiple Choice #5	All phages must have the ability to 1. have their nucleic acid enter the host cell. 2. kill the host cell. 3. multiply in the absence of living bacteria. 4. lyse the host cell. 5. have their nucleic acid replicate in the host cell. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	E
Ch 13 Multiple Choice #6	Filamentous phages a) infect animal and bacterial cells. b) cause their host cells to grow more quickly. c) are extruded from the host cell. d) undergo assembly in the cytoplasm. e) degrade the host cells' DNA.	C
Ch 13 Multiple Choice #7	Influenza vaccines must be changed yearly because the amino acid sequence of the viral proteins change gradually over time. Based on this information, which is the most logical conclusion? The influenza virus a) is enveloped. b) is naked.	D

	c) has a DNA genome. c) has an RNA genome. e) causes a persistent infection.	
Ch 13 Multiple Choice #8	Acute infections of animals 1. are a result of productive infection. 2. generally lead to long-lasting immunity. 3. result from integration of viral nucleic acid into the host. 4. are usually followed by chronic infections. 5. often lead to tumor formation. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	A
Ch 13 Multiple Choice #9	Quantitating viral titers of both phage and animal viruses frequently involves a) plaque formation. b) quantal assays. c) hemagglutination. d) determining the ID50. e) counting of virions by microscopy.	A
Ch 13 Multiple Choice #10	Prions a) contain only nucleic acid without a protein coat. b) replicate like HIV. c) integrate their nucleic acid into the host genome. d) cause diseases of humans. e) cause diseases of plants.	D
Ch 13 Applications #1	A public health physician isolated large numbers of phages from rivers used as a source of drinking water in western Africa. The physician is very concerned about humans becoming ill from drinking this water, although she knows that phages specifically attack bacteria. Why is she concerned?	The phages likely were released from bacteria, some of which might be pathogens, This suggests that dangerous bacteria might be in the environment.
Ch 13	Researchers debate the	The second view seems more

Applications #2	evolutionary value to the virus of its ability to cause disease. Many argue that viruses accidentally cause disease and only in animals that are not the natural host. They state that this strategy may eventually prove fatal to the virus's future in that host. It is reasoned that the animals will eventually develop immune mechanisms to combat the virus and prevent its spread. Another group of researchers supports the view that disease is a way to enhance the survival of the virus. What position would you take, and what arguments would you give to support your view?	probable. The only virus disease that has been eliminated has been small pox and only after extensive and wide-spread immunization of all susceptible human populations. On the other hand, even with extensive immunization, there will always be susceptible populations to a virus disease so that the viruses can spread and continue to survive in the population.
Ch 13 Critical Thinking #1	A filter capable of preventing bacteria from passing is placed at the bottom of a U tube to separate the two sides. Streptomycin-resistant cells of a bacterial strain are placed on one side of the filter and streptomycin-sensitive cells are placed on the other side. After incubation, the side of the tube that originally contained only streptomycin-sensitive cells now contains some streptomycin-resistant cells. Give three possible reasons for this observation. What further experiments would you do to determine the correct explanation?	Three possible reasons: 1. The streptomycin sensitive cells mutated to resistance. 2, The streptomycin sensitive cells were transformed to streptomycin resistance by DNA- mediated transformation 3. The streptomycin sensitive cells were transduced to streptomycin resistance by transduction To distinguish between these possibilities, the number of streptomycin resistant cells arising from streptomycin sensitive should be compared under the following conditions: 1. How many resistant cells arise when the sensitive cells are plated on streptomycin containing medium in the absence of resistant

		cells. The possibility of reversion 2. Is the number of resistant cells reduced if DN'ase is added to both sides of the filter, 3. Irradiate the resistant cell population and look for clearing of the culture to indicate lysis and suggest phage induction.
Ch 13 Critical Thinking #2	Why is it virtually impossible to eradicate (eliminate) a disease caused by a zoonotic virus?	It would be impossible to eradicate all of the animal hosts.
Chapter 14		
Chapter 14 Short answer #1	Describe how the skin protects against infection.	The skin protects against infection mechanically and chemically. Mechanically, the cells of the skin are tightly connected to one another and, for the most part, form an unbroken barrier. Further, the top layer of the skin is composed of keratin, a tough waterproof protein, and dead cells. Chemically, the skin is dry and acidic due to the presence of fatty acids and lactic acid, conditions that are not conducive to the growth of most microorganisms, and contains other inhibitory substances.
Chapter 14 Short answer #2	What factors in saliva aid in protection against microbes?	Saliva flushes many materials out of the oral cavity into the throat where they are swallowed and destroyed by stomach acids. Also, saliva is rich in antimicrobial factors such as the peroxidase system, lysozyme, and lactoferrin. Antibodies are also present in saliva.
Chapter 14 Short answer #3	Why is iron metabolism important in body defenses?	Microorganisms require iron for growth (as do all organisms). By making iron less available, the host can prevent microbial growth.
Chapter 14 Short answer #4	Name two categories of cytokines and give their effects.	See table 14.2.
Chapter 14 Short answer #5	What is the function of a TLR?	It detects a microbial component; for example one detects

		peptidoglycan and another detects LPS
Chapter 14 Short answer #6	Contrast the pathways of complement activation.	The alternative pathway will be activated by cell surfaces unless that action prevented by host regulatory proteins. The lectin pathway is activated by certain arrangements of mannose on cell surfaces. The classical pathway is activated by immune complexes.
Chapter 14 Short answer #7	How do complement proteins cause foreign cell lysis?	Certain complement assemble in cell membranes, forming a doughnut-shaped membrane attack complex (MAC). This creates pores in the membrane, disrupting the cell integrity.
Chapter 14 Short answer #8	How do phagocytes enter tissues during an inflammatory response?	Endothelial cells "grab" circulating phagocytes, and the phagocytes then make adhesion molecules in response, causing them to tumble to a halt; finally, they squeeze between the endothelial cells, a process called diapedesis.
Chapter 14 Short answer #9	How is acute inflammation different from chronic inflammation?	Acute inflammation is marked by a prevalence of neutrophils, and as the infection is controlled, resolution of inflammation occurs. Chronic inflammation is characterized by an accumulation of macrophages and giant cells.
Chapter 14 Short answer #10	Describe the function of apoptosis.	Apoptosis provides the body with a mechanism to destroy host cells without eliciting inflammation. This allows the immune system to eliminate virally infected cells, as well as cells that are no longer needed.
Ch 14 Multiple Choice #1	Lysozyme does which of the following? a) Disrupts cell membranes b) Hydrolyzes peptidoglycan c) Waterproofs skin d) Propels gastrointestinal contents e) Propels the cilia of the respiratory tract	B

Ch 14 Multiple Choice #2	The hematopoietic stem cells in the bone marrow can become which of the following cell types? 1. Red blood cell 2. T cell 3. B cell 4. Monocyte 5. Macrophage a) 2, 3 b) 2, 4 c) 2, 3, 4, 5 d) 1, 4, 5 e) 1, 2, 3, 4, 5	E
Ch 14 Multiple Choice #3	All of the following refer to the same type of cell except a) macrophage. b) neutrophil. c) poly. d) PMN.	A
Ch 14 Multiple Choice #4	TLRs are triggered by all of the following compounds except a) peptidoglycan. b)glycolysis enzymes. c) lipopolysaccharide. d) flagellin. e) certain nucleotide sequences.	B
Ch 14 Multiple Choice #5	The direct/immediate action of interferon on a cell is to a) interfere with the replication of the virus. b) prevent the virus from entering the cell. c) stimulate synthesis of inactive “suicide enzymes.” d) stimulate the immune response. e) stop the cell from dividing.	C
Ch 14 Multiple Choice #6	A pathogen that can avoid the complement component C3b would directly protect itself from a) opsonization. b) triggering inflammation. c) lysis. d) inducing interferon. e) antibodies.	A
Ch 14 Multiple Choice #7	Which of the following statements about phagocytosis is false? a) Phagocytes move toward an area of infection by	E

	chemotaxis. b) Digestion of invaders occurs within a phagolysosome. c) Phagocytes have receptors that recognize C3b bound to bacteria. d) Phagocytes have receptors that recognize antibodies bound to bacteria. e) Macrophages die after phagocytizing bacteria, but neutrophils regenerate their lysosomes and survive.	
Ch 14 Multiple Choice #8	All of the following cell types are found in a granuloma except a) neutrophils. b)macrophages. c) giant cells. d) T cells.	A
Ch 14 Multiple Choice #9	All of the following trigger an inflammatory response except a) engagement of TLRs. b) complement system activation. c) interferon induction of antiviral protein synthesis. d) tissue damage.	C
Ch 14 Multiple Choice #10	Which of the following statements about inflammation is false? a) Vasodilation results in leakage of blood components. b) The process can damage host tissue. c) Neutrophils are the first to migrate to a site of inflammation. d) Apoptosis induces inflammation. e) The signs of inflammation are redness, swelling, heat, and pain.	D

Ch 14 Applications #1	Paraplegic patients often have recurrent urinary tract infections. Why would the condition keep coming back in spite of repeated treatment?	In many cases, the paralysis prevents the patient from urinating properly. Thus the flushing and cleansing action of active urination is not present to remove bacteria from the urinary tract. Bacteria can then readily invade and can also become reestablished in the urinary tract after treatment.
Ch 14 Applications #2	A cattle farmer sees a sore on the leg of one of his cows. The farmer feels the sore and notices that the area just around the sore is warm to the touch. A veterinarian examines the wound and explains that the warmth may be due to inflammation. The farmer wants an explanation of the difference between the localized warmth and fever. What would be the vet's explanation to the farmer?	Fever is an increase in the temperature of the whole body, resulting from the actions of various white blood cell products that are secreted and travel throughout the body. These products cause the hypothalamus to be reset to a higher temperature, resulting in the elevated temperature. This often occurs because of microbial invasion of the body. The heat of inflammation is localized to the area of inflammation and results largely from pooling of blood in that area. It is an indication of localized tissue damage or infection.
Ch 14 Critical Thinking #1	A student argues that phagocytosis is a wasteful process because after engulfed organisms are digested and destroyed, the remaining material is excreted from the cell (see figure 14.13). A more efficient process would be to release the digested material inside the cell. This way, the material and enzymes could be reused by the cell. Does the student have a valid argument? Why or why not?	The student is accurate in that the process is inefficient; many amino acids, carbohydrates and other materials useful to the cell are "wasted" by excretion. However, the excreted materials contain digestive enzymes that have destroyed the engulfed organisms and that could also degrade molecules inside the cell if released. To prevent this damaging effect, the enzyme must be excreted from the cell. Moreover, if the engulfed microorganisms produced a toxin, this material may not be destroyed by the digestive enzymes and should not be released inside the cell.

Ch 14 Critical Thinking #2	According to figure 14.9, any cell infected by viruses may die due to the action of interferons. This strategy, however, seems counter-productive. The same result would occur without interferon—any cell infected by a virus might die directly from the virus. Is there any apparent benefit from the interferon action?	The benefit of the interferon action is that the cell dies before new viruses are produced. Even though the cell dies, the production and spread of more virions is prevented. The few cells initially infected are sacrificed to prevent the spread of the virus. When the cell dies due to viral infection, many new virions are produced and can infect other cells. This will result in many more cells dying than would occur due to the action of interferon.
Chapter 15		
Chapter 15 Short answer #1	What is a secondary lymphoid organ?	The sites where B cells and T cells gather to encounter antigen.
Chapter 15 Short answer #2	Diagram an IgG molecule and label (a) the Fc region and (b) the areas that combine with antigen.	See figure 15.7.
Chapter 15 Short anser #3	What are the protective outcomes of antibodies binding to antigen?	See figure 15.8
Chapter 15 Short answer #4	Which antibody class is the first produced during the primary response?	IgM
Chapter 15 Short answer #5	Which antibody class neutralizes viruses in the intestinal tract?	IgA
Chapter 15 Short answer #6	Describe clonal selection and expansion in the immune response.	When a lymphocyte encounters its specific antigen and receives any required accessory signals, it is activated. This allows it to proliferate to producing clones of the original cells.
Chapter 15 Short answer #7	How do T-independent antigens differ from T-dependent antigens?	T-independent antigens (lipopolysaccharide and polysaccharides that have numerous identical epitopes) can activate B cells in the absence of T-cell assistance, while T-dependent antigens (proteins) require this T-cell assistance).
Chapter 15 Short answer #8	What are antigen-presenting cells (APCs)?	Antigen-presenting cells (dendritic cells, macrophages and B

		lymphocytes) can present antigen on MHC class II molecules.
Chapter 15 Short answer #9	Describe the role of dendritic cells in T-cell activation.	Dendritic cells gather antigen from tissues and then migrate to the lymph nodes where they present it to naive T cells. Dendritic cells that detect microbial products or tissue damage express co-stimulatory molecules, signifying to the naive T cells that the material being presented is associated with danger or damage. T cells that recognize antigen presented by dendritic cells expressing co-stimulatory molecules become activated.
Chapter 15 Short answer #10	How does the role of natural killer cells differ from cytotoxic T cells?	Natural killer cells are not antigen-specific, while cytotoxic T cells are antigen-specific.
Ch 15 Multiple Choice #1	The variable regions of antibodies are located in the 1. Fc region. 2. Fab region. 3. light chain. 4. heavy chain. 5. light chain and heavy chain. a) 1, 3 b) 1, 5 c) 2, 3 d) 2, 4 e) 2, 5	E
Ch 15 Multiple Choice #2	Which of the following statements about antibodies is false? a) If you removed the Fc portion, antibodies would no longer be capable of opsonization. b) If you removed the Fc portion, antibodies would no longer be capable of activating the complement system. c) If you removed the Fab portion, an antibody would no longer be capable of cross-linking antigen. d) If IgG were a pentamer, it would bind antigens more efficiently. e) If IgE had longer half-life,	E

	it would protect newborn infants.	
Ch 15 Multiple Choice #3	Which class of antibody can cross the placenta? a) IgA b) IgD c) IgE d) IgG e) IgM	D
Ch 15 Multiple Choice #4	A person who has been vaccinated against a disease should have primarily which of these types of serum antibodies against that agent 2 years later? a) IgA b) IgD c) IgE d) IgG e) IgM	D
Ch 15 Multiple Choice #5	Which of the following statements about B cells/antibody production is false? a) B cells of a given specificity initially have the potential to make more than one class of antibody. b) In response to antigen, all B cells located close to the antigen begin dividing. c) Each B cell is programmed to make a single specificity of antibody. d) The B-cell receptor allows B cells to detect antigen. e) The cell type that makes and secretes antibody is called a plasma cell.	B
Ch 15 Multiple Choice #6	Which term describes the loss of specific heavy chain genes? a) Affinity maturation b) Apoptosis c) Clonal selection d) Class switching	D
Ch 15 Multiple Choice #7	Which of the following specifically refers to an effector lymphocyte? a) B cell b) Cytotoxic T cell c) Helper T cell d) Plasma cell	D
Ch 15 Multiple Choice #8	Which markers are found on all nucleated cells?	A

	a) MHC class I molecules b) MHC class II molecules c) CD4 d) CD8	
Ch 15 Multiple Choice #9	Which of the following are examples of an antigen-presenting cell (APC)? 1. Macrophage 2. Neutrophil 3. B cell 4. T cell 5. Plasma cell a) 1, 2 b) 1, 3 c) 2, 4 d) 3, 5 e) 1, 2, 3	B
Ch 15 Multiple Choice #10	What is the appropriate response when antigen is presented on MHC class II molecules? a) An effector CD8 cell should kill the presenting cell. b) An effector CD4 cell should kill the presenting cell. c) An effector CD8 cell should activate the presenting cell. d) An effector CD4 cell should activate the presenting cell.	D
Ch 15 Applications #1	Many dairy operations keep cow's milk for sale and use formula and feed to raise any calves. One farmer noticed that calves raised on the formula and feed needed to be treated for diarrhea more frequently than calves left with their mothers to nurse. He had some tests run on the diets and discovered no differences in the calories or nutritional content. The farmer called a veterinarian and asked him to explain the observations. What was the vet's response?	All mammals can pass antibodies from the mother to the offspring through the milk, giving a degree of passive immunity. In cattle, a diarrhea disease called scours often occurs when the calf is weaned too soon, depriving it of maternal antibodies in the milk that would have protected it from some intestinal infections.
Ch 15	What kinds of diseases	Lack of B or T lymphocytes would

Applications #2	would be expected to occur as a result of lack of T or B lymphocytes?	cause immunodeficiency diseases, in which infections would be overwhelming. With a lack of B cells, antibodies would not be produced and pyogenic infections would occur. With lack of T cells, viral diseases, granulomatous diseases, and cancers would predominate.
Ch 15 Critical Thinking #1	The development of primary and secondary immune responses to an antigen differ significantly. The primary response may take a week or more to develop fully and establish memory. The secondary response is rapid and relies on the activation of clones of memory cells. Would it not be better if clones of reactive cells were maintained regardless of prior exposure? In this way, the body could always respond rapidly to any antigen exposure. Would there be any disadvantages to this approach? Why?	Maintaining an extensive variety of clones that could respond to any antigen would make serious demands on the body's resources, since a huge number of cells must be produced. An effective strategy should strike a balance between response time and the amount of resources and material devoted to the response. Maintaining clones only to antigens previously experienced is one way to achieve such a balance.
Ch 15 Critical Thinking #2	Early investigators proposed two hypotheses to explain the specificity of antibodies. The clonal selection hypothesis states that each lymphocyte can produce only one specificity of antibody. When an antigen binds to that B-cell receptor, the lymphocyte is selected to give rise to a clone of plasma cells producing the antibody. The template hypothesis states that any antigen can interact with any lymphocyte and act as a template, causing newly forming	If each cell produced antibodies to both antigens, this would support the template hypothesis. If each cell produced antibodies to only one of the antigens, this would support the clonal selection hypothesis. If some cells did not produce antibody to either antigen, this would also be consistent with the clonal selection hypothesis since this could be a lymphocyte specific to some antigen other than the ones being tested.

	antibodies to be specific for that antigen. In one experiment to test these hypotheses, an animal was immunized with two different antigens. After several days, lymphocytes were removed from the animal and individual cells placed in separate small containers. Then, the original two antigens were placed in the containers with each cell. What result would support the clonal selection hypothesis? The template hypothesis?	
Chapter 16		
Chapter 16 Short answer #1	Describe three types of symbiotic relationships.	Commensalism — one partner benefits but the other is unaffected. Mutualism — both partners benefit. Parasitism — parasite benefits at the expense of the host.
Chapter 16 Short answer #2	Describe two situations that can lead to changes in the composition of the normal microbiota.	The composition of the normal microbiota can change with variations in diet, acidity of the stomach, ingestion of antibiotics, age, hormonal status, and others.
Chapter 16 Short answer #3	How are acute, chronic, and latent infections different?	Acute infections result in diseases characterized by symptoms that have a rapid onset but last only a short time; chronic infections develop more slowly and last longer; latent infections are never completely eliminated. The symptomatic phase of a latent infection can be either acute or chronic.
Chapter 16 Short answer #4	Why are Koch's postulates not sufficient to establish the cause of all infectious diseases?	Koch's postulates require that the organism can be grown in pure culture and that there are appropriate hosts in which to test the hypothesis, conditions that are often not met.
Chapter 16	Describe the four general	Production of toxins that are then

Short answer #5	mechanisms by which microorganisms cause disease.	ingested; colonization of surface of the host, followed by toxin production; invasion of host tissues; invasion of host tissues, followed by toxin production.
Chapter 16 Short answer #6	Describe two mechanisms that bacteria use to invade via mucous membranes.	Some deliver molecules to epithelial cells, inducing those cells to engulf them. Others exploit antigen-sampling processes; for example, using the M cells of Peyer's patches to transfer the bacterial cells from one side of the membrane to the other.
Chapter 16 Short answer #7	Explain how a capsule can allow an organism to be serum resistant and avoid phagocytosis.	The capsules bind to the complement regulatory proteins; these proteins degrade C3b before it can activate complement by the alternative pathway and function as an opsonin.
Chapter 16 Short answer #8	Give an example of a neurotoxin, an enterotoxin, and a cytotoxin.	Neurotoxin – botulinum toxin, tetanus toxin; enterotoxin – cholera toxin, cholera-like toxin, staphylococcal enterotoxins; cytotoxin – shiga toxin, diphtheria toxin, pertussis toxin
Chapter 16 Short answer #9	Describe two mechanisms a virus might use to prevent the induction of apoptosis in an infected cell.	Controlling p53, the protein that regulates apoptosis initiation; interfering with antigen presentation by MHC class I molecules.
Chapter 16 Short answer #10	How do Schistosoma species avoid antibodies?	They mimic the host by coating themselves with host blood proteins, effectively disguising themselves.
Ch 16 Multiple Choice #1	Opportunistic pathogens are least likely to affect which of the following groups? a) AIDS patients b) Cancer patients c) College students d) Drug addicts e) Transplant recipients	C
Ch 16 Multiple Choice #2	Capsules and M protein are thought to interfere with which of the following?	A

	a) Opsonization by complement proteins b) Opsonization by antibodies c) Recognition by T cells d) Recognition by B cells e) Phagosome-lysosome fusion	
Ch 16 Multiple Choice #3	The C5a peptidase enzyme of Streptococcus pyogenes breaks down C5a, resulting in a) lysis of the Streptococcus cells. b) lack of opsonization of Streptococcus cells. c) killing of phagocytes. d) decreased accumulation of phagocytes. e) inhibition of membrane attack complexes.	D
Ch 16 Multiple Choice #4	All of the following are known mechanisms of avoiding the effects of antibodies except a) antigenic variation. b) mimicking "self." c) synthesis of an Fc receptor. d) synthesis of IgG protease. e) remaining intracellular.	D
Ch 16 Multiple Choice #5	Which of the following statements about diphtheria toxin is false? It a) is an example of an endotoxin. b) is produced by a species of Corynebacterium. c) inhibits protein synthesis. d) can cause local damage to the throat. e) can cause systemic damage (that is, to organs such as the heart).	A
Ch 16 Multiple Choice #6	Which of the following statements about botulism is true? a) It is caused by Bacillus	Controlling p53, the protein that regulates apoptosis initiation; interfering with antigen presentation by MHC class I molecules.

	botulinum, an obligate aerobe. b) The toxin is heat-resistant, withstanding temperatures of 100°C. c) The organism that causes botulism can cause disease without avoiding the immune response. d) Vaccinations are routinely given to prevent botulism. e) Symptoms of botulism include uncontrolled contraction of muscles.	
Ch 16 Multiple Choice #7	Superantigens a) are exceptionally large antigen molecules. b) cause a very large antibody response. c) elicit a response from a large number of T cells. d) attach non-specifically to B-cell receptors. e) assist in a protective immune response.	They mimic the host by coating themselves with host blood proteins, effectively disguising themselves.
Ch 16 Multiple Choice #8	Which of the following statements about endotoxin is true? It a) is an example of an A-B toxin. b) is a component Gram-positive bacteria. c) can be converted to a toxoid. d) is heat-stable. e) causes T cells to release cytokines.	C
Ch 16 Multiple Choice #9	The tissue damage caused by Neisseria gonorrhoeae is primarily due to a) cross-reactive antibodies. b) exotoxins. c) hydrolytic enzymes. d) the inflammatory response.	A

	e) all of the these.	
Ch 16 Multiple Choice #10	Which of the following statements about viruses is false? They may a) colonize the skin. b) enter host cells by endocytosis. c) enter host cells by fusion of the viral envelope with the cell membrane. d) induce apoptosis in infected host cells. e) suppress expression of MHC class I molecules on host cells.	A
Ch 16 Applications #1	A group of smokers suffering from Staphylococcus aureus infections are suing the cigarette companies. They claim that the disease was aggravated by smoking. The group is citing studies indicating that phagocytes are inhibited in their action by compounds in cigarette smoke. A statement prepared by their lawyers states that the S. aureus would not have caused such a severe disease if the phagocytes were functioning properly. During the proceedings, a microbiologist was called in as a professional witness for the court. What were her conclusions about the validity of the claim?	The microbiologist would not support the claims of the smokers. First, *S. aureus* has mechanisms that protect it from phagocytosis, and it is capable of killing phagocytes with leukocidins. Weakening the phagocytes would not be expected to have as great an effect against *S. aureus* as against some other organisms. More important is the consideration that *S. aureus* would not be the only organism affected if the immune system were significantly weakened. The smokers would probably have other severe infections if the phagocytes were inhibited to the point of increasing the severity of staph infections. The phagocytes most affected by smoking are the alveolar phagocytes of the lungs, whereas the phagocytes involved in fighting staphylococcal infections are primarily neutrophils.
Ch 16 Applications #2	A microbiologist put forth a grant proposal to study the molecules bacteria use to communicate. Her principal rationale was that the	The application could have merit. Because some pathogenic microorganisms do not activate virulence genes until the population size is sufficient to provide a

	damaging effects of many pathogenic microorganisms could be prevented by inactivating the molecules these bacteria use to communicate. Is this a reasonable proposal? Why or why not?	"quorum", such an approach should be reasonable. The trick should be to find the particular molecules communicating about virulence genes, without interfering with other intercellular communication. The object would be not to prevent growth or reproduction of the microorganisms, but only to prevent activation of their virulence genes.
Ch 16 Critical Thinking #1	A student argued that no distinction should be made between commensalism and parasitism. Even in commensalism, the microorganisms are gaining some benefit (such as nutrients) from the host, and this represents a loss to the host. In this sense, the host is being damaged. Does the student have a valid argument? Why or why not?	The question here is where to draw the line between commensalism and parasitism. At the extremes a distinction is obvious. Some parasites can be extremely damaging and cause death, while some commensals derive only shelter and protection from the host without using any materials or placing any limitations on the host. A distinction becomes more difficult when one considers parasites that cause very little damage to the host or commensals that obtain substantial materials from the host. The student has a valid point when considering this "middle ground" where a distinction is difficult.
Ch 16 Critical Thinking #2	A microbiologist argued that there is no such thing as "normal" microbiota in the human body, since the population is dynamic and is constantly changing, depending on diet and external environment. What would be an argument against this microbiologist's view?	The "normal" microbiota has a range of variation depending on conditions. In this sense the microbiologist would be correct. However, within this range the kinds of organisms and their relationships are typical of healthy humans and can be considered what would usually be found. On the other hand, under pathological conditions the numbers and kinds of microorganisms can be quite different and would indicate an "abnormal" condition.

Chapter 17		
Chapter 17 Short answer #1	Why are antihistamines useful for treating many IgE-mediated allergic reactions but not effective in treating asthma?	Histamine does not mediate asthma. Therefore, antihistamines are not effective for treating the disease. Bronchodilating drugs and steroids are useful.
Chapter 17 Short answer #2	Penicillin is a very small molecule, yet it can cause any of the types of hypersensitivity reactions, especially type I. How can this occur?	Penicillin is a hapten that combines with body proteins to become an effective allergen.
Chapter 17 Short answer #3	What are some major differences between an IgE-mediated skin reaction, such as hives, and a delayed-type hypersensitivity reaction, such as a positive tuberculin skin test?	An IgE-mediated skin reaction occurs within minutes of exposure to the antigen and it is a wheal and flare reaction with fluid in the tissues, rather like a mosquito bite. A positive delayed hypersensitivity reaction is not visible until hours after exposure to the antigen, and it peaks at 2 to 3 days. It is thickened (indurated) and reddened but there is no fluid in the tissues.
Chapter 17 Short answer #4	What causes insulin-dependent diabetes mellitus?	It is an autoimmune disease caused by T cytotoxic cell destruction of insulin-producing cells of the pancreas.
Chapter 17 Short answer #5	Compare and contrast the autoimmune processes causing myasthenia gravis and Graves' disease.	Both occur when antibodies bind inappropriately to receptors on cells of the body. In myasthenia gravis antibodies bind to the acetylcholine receptors at the neuromuscular junction and prevent nerve impulses that would trigger contraction. Antibodies can activate complement that damages the receptors. Graves' disease occurs when antibodies bind to receptors for thyroid-stimulating hormone on the thyroid gland resulting in inappropriate activation.
Chapter 17 Short answer #6	Give an example of an organ-specific autoimmune disease and one that is widespread, involving a	Organ-specific diseases are thyroiditis, diabetes, and myasthenia gravis. Widespread autoimmune diseases include

	variety of tissues and organs.	rheumatoid arthritis and lupus erythematosus.
Chapter 17 Short answer #7	Compare and contrast the Arthus reaction and serum sickness.	An Arthus reaction is a localized immune-complex tissue reaction caused by injecting a large amount of antigen into tissue where a large amount of antibody is present. The reaction peaks within a few hours and is characterized by neutrophils responding to the immune complex and causing inflammation. Serum sickness arises when serum from a horse other animal is used in the preparation of antibodies for injection into a human (passive immunity); the recipient's immune system mounts a response to antigens in the foreign serum.
Chapter 17 Short answer #8	Why might malnutrition and starvation lead to immunodeficiencies?	Immune responses require high levels of cellular proliferation and synthesis of proteins and other mediators. These activities depend on good nutrition to supply energy and necessary materials.
Chapter 17 Short answer #9	What is the most common primary immunodeficiency disorder?	Selective IgA deficiency is the most common primary immunodeficiency, occurring in about one per 333-700 individuals.
Chapter 17 Short answer #10	How can genetic abnormalities leading to immunodeficiency disorders be corrected? Give an example.	Genetic abnormalities leading to immunodeficiency disorders can be corrected by replacing the defective genes. This can be done by bone marrow transplantation where the defective cells are replaced, supplying new cells with functional genes. This has been used in a number of different kinds of SCID. Gene therapy has also been used, collecting defective T cells, inserting the needed gene linked to a retrovirus, and returning the corrected cells to the patient. This has been used to correct adenosine deaminase deficiency in SCID.
Ch 17	An IgE-mediated allergic	A

Multiple Choice #1	reaction a) reaches a peak within minutes after exposure to antigen. b) occurs only to polysaccharide antigens. c) requires complement activation. d) requires considerable macrophage participation. e) is characterized by induration.	
Ch 17 Multiple Choice #2	Which of the following statements is true of the ABO blood group system in humans? a) A antigen is present on type O red cells. b) B antigen is the most common antigen in the population of the United States. c) Natural anti-A and anti-B antibodies are of the class IgG. d) People with blood group O do not have natural antibodies against A and B antigens. e) In blood transfusions, incompatibilities cause complement lysis of red blood cells.	E
Ch 17 Multiple Choice #3	All of the following are true of immune complexes except a) the most common complexes consist of antigen and IgE. b) an immune complex consists of soluble antigen attached to antibody. c) complement components are activated by antigen-antibody complexes. d) immune complexes cause	A

	strong inflammatory reactions. e) immune complexes deposit in kidneys, joints, and skin.	
Ch 17 Multiple Choice #4	Delayed-type hypersensitivity reactions in the skin a) are characterized by a wheal and flare reaction. b) peak at 4 to 6 hours after exposure to antigen. c) require complement activation. d) show induration because of the influx of sensitized T cells and macrophages. e) depend on activities of the Fc portion of antibodies.	D
Ch 17 Multiple Choice #5	Organ transplants, such as of kidneys a) are experimental at present. b) can be successful only if there are exact matches between donor and recipient. c) survive best if radiation is used for immunosuppression. d) survive best if B cells are suppressed. e) are rejected by a complex process in which cellular mechanisms predominate.	E
Ch 17 Multiple Choice #6	All of the following are true of autoimmune disease except a) some show association with particular major histocompatibility types. b) induction of tolerance may alleviate symptoms. c) damage to organs occurs due to long-term exaggerated production of IgE. d) disease may result from	C

	reaction to viral antigens that are similar to autoantigens. e) some are organ-specific and some are widespread in the body.	
Ch 17 Multiple Choice #7	Autoantibody-induced autoimmune diseases a) can sometimes be passively transferred from mother to fetus. b) include diabetes mellitus. c) are always organ-specific. d) are never organ-specific. e) cannot be treated.	A
Ch 17 Multiple Choice #8	All of the following approaches are used to treat autoimmune diseases except a) immunosuppressant drugs. b) induction of tolerance. c) antibiotics. d) anti-inflammatory medications. e) replacement therapy, as with insulin in diabetes.	C
Ch 17 Multiple Choice #9	Patients with primary immunodeficiencies in the complement system a) who lack late-acting components (C5, C6, C7, C8) show increased susceptibility to Neisseria infections. b) who lack C3 are prone to develop tuberculosis. c) generally have no symptoms. d) only show defects in the major components C1 through C9. e) usually handle infections normally.	A
Ch 17 Multiple Choice #10	One of the most serious of the secondary immunodeficiencies is	A

	a) acquired immunodeficiency syndrome, caused by the human immunodeficiency virus. b) severe combined immunodeficiency. c) DiGeorge syndrome. d) chronic granulomatous disease. e) Chediak-Higashi disease.	
Ch 17 Applications #1	Jack and Jill were badly burned in an accident at the well and both were taken to the burn unit of the local hospital. The burns covered only a small area of skin so grafts were prepared for both patients from the skin of Jack's thigh. Jack's graft was successful and his burn healed completely. Jill, however, rejected the grafted skin. Explain the immune responses of both patients to these grafts. What treatments could have helped Jill to avoid rejection of her graft?	Since the graft came from Jack's body, it was an autograft for him and therefore contained his own antigens that would not elicit an immune response. The skin was an allograft for Jill. Since the antigens in Jack's skin were foreign, Jill would have mounted an immune response. The response would have been T-cell mediated and resulted in the destruction of the foreign cells. To avoid this outcome, Jill's graft could have been prepared from her own skin. Alternatively, she could have been administered immunosuppressive drugs to minimize the immune response against the graft.
Ch 17 Applications #2	Horse serum containing specific antibody to snake venom has been a successful approach to treating snakebite in humans. How do you think this anti-venom could be generated? What are some advantages of using horses to produce the antibody instead of humans? Why might it be unsafe to administer the anti-venom more than once?	The anti-venom can be generated by injecting a horse with a dilute preparation of snake venom; the horse then makes antibodies to the venom that can be harvested. Use of horses is preferable to injecting humans with any preparation of snake venom. A person may develop an immune response to antigens present in the horse serum. If exposed to it again, the person may launch an immune response against the serum, resulting in serum sickness.
Ch 17 Critical Thinking #1	Hypersensitivity reactions, by definition, lead to tissue damage. Can they also be	The immune response operates by various mechanisms, both humoral and cellular. The same mechanisms

	beneficial? Explain.	lead to either protection (immunity) or damage (hypersensitivity). It is really semantic, as often both are occurring at the same time. For example, an abscess causes a lot of tissue damage, but at the same time gets rid of the bacteria causing the problem. Similarly, an infection with tubercle bacilli will lead to formation of tissue-damaging granulomas that at the same time wall off the invading bacilli and prevent them from spreading.
Ch 17 Critical Thinking #2	Explain why people with B-cell deficiencies are more prone to bacterial infections, but people with T-cell deficiencies are more prone to viral infections.	B cells respond to antigens by producing antibodies that mark the carriers for destruction by phagocytes or complement. They are effective against pathogens in the bloodstream. Viruses must enter a cell to replicate; T cells kill virus-infected cells.
Chapter 18		
Chapter 18 Short answer #1	How is immune globulin different from hyperimmune globulin?	Immune globulin is the pooled serum from many individuals and contains a variety of different antibody specificities. Hyperimmune globulin is serum from donors with high amounts of antibodies to certain diseases, and is used to prevent or treat specific diseases.
Chapter 18 Short answer #2	Describe two advantages of an attenuated vaccine over an inactivated one.	Advantages of an attenuated vaccine: 1) stronger immune response; 2) more appropriate immune response (such as cell-mediated)
Chapter 18 Short answer #3	Describe two advantages of an inactivated vaccine over an attenuated one.	Advantages of an inactivated vaccine: 1) safe for immunocompromised individuals, 2) cannot mutate to virulence, 2) more temperature-stable than attenuated vaccines.
Chapter 18 Short answer #4	What is herd immunity?	Phenomenon that occurs when a critical concentration of immune hosts prevents the spread of a pathogen.

Chapter 18 Short answer #5	Describe how both active and passive immunization can be used to combat tetanus.	Active immunization with toxoid will prevent tetanus; passive immunization with anti-tetanus hyperimmune globulin can neutralize the toxin if it has not already attached to nerve tissue.
Chapter 18 Short answer #6	Why are humanized monoclonal antibodies better for therapy than the original versions?	The immune system is less likely to destroy them.
Chapter 18 Short answer #7	In a precipitation reaction, what is meant by "optimal proportions"?	The proportion at which both antigen and antibody are fully incorporated into the complex, so that no free antigens or antibodies are in the mixture.
Chapter 18 Short answer #8	Is blood typing an example of a precipitation reaction or an agglutination reaction?	Agglutination
Chapter 18 Short answer #9	An ELISA test is used to screen patient specimens for HIV. A positive ELISA test is confirmed by a Western blot test. Why not the other way around, with the ELISA second?	ELISA is much less expensive, but occasionally false positives occur. The more expensive Western blot will confirm a positive test, and because the antigens are separated, it will show which antigens in the mixture are being responded to.
Chapter 18 Short answer #10	What is the purpose of anti-human IgG antibodies in immunological testing?	They are used to detect antibodies in a patient's serum. This is important because the patient's antibodies do not carry a detectable label.
Ch 18 Multiple Choice #1	Which is an example of immunization that elicits active immunity? a) Giving antibodies against diphtheria b) Immune globulin injections to prevent hepatitis c) Sabin polio immunization d) Rabies immune globulin e) Tetanus immune globulin	C
Ch 18 Multiple Choice #2	Breast feeding provides which of the following to an infant? a) Artificial active immunity b) Artificial passive	D

	immunity c) Natural active immunity d) Natural passive immunity	
Ch 18 Multiple Choice #3	Vaccines ideally should be all of the following, except a) effective in protecting against the disease. b) inexpensive. c) stable. d) living. e) easily administered.	D
Ch 18 Multiple Choice #4	Severely immunosuppressed people should not receive the measles vaccine. Based on this information, the vaccine is a) an inactivated whole agent. b) a toxoid. c) a subunit vaccine. d) a genetically engineered vaccine against hepatitis B. e) an attenuated vaccine.	E
Ch 18 Multiple Choice #5	All of the following are attenuated vaccines except a) chickenpox. b) mumps. c) rubella. d) Salk polio. e) yellow fever.	D
Ch 18 Multiple Choice #6	An important subunit vaccine that is widely used is the a) pertussis vaccine. b) Sabin vaccine. c) Salk vaccine. d) measles vaccine. e) mumps vaccine.	A
Ch 18 Multiple Choice #7	In quantifying antibodies in a patient's serum a) total protein in the serum is measured. b) the antibody is usually measured in grams per ml. c) the serum is serially diluted. d) both antigen and antibody are diluted. e) the titer refers to the amount of antigen added.	C

Ch 18 Multiple Choice #8	Which of the following about immunological testing is false? a) Polyclonal antibody preparations recognize multiple epitopes. b) Monoclonal antibodies recognize a single epitope. c) Serum and plasma can both be tested for antibodies. d) The direct ELISA uses anti-human IgG antibodies. e) A rise in specific antibody titer indicates an active infection.	D
Ch 18 Multiple Choice #9	All of the following are matching pairs except a) ELISA—radioactive label. b) fluorescence-activated cell sorter—flow cytometry. c) fluorescent antibody test—microscopy. d) Western blot—gel electrophoresis.	A
Ch 18 Multiple Choice #10	Which of the following would be most useful for screening thousands of specimens for antibodies that indicate a certain disease? a) Western blot b) Fluorescent antibody c) ELISA d) All of the above e) None of the above	C
Ch 18 Applications #1	A new parent asks you which vaccines the CDC recommends for a 2-month-old infant. What is your answer? The chapter 18 readings at the text website (www.mhhe.com/nester7) provide a link to the CDC's recommended immunization schedules.	The CDC website listed in the question gives the most current answer.
Ch 18 Applications #2	There has been debate about keeping smallpox virus	An argument could be that it would not be possible to counteract or to

	stored, since the disease has been eradicated. What would be an argument for keeping the virus? What should be done to protect against use of the virus in biological warfare?	study the virus if it ever emerged again unless some virus was available. What is of primary importance is the necessity to keep high enough supplies of vaccinia vaccine against the smallpox virus in case this virus was ever used in warfare or in an attack by terrorists. Most of the population of the U. S. has waning immunity or no immunity at all to the virus now.
Ch 18 Critical Thinking #1	In figure 18.5, how would the curve change if the concentration of antibody in the original sample were increased? (Would the shape of the curve change? Would the curve be shifted left, right, up, or down?) Briefly explain your answer.	The shape of the curve should remain the same since only the concentration has changed. The curve should shift to the right, as the zone of antibody excess will be larger. It should shift up, as more antibody will be present to be precipitated by the increasing amounts of antigen.
Ch 18 Critical Thinking #2	Staphylococcus aureus makes a protein called protein A, which binds to the Fc region of antibody molecules from a wide variety of species. How could protein A be exploited in immunoassays?	Protein A could be isolated from *S. aureus* and labeled with a detectable marker, such as a colored or fluorescent molecule. The protein could then be used in place of anti-human IgG molecules or any other secondary antibody.
Chapter 19		
Chapter 19 Short answer #1	Describe the impact on a society of high incidence and high prevalence of an endemic debilitating disease.	A disease of high incidence means that people often contract the disease; visitors to a region are at high risk of getting it. A disease of high prevalence means that a significant percentage of the population suffers from the disease at any time. This would affect the economy, culture, and healthcare of the region.
Chapter 19 Short answer #2	What is the epidemiological significance of people who have asymptomatic infections?	They act as carriers of the disease agent and may unknowingly transmit it to others.
Chapter 19	Explain why zoonotic	There has been no evolution

Short answer #3	diseases are often severe in humans.	towards the balance of pathogenicity that normally occurs between a parasite and its host.
Chapter 19 Short answer #4	List the main portals of exit from the human body.	digestive tract, respiratory tract, genitourinary tract, broken skin
Chapter 19 Short answer #5	Name the most important control measure for preventing person-to-person transmission of a disease.	handwashing
Chapter 19 Short answer #6	Describe the factors within a population that may make it more susceptible to infectious disease.	percentage of population that is immune to the disease, age distribution, genetic background, religious or cultural practices, and the general health and stress level of the population
Chapter 19 Short answer #7	Draw a representative graph (time versus number of people ill) depicting both a propagated and a common-source epidemic.	The graph should look like the one in Figure 19.8.
Chapter 19 Short answer #8	Describe the differences between a retrospective (case-control) study and a prospective (cohort) study.	A retrospective study looks back and compares what happened to cases and controls; a prospective study looks to the future and watches what happens to cohort groups.
Chapter 19 Short answer #9	What information is available in the Weekly Epidemiological Record?	information about epidemics around the globe
Chapter 19 Short answer #10	Explain how smallpox was eradicated.	Widespread vaccination programs established herd immunity; those who had the disease were isolated from those who did not.
Chapter 19 Short answer #11	Describe the factors that contribute to the emergence or re-emergence of disease.	Complacency and the breakdown of public health infrastructure; microbial evolution; changes in human behavior; advances in technology; population expansion; development; mass distribution and importation of food; civil war and unrest; climate changes.
Chapter 19 Short answer #12	What are the main reservoirs of nosocomial infections?	the healthcare environment, healthcare personnel, other patients, the patient's own microbiota
Ch 19	Which of the following is an	A

Multiple Choice #1	example of a fomite? a) Table b) Flea c) Staphylococcus aureus carrier d) Water e) Air	
Ch 19 Multiple Choice #2	Which of the following would be the easiest to eradicate? a) A pathogen that is common in wild animals but sometimes infects humans b) A disease that occurs exclusively in humans, always resulting in obvious symptoms c) A mild disease of humans that often results in no obvious symptoms d) A pathogen found in marine sediments e) A pathogen that readily infects both wild animals and humans	B
Ch 19 Multiple Choice #3	Which of the following methods of disease transmission is the most difficult to control? a) Airborne b) Foodborne c) Waterborne d) Vector-borne e) Direct person-to-person	A
Ch 19 Multiple Choice #4	Which of the following statements is false? a) A botulism epidemic that results from improperly canned green beans is an example of a common-source outbreak. b) Droplet nuclei fall quickly to the ground. c) Congenital syphilis is an example of a disease acquired through vertical transmission. d) Plague is endemic in the prairie dog population in parts of the United States.	B

	e) The first case in an outbreak is called the index case.	
Ch 19 Multiple Choice #5	Which of the following statements is false? a) A disease with a long incubation period might spread extensively before an epidemic is recognized. b) A person exposed to a low dose of a pathogen might not develop disease. c) The young and the aged are more likely to develop certain diseases. d) Malnourished populations are more likely to develop certain diseases. e) Herd immunity occurs when a population does not engage in a given behavior, such as eating raw fish, that would otherwise increase their risk of disease.	E
Ch 19 Multiple Choice #6	The purpose of an analytical study is to a) identify the person, place, and time of an outbreak. b) identify risk factors that result in high frequencies of disease. c) assess the effectiveness of preventive measures. d) determine the effectiveness of a placebo. e) None of the above	B
Ch 19 Multiple Choice #7	Which of the following causes of emerging diseases is thought to be a new pathogen? a) Giardia b) Vibrio cholerae O139 c) Mycobacterium tuberculosis d) Shigella dysenteriae e) Schistosoma	B
Ch 19	All of the following are	E

Multiple Choice #8	thought to contribute to the emergence of disease except a) advances in technology. b) breakdown of public health infrastructure. c) construction of dams. d) mass distribution and importation of food. e) widespread vaccination programs.	
Ch 19 Multiple Choice #9	Which of the following common causes of healthcare-associated infections is an environmental organism that grows readily in nutrient-poor solutions? a) Enterococcus b) Escherichia coli c) Pseudomonas aeruginosa d) Staphylococcus aureus	C
Ch 19 Multiple Choice #10	What is the most common type of nosocomial infection? a) Bloodstream infection b) Gastrointestinal infection c) Pneumonia d) Surgical wound infection e) Urinary tract infection	E
Ch 19 Applications #1	A news station reported about a potentially fatal epidemic disease occurring in a small Laotian village. An epidemiologist from the CDC was interviewed to discuss the disease and was very distressed that it was not being contained. Why did the epidemiologist feel the disease was a concern for people in North America?	World travel makes it likely that the disease can spread beyond the borders of Laos. Depending on how the disease spreads, the organism or vectors that transmit the disease-causing agent can make its way around the world.
Ch 19 Applications #2	An international team was gathered to discuss how funding should be spent to	They must first consider the morbidity of the disease, how many people the disease affects, and how

	eliminate human infectious disease. There is only enough funding to eliminate one disease. How would the scientists go about choosing the next disease to be eliminated from the planet?	easy it is for the disease to spread. They also need to assess how the disease is spread to see whether it is feasible to control the spread. Improving sanitation or changing personal habits easily controls some diseases. Others involve controlling vectors that may be difficult or not ecologically sound to eliminate.
Ch 19 Critical Thinking #1	Yersinia pestis and hantavirus are both found in wild rodents in the southwestern United States. What is the risk of trying to stop a hantavirus epidemic by destroying rodents in that region?	The fleas that had been residing on the rodents would look for a new host from which to take a blood meal. This could result in a plague epidemic.
Ch 19 Critical Thinking #2	A student disagreed with the presentation of the examples in figure 19.8. She claimed that the number of cases from a common-source outbreak could remain high over a much longer period of time in some cases and not decrease to zero. Is the student's claim reasonable? Why or why not?	A common-source outbreak could continue to produce a large number of new cases if the source continued to infect individuals. For example, if a single restaurant continued to serve contaminated food over a long period of time, new cases would arise and the peak of the curve could remain high until the source of contamination was eliminated. The student is correct in her claim, but most common-source outbreaks are short-lived as shown in the diagram.
Chapter 20		
Chapter 20 Short answer #1	Describe the difference between the terms antibiotic and antimicrobial.	An antibiotic is a compound made by a microorganism that kills or inhibits other microorganisms. An antimicrobial includes all medications that kill or inhibit microbes; the term antimicrobial includes antibiotics and chemically synthesized drugs.
Chapter 20 Short answer #2	Define therapeutic index and explain its importance.	The therapeutic index is the lowest dose toxic to the patient divided by the dose used for therapy. It is a measurement of the relative toxicity of the drug; those that have a low therapeutic index are relatively

		toxic and must be administered with caution.
Chapter 20 Short answer #3	Explain the role of penicillin-binding proteins in drug suscepti-bility.	The targets of β-lactam drugs are the penicillin-binding proteins, which are enzymes required for peptidoglycan synthesis. The penicillin-binding proteins of some bacteria have a low affinity for certain β-lactam drugs.
Chapter 20 Short answer #4	Name three classes of antimicrobial drugs that target ribosomes.	Any three in this list is correct: Macrolides, tetracyclines, aminoglycosides, chloramphenicol, streptogramins, oxazolidinones
Chapter 20 Short answer #5	Explain the roles of the first-line drugs versus the second-line drugs in the treatment of tuberculosis.	The first-line drugs are the preferred treatment because the are the most effective as well as least toxic. The second-line drugs are used for strains that are resistant to the first-line drugs, but they are less effective or more toxic.
Chapter 20 Short answer #6	Compare and contrast the method for determining the minimum inhibitory concentration (MIC) with the Kirby-Bauer disc diffusion test.	Both methods determine whether or not an organism is sensitive to an antimicrobial drug. The MIC is quantitative; it determines the minimum concentration of a specific drug that inhibits an organism. The Kirby-Bauer disk diffusion test is not quantitative, but multiple drugs can be tested simultaneously.
Chapter 20 Short answer #7	Name three targets that can be altered sufficiently via spontaneous mutation to result in resistance to an antimicrobial drug.	Penicillin-binding proteins, ribosomes, DNA gyrase, RNA polymerase.
Chapter 20 Short answer #8	What is MRSA? Why is it significant?	Methicillin-resistant *Staphylococcus aureus*. These strains of *S. aureus* are resistant to all β-lactam drugs. Until the recent development of streptogramins and oxazolidinones, vancomycin was generally the only conventional treatment option for infections caused by these organisms.
Chapter 20 Short answer #9	Why is it difficult to develop antiviral drugs?	Viruses rely on processes of the eukaryotic cell to replicate;

		interfering with these processes will destroy eukaryotic cells along with viruses. Most antiviral drugs target the relatively few viral encoded enzymes.
Chapter 20 Short answer #10	Explain the difference between the mechanism of action of an azole and that of a polyene.	The azoles inhibit the synthesis of ergosterol; the polyenes bind to ergosterol, interfering with its function.
Ch 20 Multiple Choice #1	Which of the following targets would you expect to be the most selective with respect to toxicity? a) Cytoplasmic membrane function b) DNA synthesis c) Glycolysis d) Peptidoglycan synthesis e) 70S ribosome	D
Ch 20 Multiple Choice #2	Penicillin has been modified to make derivatives that differ in all of the following except a) spectrum of activity. b) resistance to β-lactamases. c) potential for allergic reactions. d) a and c.	C
Ch 20 Multiple Choice #3	Which of the following is the target of β-lactam antibiotics? a) Peptidoglycan synthesis b) DNA synthesis c) RNA synthesis d) Protein synthesis e) Folic acid synthesis	A
Ch 20 Multiple Choice #4	Which of the following statements is false? a) A bacteriostatic drug stops the growth of a microorganism. b) The lower the therapeutic index, the less toxic the drug. c) Broad-spectrum	B

	antibiotics are associated with the development of Clostridium difficile–associated disease. d) Azithromycin has a longer half-life than does penicillin V. e) Chloramphenicol can cause a life-threatening type of anemia.	
Ch 20 Multiple Choice #5	All of the following interfere with the function of the ribosome except a) fluoroquinolones. b) lincosamides. c) macrolides. d) streptogramins. e) tetracyclines.	A
Ch 20 Multiple Choice #6	The target of the sulfonamides is a) cytoplasmic membrane proteins. b) folate synthesis. c) gyrase. d) peptidoglycan biosynthesis. e) RNA polymerase.	B
Ch 20 Multiple Choice #7	Routine antimicrobial therapy to treat tuberculosis involves taking a) one drug for 10 days. b) two or more drugs for 10 days. c) one drug for at least 6 months. d) two or more drugs for at least 6 months. e) five drugs for 2 years.	D
Ch 20 Multiple Choice #8	Staphylococcus aureus strains referred to as HA-MRSA are sensitive to a) methicillin. b) penicillin. c) cephalosporin. d) vancomycin. e) none of the above.	D
Ch 20 Multiple Choice #9	Acyclovir is a	A

	a) nucleoside analog. b) non-nucleoside polymerase inhibitor. c) protease inhibitor. d) none of the above.	
Ch 20 Multiple Choice #10	The antifungal drug griseofulvin is used to treat a) vaginal infections. b) systemic infections. c) nail infections. d) eye infections.	C
Ch 20 Applications #1	A physician was treating one young woman and one elderly patient for urinary tract infections caused by the same type of bacterium. Although the patients had similar body dimensions and weight, the physician gave a smaller dose of drug to the older patient. What was the physician's rationale for this decision?	Elderly people generally clear drugs from the body less effectively than younger people due to age-related liver and kidney conditions, so the younger patient needed more medication because her body was better at removing it. The physician gauged the older patient's dosage to adjust for the decreased drug loss.
Ch 20 Applications #2	An advocacy group in Washington, D.C., is petitioning the U.S. Department of Agriculture (USDA) to stop the use of low-dosage antimicrobial agents used to enhance the growth of cattle and chickens. Why is the group against this practice? Why does the USDA permit it?	The group is concerned that antibiotic resistant strains of bacteria will develop in these animals as a result of the practice. This will make it very difficult to control bacterial diseases spread through meat and poultry products. The USDA has not seen this become a major problem and is concerned about an increase in the cost of foods if the practice is discontinued. Higher food prices may lead to more malnutrition in families who cannot afford these higher priced foods.
Ch 20 Critical Thinking #1	Figure 20.12 shows the E-test procedure for determining an MIC value. How would the zone of inhibition appear if the drug concentrations in the strip were decreased slightly?	The inhibition zone would still be tear-shaped but would be smaller and the point of intersection would be closer to the end of the strip where the concentration of the drug is highest. If the drug concentration were further decreased, the zone of

		inhibition would continue to become smaller. At some point if the highest concentration on the strip were equal to the MIC, then no inhibition would be observed.
Ch 20 Critical Thinking #2	Why is acyclovir converted to a nucleotide analog only in cells infected with herpes simplex virus?	Only the virus encodes the enzyme that catalyzes the conversion. Since the virus is found in infected cells, these are the only cells that can produce the enzyme. If this were not the case, then normal cells would also be affected by the nucleoside analog.
Chapter 21		
Chapter 21 Short answer #1	How does contamination of the eye lead to upper respiratory infection?	Organisms are carried from the surface of the eye to nasopharynx via the nasolacrimal duct.
Chapter 21 Short answer #2	After you recover from strep throat, can you get it again? Explain.	Yes, a person can get strep throat more than once. There are many antigenic types of the causative agent; infection with one type gives immunity to only that one.
Chapter 21 Short answer #3	Where is the gene for diphtheria toxin production located?	The gene for diphtheria toxin is located in a bacteriophage.
Chapter 21 Short answer #4	Describe two ways to decrease the chance of contracting a cold.	The chance of contracting a cold can be decreased by frequent hand washing (even with plain water); keeping hands away from eyes and nose; avoiding cold sufferers during the first two to three days of their illness.
Chapter 21 Short answer #5	What kinds of diseases are caused by adenoviruses?	Adenoviruses cause fever, sore throat, large lymph nodes, conjunctivitis, pleurisy, and pneumonia.
Chapter 21 Short answer #6	How do alcoholism and cigarette smoking predispose a person to pneumonia?	Alcoholism and cigarette smoking predispose a person to pneumonia by impairing the mucociliary escalator, the function of which is to remove microbes from the respiratory tract.
Chapter 21 Short answer #7	Give a mechanism by which Klebsiella sp. become	*Klebsiella* sp. become antibiotic-resistant through acquisition of R

	antibiotic-resistant.	factors. R factors have transposons, allowing for further spread of the resistance to other cells or species.
Chapter 21 Short answer #8	Why does the incidence of whooping cough rise promptly when pertussis immunizations are stopped?	The incidence of whooping cough rises promptly when pertussis immunizations are stopped because unrecognized carriers and mild cases common among teenagers and older adults transmit the infection to infants.
Chapter 21 Short answer #9	Why are two or more antitubercular medications used together to treat tuberculosis?	Two or more antitubercular medications used together to treat tuberculosis in order to reduce the chance of selecting resistant mutants of the causative agent, *Mycobacterium tuberculosis*.
Chapter 21 Short answer #10	Why did it take so long to discover the cause of Legionnaires' disease?	It took a long time for the causative agent of Legionnaires' disease, *Legionella pneumophila*, to be discovered because it stains poorly in tissue, and it requires a special medium for cultivation.
Ch 21 Multiple Choice #1	The following are all complications of streptococcal pharyngitis except a) glomerulonephritis. b) scarlet fever. c) subacute bacterial endocarditis. d) acute rheumatic fever. e) Reye's syndrome.	E
Ch 21 Multiple Choice #2	All of the following are true of diphtheria except a) a membrane that forms in the throat can cause suffocation. b) a toxin is produced that interferes with ribosome function. c) the causative organism typically invades the bloodstream. d) immunization with a toxoid prevents the disease.	C

	e) nerve injury with paralysis is common.	
Ch 21 Multiple Choice #3	Adenoviral infections generally differ from the common cold in all the following ways, except adenoviral infections are a) not caused by picornaviruses. b) often associated with fever. c) associated with severe sore throat. d) much more likely to cause pneumonia. e) avoided by handwashing.	E
Ch 21 Multiple Choice #4	All are true of mycoplasmal pneumonia except a) it is a mycosis. b) it usually does not require hospitalization. c) penicillin is ineffective for treatment. d) it is the leading cause of bacterial pneumonia in college students. e) the infectious dose of the causative organism is low.	A
Ch 21 Multiple Choice #5	All of the following are true of Legionnaires' disease except a) the causative organism can grow inside amebas. b) it spreads readily from person to person. c) it is more likely to occur in long-term cigarette smokers than in nonsmokers. d) it is often associated with diarrhea or other intestinal symptoms. e) it can be contracted from household water supplies.	B
Ch 21 Multiple Choice #6	Which of the following infectious agents is most likely to cause a pandemic? a) Influenza A virus	A

	b) Streptococcus pyogenes c) Histoplasma capsulatum d) Sin Nombre virus e) Coccidioides immitis	
Ch 21 Multiple Choice #7	Respiratory syncytial virus a) is a leading cause of bronchiolitis in infants. b) is an enveloped DNA virus of the adenovirus family. c) attaches to host cell membranes by means of neuraminidase. d) poses no threat to elderly people. e) mainly causes disease in the summer months.	A
Ch 21 Multiple Choice #8	In the United States, hantaviruses a) are limited to southwestern states. b) are carried only by deer mice. c) infect human beings with a fatality rate above 40%. d) were first identified in the early 1970s. e) are contracted mainly in bat caves.	C
Ch 21 Multiple Choice #9	All of the following are true of coccidioidomycosis except a) it is contracted by inhaling arthrospores. b) it is caused by a dimorphic fungus. c) endospores are produced within a spherule. d) it is more common in Maryland than in California. e) it is often associated with painful nodules on the legs.	D
Ch 21 Multiple Choice #10	The disease histoplasmosis a) is caused by an	D

	encapsulated bacterium. b) is contracted by inhaling arthrospores. c) occurs mostly in hot, dry, and dusty areas of the American Southwest. d) is a threat to AIDS patients living in areas bordering the Mississippi River. e) is commonly fatal for pigeons and bats.	
Ch 21 Applications #1	A physician is advising the family on the condition of a diphtheria patient. How would the physician explain why the disease affects some tissues and not others?	The physician should explain that the toxin only attaches to certain cells. It only kills cells that it can attach to and enter. Unfortunately, the toxin can attach to and enter the cells that make up the heart, kidneys and nerves.
Ch 21 Applications #2	How should a physician respond to a mother who asks if her daughter can get pneumococcal pneumonia again?	Recovery from her pneumonia results in immunity to only one of many different strains of pneumococci, so it is possible that her daughter could get the disease again. However, relatively few strains are likely to cause serious disease. Vaccination against these strains could be considered, particularly if the child has a predisposing condition.
Ch 21 Critical Thinking #1	If all transmission of Mycobacterium tuberculosis from one person to another was stopped, how long would it take for the world to be rid of the disease?	The disease can remain dormant for a lifetime in infected people (latent TB), but can reactivate at any time. So the disease would not be eradicated until the last infected person dies.
Ch 21 Critical Thinking #2	Medications that prevent and treat influenza by binding to neuraminidase on the viral surface act against all the kinds of influenza viruses that infect humans. What does this imply about the nature of the interaction between the medications and the neuraminidase	A medication that is universally effective against influenza viruses implies that it blocks pathogenicity by reacting with molecular structures possessed by all the viruses. Hopefully, resistant mutants will not arise as readily as they do to antibodies induced by vaccines.

	molecules?	
Chapter 22		
Chapter 22 Short answer #1	What is the difference between a furuncle and carbuncle?	A carbuncle is a furuncle or boil that has spread to involve multiple hair follicles.
Chapter 22 Short answer #2	Why do only certain strains of Staphylococcus aureus cause scalded skin syndrome?	Not all strains of *S. aureus* produce exfoliatin, the toxin that causes the symptoms of scalded skin syndrome.
Chapter 22 Short answer #3	How is impetigo spread?	Impetigo is spread by person-to-person transmission, insects and fomites.
Chapter 22 Short answer #4	How does the fact that Rocky Mountain spotted fever is a zoonosis relate to the relative severity of the disease symptoms?	Humans are an incidental host for the causative organism – humans are thus not adapted to living with the organsms, and can thus develop severe disease if infected.
Chapter 22 Short answer #5	Describe the causative agent of Lyme disease.	It is a microaerophilic spirochete with multiple copies of a linear genome and plasmid-like elements containing bacterial genes.
Chapter 22 Short answer #6	What is characteristic about the rash of varicella?	The lesions seen in varicella are pruritic, or itchy. Scratching may lead to serious, even fatal infection. Lesions appear at different times, so that at any one time, macules, papules and pustules are present.
Chapter 22 Short answer #7	What is the relationship between chickenpox (varicella) and shingles (herpes zoster)?	Chickenpox is the result of the initial infection with varicella-zoster virus, which then persists indefinitely in sensory nerve ganglia. Shingles is the result of reactivation of the latent virus in someone with fading or otherwise impaired immunity to the virus.
Chapter 22 Short answer #8	Why are many cases of measles complicated by secondary infections?	The rubeola virus can cause fatal pneumonia and encephalitis. It also impairs body defenses, thereby fostering secondary infections such as bacterial pneumonia, and it impairs cellular immunity allowing

		reactivation of latent infections such as tuberculosis.
Chapter 22 Short answer #9	What is the significance of rubella viremia during pregnancy?	The virus can cross the placenta and infect the fetus, leading to congenital rubella syndrome and birth defects.
Chapter 22 Short answer #10	How does a person contract warts?	Wart-causing papillomaviruses originating from another person infect skin cells through minor abrasions.
Ch 22 Multiple Choice #1	Which of the following conditions is important in the ecology of the skin? a) Temperature b) Salt concentration c) Lipids d) pH e) All of the above	E
Ch 22 Multiple Choice #2	Staphylococcus aureus can be responsible for which of these following conditions? a) Impetigo b) Food poisoning c) Toxic shock syndrome d) Scalded skin syndrome e) All of the above	E
Ch 22 Multiple Choice #3	The main effect of staphylococcal protein A is to a) interfere with phagocytosis. b) enhance the attachment of the Fc portion of antibody to phagocytes. c) coagulate plasma. d) kill white blood cells. e) degrade collagen.	A
Ch 2 Multiple Choice #4	Which of the following is essential for the virulence of Streptococcus pyogenes? a) Protease b) Hyaluronidase c) DNase d) All of the above e) None of the above	E
Ch 22 Multiple Choice #5	Which of the following	E

	statements is true of streptococcal impetigo? a) It is caused by a Gram-negative rod. b) It cannot be transmitted from one person to another. c) Pathogenic streptococci all produce coagulase. d) All of the above. e) None of the above.	
Ch 22 Multiple Choice #6	All of the following are true of Rocky Mountain spotted fever except a) the disease is most prevalent in the western United States. b) it is caused by an obligate intracellular bacterium. c) it is a zoonosis transmitted to human beings by ticks. d) those with the disease characteristically develop a hemorrhagic rash. e) antibiotic therapy is usually curative if given early in the disease.	A
Ch 22 Multiple Choice #7	All of the following are true of Lyme disease except a) it is caused by a spirochete. b) it is transmitted by certain species of ticks. c) it occurs only in the region around Lyme, Connecticut. d) most cases get a rash that looks like a target. e) it can cause heart and nervous system damage.	C
Ch 22 Multiple Choice #8	Which of the following statements is more likely to be true of measles (rubeola) than German measles (rubella)? a) Koplik spots are present. b) It causes birth defects. c) It causes only a	A

	mild illness. d) Human beings are the only natural host. e) Attenuated virus vaccine is available for prevention.	
Ch 22 Multiple Choice #9	All of the following must be cultivated in cell cultures instead of cell-free media except a) Rickettsia rickettsii. b) rubella virus. c) varicella-zoster virus. d) Borrelia burgdorferi. e) rubeola virus.	D
Ch 22 Multiple Choice #10	All of the following might contribute to development of ringworm or other superficial cutaneous mycoses except a) obesity. b) playing with kittens. c) rubber boots. d) using skin powder. e) dermatophyte virulence.	D
Ch 22 Applications #1	A school administrator in a small Iowa community prohibited a child with chickenpox from attending school. He said this was the first case of chickenpox in the school in 6 years and he did not want to have an outbreak. Several parents argued to the school board that an outbreak would benefit the school in the long term. Discuss the pros and cons of allowing this child to attend school.	The school administration knew that most of the children at the school would be susceptible to chickenpox because there has not been an outbreak in a while. The children's immune systems have not built up defenses against chickenpox. The parents know that an outbreak would immunize most of the children in the community and prevent future outbreaks.
Ch 22 Applications #2	A public health official was asked to speak about immunization during a civic group luncheon. One parent asked if rubella was still a problem. In answering the question, the official cautioned women planning to have another child to have their present children	Rubella is very dangerous to pregnant women because it can cause birth defects in the developing fetus. Women with young children or around other children may pick up rubella being carried by them.

	immunized against rubella. Why did the official suggest this?	
Ch 22 Critical Thinking #1	When Lyme disease was first being investigated, the observation that frequently only one person in a household was infected was a clue leading to the discovery that the disease was spread by arthropod bites. Why was this so?	If Lyme disease were spread by direct contact with other humans, such as measles or the common cold, it would be expected that the disease would be passed to other family members. If spread by contact with some common source, such as drinking water or food, more than one family member should again be affected. Apparently, the disease was due to contact with some source outside the family. Arthropod bites were one possibility. Of course, numerous other possibilities also existed. Several other clues, such as the observation that affected individuals had almost always visited or lived near wooded areas, contributed to narrowing the possibilities down to tick bites.
Ch 22 Critical Thinking #2	Why might it be more difficult to eliminate a disease like Lyme disease or Rocky Mountain spotted fever from the earth than rubeola or rubella?	The rubeola and rubella viruses are found only in humans and do not survive outside the human body. This means that if all individuals who had these diseases were cured, there would be no surviving viruses and no existing sources of infection. Lyme disease and Rocky Mountain spotted fever are harbored by intermediate hosts (mice and deer) and are spread to humans by arthropods (ticks). Elimination of these diseases would involve their elimination from the intermediate hosts and vectors as well as from humans, a much more difficult task. The same difficulty is presented by bubonic plague, spread by fleas, and malaria, spread by mosquitoes.
Chapter 23		
Chapter 23 Short answer #1	What property of *Staphylococcus epidermidis*	The organism can bind to fibronectin, a blood protein that

	help it to colonize plastic materials used in medical procedures?	quickly coats surgical implants in the body.
Chapter 23 Short answer #2	What is the relationship between the superantigens of S. aureus and the organism's production of toxic shock?	Superantigens cause a massive and inappropriate release of cytokines, which cause the shock.
Chapter 23 Short answer #3	Name two underlying conditions that predispose a person to *Streptococcus pyogenes* flesh-eating disease.	Diabetes, cancer, alcoholism, surgery, childbirth, injected-drug abuse
Chapter 23 Short answer #4	Give two sources of *Pseudomonas aeruginosa.*	Flowers and produce, shoes, damp soil
Chapter 23 Short answer #5	Outline the pathogenesis of tetanus.	Spores of *Clostridium tetani* contaminate a wound in which anaerobic conditions exist; spores germinate; vegetative bacteria multiply, releasing tetanospasmin toxin; toxin is carried to the central nervous system by motor nerves and bloodstream and blocks transmission of inhibitory neuron impulses, leaving neurons that cause muscle contraction unopposed.
Chapter 23 Short answer #6	Explain why *C. tetani* can be cultivated from wounds in the absence of tetanus.	The spores of the bacterium contaminate many wounds, but can only germinate and grow under anaerobic conditions. Spores cannot produce toxin.
Chapter 23 Short answer #7	What characteristics of bite wounds lead to anaerobic infections?	They are typically crushing injuries, causing tissue death and anaerobic conditions.
Chapter 23 Short answer #8	What is the causative agent of cat scratch disease? Why is it a threat to patients with AIDS?	*Bartonella henselae*, a tiny Gram-negative rod, causes cat scratch disease. It can cause peliosis hepatis and bacillary angiomatosis, life-threatening conditions in AIDS patients.
Chapter 23 Short answer #9	What is a synergistic infection? How might one be acquired?	A synergistic infection is one in which the involved microorganisms acting together produce more damage than one would expect from the sum of each acting alone. This can occur with human bite

		wounds in which the normally benign mouth flora act together to cause a serious infection.
Chapter 23 Short answer #10	Why is sporotrichosis sometimes called rose gardener's disease?	The thorns of rose bushes easily penetrate the skin and introduce the causative fungus. However, any sharp plant material can be responsible.
Ch 23 Multiple Choice #1	Which of the following about *Staphylococcus aureus* is *false*? a) It is generally coagulase-positive. b) Its infectious dose is increased in the presence of foreign material. c) Some strains infecting wounds can cause toxic shock. d) Nasal carriers have an increased the risk of surgical wound infection. e) It is pyogenic.	B
Ch 23 Multiple Choice #2	Which of these statements about *Streptococcus pyogenes* is *false*? a) It is a Gram-positive coccus occurring in chains. b) Some strains that infect wounds can cause toxic shock. c) Some strains that infect wounds can cause necrotizing fasciitis. d) It can cause puerperal sepsis. e) A vaccine is available for preventing *S. pyogenes* infections.	E
Ch 23 Multiple Choice #3	Choose the one *false* statement about *Pseudomonas aeruginosa.* a) It is widespread in nature. b) Some strains can grow in distilled water. c) It is a	C

	Gram-positive rod. d) It produces a hemolytic toxin. e) Under certain circumstances, it can grow anaerobically.	
Ch 23 Multiple Choice #4	Which of these statements about tetanus is *true*? a) It can start from a bee sting. b) Immunization is carried out using tiny doses of killed *C. tetani*. c) Those who recover from the disease are immune for life. d) Tetanus immune globulin does not prevent the disease. e) It is easy to avoid exposure to spores of the causative organism.	A
Ch 23 Multiple Choice #5	Choose the one *true* statement about gas gangrene. a) There are few or no leukocytes in the wound drainage. b) It is best to rely on antibacterial medications and avoid disfiguring surgery. c) A toxoid is generally used to protect against the disease. d) Only one antitoxin is used for treating all cases of the disease. e) It is easy to avoid spores of the causative agent.	A
Ch 23 Multiple Choice #6	Which of the following statements about actinomycosis is *false*? a) It can occur in cattle. b) It is caused by a branching filamentous bacterium. c) It always appears on the jaw. d) It can arise from intestinal	C

	surgery. e) Its abscesses can penetrate bone.	
Ch 23 Multiple Choice #7	Which of the following statements about *Pasteurella multocida* is *false*? a) Infections generally respond to a penicillin. b) It can cause epidemics of fatal disease in domestic animals. c) It is commonly found in the mouths of biting animals, including humans. d) A vaccine is used to prevent *P. multocida* disease in people. e) Cat bites are more likely to result in *P. multocida* infections than dog bites.	D
Ch 23 Multiple Choice #8	Which of these statements about cat scratch disease is *false*? a) It is a common cause of chronic lymph node enlargement in children. b) It is a serious threat to individuals with AIDS. c) Cat scratches are the only mode of transmission to humans. d) It is a zoonosis of cats transmitted by fleas. e) It can affect the brain or heart valves in a small percentage of cases.	C
Ch 23 Multiple Choice #9	The following statements about *Streptobacillus moniliformis* are all *true* except a) it can be transmitted by food. b) its colonies can resemble those of mycoplasmas. c) it can be transmitted by	E

	the bites of animals other than rats. d) human infection is characterized by irregular fevers, rash, and joint pain. e) it is a Gram-positive spore-forming rod.	
Ch 23 Multiple Choice #10	Which statement concerning sporotrichosis is *false*? a) It is characterized by ulcerating lesions along the path of a lymphatic vessel. b) Person-to-person transmission is common. c) It can occur in epidemics. d) It can persist for years if not treated. e) The causative organism is a dimorphic fungus.	B
Ch 23 Applications #1	Clinicians become concerned when the laboratory reports that organisms capable of digesting collagen and fibronectin are present in a wound culture. What is the basis of their concern?	These are structural components of tissue. Their digestion means that not only could the organisms spread easily, but also important structures such as tendons could be destroyed.
Ch 23 Applications #2	An army field nurse working at a mobile surgical hospital asks this question of all the ambulance drivers: "Was the soldier wounded while in a field with cows?" Why does the nurse ask this question?	Pastures are usually rich with animal droppings, a source of pathogenic clostridia. A neglected wound in such a setting might lend urgency to medical evaluation and treatment.
Ch 23 Critical Thinking #1	In what way would the incidence of tetanus at various ages in a developing country differ from age incidence in developed ountries?	The incidence would probably be higher in each age group. The incidence would be different because less prenatal care and immunization of children would increase the rates in newborn infants and in childhood.
Ch 23 Critical Thinking #2	Could colonization of a wound by a non-invasive bacterium cause disease? Explain your answer.	Yes, if the bacterium released an exotoxin that was taken up by the bloodstream.
Chapter 24		
Chapter 24	Describe two characteristics	Growth is not inhibited by low pH

Short answer #1	of *Streptococcus mutans* that contribute to its ability to cause dental caries.	that is produced by lactic acid that the bacteria produce during fermentation; it produces glucans that hold plaque organisms to the tooth and exclude saliva
Chapter 24 Short answer #2	Describe the process of periodontal disease.	A chronic inflammatory and immune reaction to dental plaque at the gum margin with widening of the gingival crevice and extension of plaque into it. Anaerobic bacteria predominate as the population increases, releasing enzymes and endotoxin. Tissues around the tooth loosen, and the bone softens. Eventually the tooth falls out.
Chapter 24 Short answer #3	How does *Helicobacter pylori* cause stomach ulcers?	It contains an enzyme, urease, that converts urea to ammonia. Ammonia is a strong base that neutralizes stomach acid and allows the organism to survive in the stomach. It burrows into the mucus and incites a damaging inflammatory reaction in cells lining the stomach. Mucus production decreases so the stomach is less protected from acid.
Chapter 24 Short answer #4	When would a case of mumps likely be complicated by swelling of the testicles?	Puberty
Chapter 24 Short answer #5	What characterizes the solutions used for oral rehydration therapy?	ORS contains a mixture of glucose to increase absorption in the intestine and various salts in water.
Chapter 24 Short answer #6	How do *Shigella* cells move from one host cell to another even though they are non-motile?	*Shigella* take advantage of the antigen-sampling behavior of M cells in intestinal epithelial cells that transport them across the epithelium. They then attach to the base of epithelial cells and induce those cells to take them in. They escape the endosome and cause host cell actin to polymerase forming “actin tails” that can propel the bacterium within the host cell or into a neighboring cell.
Chapter 24 Short answer #7	Name four different pathogenic groups of	Enterotoxigenic, enteroinvasive, enteropathogenic, and

	Escherichia coli.	enterohemorrhagic
Chapter 24 Short answer #8	What predisposes someone to a *Clostridium difficile* infection?	Loss of normal microbiota that typically out-compete the organism; often due to use of antibiotics in hospital patients
Chapter 24 Short answer #9	Name two kinds of hepatitis that can be prevented by vaccines.	Hepatitis A, Hepatitis B
Chapter 24 Short answer #10	Contrast the cause and epidemiology of giardiasis and amebiasis.	Giardiasis is caused by *Giardia lamblia,* a flagellated protozoan, which has a number of animal species that serve as its reservoir. Amebiasis is caused by *Entamoeba histolytica,* an ameba, generally contracted from other human beings. The fecal-oral route transmits both.
Ch 24 Multiple Choice #1	Which of the following about intestinal bacteria is *false*? a) They produce vitamins. b) They can produce carcinogens. c) They are mostly aerobes. d) They produce gas from indigestible substances in foods. e) They include potential pathogens.	C
Ch 24 Multiple Choice #2	All of the following attributes of *Streptococcus mutans* are important in tooth decay *except* a) it produces endotoxin, which triggers an inflammatory response. b) it can grow at pH below 5. c) it produces lactic acid. d) it synthesizes glucan. e) it stores fermentable polysaccharide.	A
Ch 24 Multiple Choice #3	*Helicobacter pylori* has all of the following characteristics *except* a) it is a helical bacterium with sheathed flagella.	B

	b) it has not been cultivated *in vitro.* c) it produces a powerful urease. d) it causes long-term infections, lasting for years. e) it can cause stomach ulcers.	
Ch 24 Multiple Choice #4	*Vibrio cholerae* pathogenesis involves all of the following *except* a) attachment to the small intestinal epithelium. b) production of cholera toxin. c) lysogenic conversion. d) acid resistance.	D
Ch 24 Multiple Choice #5	Which of the following statements concerning *Salmonella enterica* serotype Typhi is *false*? a) It is commonly acquired from domestic animals. b) It can colonize the gallbladder for years. c) It is highly resistant to killing by bile. d) It can destroy Peyer's patches. e) It causes typhoid fever.	A
Ch 24 Multiple Choice #6	Which statement about rotaviral gastroenteritis is *false*? a) A vaccine is available to prevent the disease. b) On a worldwide basis, most of the deaths are due to dehydration. c) Most cases of the disease occur in infants and children. d) The causative agent infects mainly the stomach. e) The disease is transmitted by the fecal-oral route.	D

Ch 24 Multiple Choice #7	Which of the following statements about noroviruses is *false*? a) They are the most common cause of viral gastroenteritis in the United States. b) They have a low infectious dose. c) They generally cause vomiting lasting 1 to 2 weeks. d) Immunity does not last long. e) They are a category B bioterrorism agent.	C
Ch 24 Multiple Choice #8	Which of the following statements about hepatitis is *false*? a) Both RNA and DNA viruses can cause hepatitis. b) Some kinds of hepatitis can be prevented by vaccines. c) HCV infections are often associated with injected-drug abuse. d) Lifelong carriers of hepatitis A are common. e) Hepatitis A spreads by the fecal-oral route.	D
Ch 24 Multiple Choice #9	Which of the following statements about hepatitis B virus is *false*? a) Replication involves reverse transcriptase. b) Infected persons may have large numbers of non-infectious viral particles circulating in their bloodstream. c) In the United States, infection rates have been steadily increasing over the last few years.	C

	d) Asymptomatic infections can last for years. e) Infection can result in cirrhosis.	
Ch 24 Multiple Choice #10	Choose the most accurate statement about cryptosporidiosis. a) Waterborne transmission is unlikely. b) The host range of the causative agent is narrow. c) It is prevented by chlorination of drinking water. d) Person-to-person spread does not occur. e) The life cycle of the causative agent occurs within small intestinal epithelial cells.	E
Ch 24 Applications #1	One reason given by Peruvian officials for not chlorinating their water supply is that chlorine can react with substances in water or in the intestine to produce carcinogens. How do you assess the relative risks of chlorinating or not chlorinating drinking water?	As is often the case, the choice is between two approaches, both carrying some risk, and the question is which one has the least risk. The effectiveness of chlorinated drinking water against diarrhea-producing bacteria could be determined by laboratory tests. Historical review of epidemics of disease arising from chlorinated and non-chlorinated public water supplies could be perfomed. The risk from possible cancer-causing substances derived from chlorine is more difficult to determine. These substances could be tested in the laboratory for cancer-causing potential. Two communities, one using water chlorination and one not using it, matched as closely as possible in factors such as water source, diet, and age distribution, could be followed to see if there were any differences in cancer rates over a period of many years.
Ch 14	A medical scientist is	By comparing liver cancer rates in

Applications #2	designing a research program to determine the effectiveness of hepatitis B vaccine in preventing liver cell cancer. Because liver cell cancer probably has multiple causes, how would you measure the success of an anticancer vaccination program?	two matched populations, one receiving the Hepatitis B vaccine and the other not receiving it.
Ch 24 Critical Thinking #1	Why does the lack of a brown color in feces indicate hepatitis?	The brown color of feces is due to the action of intestinal bacteria on bile. Lack of the color indicates that bile is not reaching the intestine, either because of obstruction to its flow, or damage to the liver as seen in hepatitis.
Ch 24 Critical Thinking #2	Mutant strains of *Helicobacter pylori* that lack the ability to produce urease fail to cause infection when they are swallowed. Infection occurs, however, if a tube is used to introduce them directly into the layer of mucus that overlies the stomach epithelium. What does this imply about the role of urease in the bacterium's pathogenicity?	The fact that infectivity of the urease-negative mutants is intact, as shown by introducing them into the mucus layer, suggests that urease is necessary to protect the organisms until they reach the mucus layer. This idea is supported by the knowledge that the extreme stomach acidity kills most bacteria, and the mucus layer approaches neutrality. Urea, known to be present in gastric juices, is converted to ammonia by urease, and the ammonia would tend to neutralize acid at the surface of the bacterium.
Chapter 25		
Chapter 25 Short answer #1	Name two substances released by lactobacilli that help protect the vagina from potential pathogens.	Lactic acid and hydrogen peroxide.
Chapter 25 Short answer #2	List four things that predispose to the development of infection of the urinary bladder.	Obstruction in the urethra, anesthesia, delaying urinating, inadequate fluid intake.
Chapter 25 Short answer #3	Name two genera of bacteria that infect the kidneys from the bloodstream.	*Salmonella* Typhi and *Leptospira.*
Chapter 25	What possible danger can be	The spot may contain infectious

Short answer #4	found in a spot on the ground where an animal has urinated 1 week earlier?	*Leptospira interrogans*, the cause of leptospirosis.
Chapter 25 Short answer #5	What is a clue cell?	An epithelial cell sloughed from the vaginal wall, covered with adherent bacteria.
Chapter 25 Short answer #6	What is ophthalmia neonatorum?	Infection of the eyes of the newborn, usually by *Chlamydia trachomatis* or *Neisseria gonorrhoeae*.
Chapter 25 Short answer #7	List three diseases caused by different antigenic types of *Chlamydia trachomatis.*	Chlamydial genital disease, lymphogranuloma venereum, trachoma.
Chapter 25 Short answer #8	Why is dark-field microscopy used to view *Treponema pallidum*?	The bacterium is too slender to be seen well with most stains. Dark-field microscopy allows visualization of the living organism.
Chapter 25 Short answer #9	Give two ways in which the chancre of chancroid differs from the chancre of syphilis.	The chancres of chancroid are tender and soft. Those of syphilis are painless and hard.
Chapter 25 Short answer #10	What is the relationship between AIDS and HIV disease?	Acquired immunodeficiency syndrome. AIDS is the end stage of HIV disease.
Ch 25 Multiple Choice #1	Which of the following about bacterial cystitis is *false*? a) About one-third of all women will have it at some time during their life. b) Catheterization of the bladder markedly increases the risk of contracting the disease. c) Individuals who have a bladder catheter in place indefinitely risk bladder infections with multiple species of intestinal bacteria at the same time. d) Bladder infections occur as often in men as they do in	D

	women. e) Bladder infections can be asymptomatic.	
Ch 25 Multiple Choice #2	Choose the one correct statement about leptospirosis. a) Humans are the only reservoir. b) Most infections produce severe symptoms. c) Transmission is by the fecal-oral route. d) It can lead to unnecessary abdominal surgery. e) Effective vaccine is generally available for preventing human disease.	D
Ch 25 Multiple Choice #3	Which one of the following statements about bacterial vaginosis is *false*? a) It is the most common vaginal disease in women of childbearing age. b) In pregnant women, it is associated with a sevenfold increased risk of obstetrical complications. c) Inflammation of the vagina is a constant feature of the disease. d) The vaginal microbiota shows a significant decrease in lactobacilli and a marked increase in anaerobic bacteria. e) The cause is unknown.	C
Ch 25 Multiple Choice #4	Pick the one *false* statement about vulvovaginal candidiasis. a) It often involves the external genitalia. b) It is readily transmitted by sexual intercourse. c) It is caused by a yeast present among the normal	B

	vaginal microbiota in about one-third of healthy women. d) It is associated with prolonged antibiotic use. e) It involves increased risk late in pregnancy.	
Ch 25 Multiple Choice #5	All of the following statements about staphylococcal toxic shock are true *except* a) It can quickly lead to kidney failure. b) The causative organism usually does not enter the bloodstream. c) It occurs only in vaginal tampon users. d) Almost one-third of victims of the disease will suffer a recurrence sometime after recovery. e) Person-to-person spread does not occur.	C
Ch 25 Multiple Choice #6	Which of the following statements about gonorrhea is *false*? a) The incubation period is only a few days. b) Disseminated gonococcal infection (DGI) is almost invariably preceded by prominent urogenital symptoms. c) DGI can result in arthritis of the knee. d) Phase variation helps the causative organism evade the immune response. e) Pelvic inflammatory disease (PID) is common in untreated women.	B
Ch 25 Multiple Choice #7	Which one of these statements about chlamydial genital infections is *false*? a) The incubation period is	A

	usually shorter than in gonorrhea. b) Infected cells develop inclusion bodies. c) Pelvic inflammatory disease (PID) can be complicated by infection of the surface of the liver. d) Tissue damage largely results from cell-mediated immunity. e) Fallopian tube damage can occur in the absence of symptoms.	
Ch 25 Multiple Choice #8	Which symptom is least likely to occur as a result of tertiary syphilis? a) Gummas b) White patches on mucous membranes c) Emotional instability d) Stroke e) Blindness	B
Ch 25 Multiple Choice #9	During the first 15 years of the AIDS epidemic, approximately how many Americans died of the disease? a) 10,000 b) 50,000 c) 300,000 d) 5 million e) 50 million	C
Ch 25 Multiple Choice #10	All of the following are true of "trich" (trichomoniasis) *except* a) It can cause burning pain on urination and painful testes in men. b) It occurs worldwide. c) Asymptomatic carriers are rare. d) Transmission can be prevented by proper use of condoms. e) Individuals with multiple sex partners are at high risk of contracting the disease.	C
Ch 25 Applications #1	Religious restrictions of a small North African	Treating only symptomatic women would leave many infected

	community are preventing a World Health Organization project from reducing the incidence of gonorrhea. The community will not permit the testing of females for the disease. They can be treated, however, if they show outward evidence of the disease. Only males are allowed to participate fully in the project, with testing for the disease and treatment. The village elders argue that eradicating the disease from males would eventually remove it from the population. What would be the impact of these restrictions on the success of the project?	women untreated, and these women likely would maintain the disease and infect at least some of the men.
Ch 25 Applications #2	Former President Ronald Reagan once commented at a press conference that the best way to combat the spread of AIDS in the United States was to prohibit everyone from having sexual contact for 5 years. What would be the success of such a program if it were possible to carry it out?	Transmission by sexual intercourse would be interrupted for five years but would resume thereafter because of the very long duration of HIV disease. Transmission by blood and from mother to newborn would continue.
Ch 25 Critical Thinking #1	The middle curve of figure 25.6 shows the occurrence of staphylococcal toxic shock syndrome in menstruating women from 1979 to 2010. What aspect of these data argues that high-absorbency tampons were not the only cause of staphylococcal toxic shock syndrome associated with menstruation?	The fact that it took so long for the menstruation-related cases to decline in numbers. Perhaps it took time for knowledge of proper tampon use to disseminate.
Ch 25 Critical Thinking #2	In early attempts to identify and isolate the cause of syphilis, various bacteria in	The bacteria in the discharge from the syphilitic sores could have come from the inanimate environment

	the discharge from syphilitic lesions in experimental animals were isolated in pure culture. None of them, however, would cause the disease when used in attempts to infect healthy animals. Why was it considered a critical step to have the cultivated bacteria reproduce the disease in the healthy animals?	including air, the animal's own normal flora, and from people attending the animals. This is the reason for Koch's third postulate.
Chapter 26		
Chapter 26 Short answer #1	What sign would differentiate meningococcal meningitis from pneumococcal meningitis?	Petechiae are characteristic of meningococcal meningitis, but not of pneumococcal meningitis.
Chapter 26 Short answer #2	Name and describe the organism that is the leading cause of bacterial meningitis in adults.	*Streptococcus pneumoniae* (pneumococcus) is the leading cause of adult meningitis. It is an encapsulated Gram-positive lancet-shaped bacterium that often occurs in pairs.
Chapter 26 Short answer #3	What measures can be undertaken to prevent neonatal meningitis?	Screen the vagina and rectum of women late in pregnancy for the presence of group B streptococcus and possibly other causative agents. Women who are positive can take antibiotics to minimize the potential of exposure of the baby during birth.
Chapter 26 Short answer #4	Why is listeriosis so important to pregnant women even though it usually causes them few symptoms?	Bacteremia commonly occurs, resulting in infection of the fetus; miscarriage, stillbirth, or infection of the newborn can result.
Chapter 26 Short answer #5	Can botulism be spread from person to person?	No, the disease is caused by ingesting spores that subsequently produce toxin, or by ingesting the toxin itself.
Chapter 26 Short answer #6	Give two ways in which viral meningitis usually differs from bacterial meningitis.	Viral meningitis is usually mild and leaves few, if any, permanent effects. Because the causative agents are viral, and there are usually only a modest number of cells in the spinal fluid, the glucose

		level in the spinal fluid is not severely depressed.
Chapter 26 Short answer #7	What is the difference between sporadic encephalitis and epidemic encephalitis? Name one cause of each.	Cases of sporadic encephalitis occur all the time, are few in number, and widely spaced in time and place; the cause is usually a common virus such as herpes simplex. Epidemic encephalitis (West Nile virus) generally occurs in outbreaks of large numbers of cases in a given area. They usually arise from zoonoses involving insects and small mammals or birds.
Chapter 26 Short answer #8	Explain why the biggest impact of poliomyelitis in the 1950s occurred in countries with good sanitation.	In those countries, infants may not get antibodies from their mothers and they are not exposed to the pathogen in low doses during childhood often resulting in mild disease. When they are exposed to the pathogen they are not protected and severe disease may result.
Chapter 26 Short answer #9	Why is it possible to prevent rabies with vaccine given after exposure?	It takes some time for the virus to invade the sensory neurons and travel to the CNS. Vaccination before this occurs will prevent the disease.
Chapter 26 Short answer #10	If you contract African sleeping sickness on a visit to central Africa, what type do you most likely have?	*Trypanosoma gambiensi* is more prevalent in central Africa so you are likely to have the chronic form of the disease that may last for years before causing death.
Ch 26 Multiple Choice #1	Which is the best way to prevent meningococcal meningitis in individuals intimately exposed to the disease? a) Vaccinate them against Neisseria meningitidis. b) Treat them with the antibiotic rifampin. c) Culture their throat and hospitalize them for observation. d) Withdraw a sample of spinal fluid and begin	B

	antibacterial treatment if the cell count is high and the glucose level is low. e) Have them return to their usual activities, but seek medical evaluation if symptoms of meningitis occur.	
Ch 26 Multiple Choice #2	Which of these statements concerning the causative agent of listeriosis is false? a) It can cause meningitis during the first month of life. b) It is a Gram-positive rod that can grow in refrigerated food. c) It is usually transmitted by the respiratory route. d) Infection commonly results in bacteremia. e) It is widespread in natural waters and vegetation.	C
Ch 26 Multiple Choice #3	Which of these statements concerning Hansen's disease is false? a) It was once common in the United States. b) An early symptom is loss of sensation, sweating, and hair in a localized patch of skin. c) The incubation period is usually less than 1 month. d) Treatment should include more than one antimicrobial medication given at the same time. e) The form the disease takes depends on the individual's immune status.	C
Ch 26 Multiple Choice #4	Which of these statements concerning foodborne botulism is false? a) It is not a central nervous system infection.	D

	b) Only some strains of the causative agent cause disease in humans. c) Food can taste normal but still cause botulism. d) Treatment is based on choosing the correct antibiotic. e) Control of the disease depends largely on proper food-canning techniques.	
Ch 26 Multiple Choice #5	Which of the following statements about viral meningitis is true? a) Vaccines are generally available to protect against the disease. b) The main symptom is muscle paralysis. c) Transmission is often by the fecal-oral route. d) The causative agents do not survive well in the environment. e) Recovery is rarely complete.	C
Ch 26 Multiple Choice #6	Which of these statements concerning arboviral encephalitis is false? a) It is likely to occur in epidemics. b) Mosquitoes can be an important vector. c) Epilepsy, paralysis, and thinking difficulties are among the possible sequels to the disease. d) Use of sentinel chickens helps warn about the disease. e) In the United States, the disease is primarily a zoonosis involving cattle.	E
Ch 26 Multiple Choice #7	Which of these statements concerning poliomyelitis is false?	A

	a) The sensory nerves are usually involved. b) It can be caused by any of three specific enteroviruses. c) Only a small fraction of those infected will develop the disease. d) The disease is transmitted via the fecal-oral route. e) A post-polio syndrome can develop years after recovery from the original illness.	
Ch 26 Multiple Choice #8	Which of these statements concerning cryptococcal meningoencephalitis is true? a) It is caused by a yeast with a large capsule. b) It is a disease of trees transmissible to humans. c) Typically it attacks the meninges but spares the brain. d) Person-to-person transmission commonly occurs. e) It is seen only in persons who are immunocompromised.	A
Ch 26 Multiple Choice #9	Which of these statements concerning African sleeping sickness is true? a) It is transmitted by a species of biting mosquito. b) It is a threat to visitors to tropical Africa. c) The onset of sleepiness is usually within 2 weeks of contracting the disease. d) It is caused by free-living protozoa. e) Distribution of the disease is determined mainly by the distribution of standing water.	B

Ch 26 Multiple Choice #10	Which of these statements concerning Creutzfeldt-Jakob disease (CJD) and vCJD is true? a) CJD occurs in children; vCJD occurs in adults over 45. b) CJD and vCJD are sometimes fatal. c) CJD is caused by prions; vCJD is a viral infection. d) Only humans suffer from diseases like CJD and vCJD. e) Both CJD and vCJD produce a spongy appearance in affected brain tissue.	E
Ch 26 Applications #1	An outbreak of viral meningitis in a small eastern city was linked epidemiologically to a group who swam a non-chlorinated pool in an abandoned quarry outside of town. What might public health officials surmise about the probable cause of the outbreak?	Groups of people swimming in a non-chlorinated pool are highly likely to become exposed to an enterovirus if any member of the group carries the agent in their intestine. They would surmise that the outbreak is probably due to an enterovirus.
Ch 26 Applications #2	Two microbiologists are writing a textbook, but they cannot agree where to place the discussion of botulism. One favored the chapter on nervous system infections, whereas the other insisted on the chapter covering digestive system infections. Where do you think the discussion should be placed, and why?	Neither one is correct. Botulism is an intoxication, not an infection, and is appropriately discussed under food microbiology. It is only under special conditions that the causative organism can colonize the intestine or a wound and cause significant intoxication.
Ch 26 Critical Thinking #1	A pathologist stated that it was much easier to determine the causative agent of meningitis than of an infection of the skin or intestine. Is her statement valid? Why or why not?	Yes. Spinal fluid is normally sterile, so any microorganism found there can usually be considered the cause of the infection.
Ch 26	Why is it important to learn	Rabies is so widespread, that unless

Critical Thinking #2	about rabies when only a few cases occur in the entire United States each year?	a practical way of immunizing or eliminating it from wildlife is found, it will continue to be a threat to humans. It is a fatal disease.
Chapter 27		
Chapter 27 Short answer #1	What is the significance of immune complex formation in SBE?	Immune complexes can be deposited in tissues and cause damage, as in the kidney.
Chapter 27 Short answer #2	What is disseminated intravascular coagulation (DIC)?	Activation of the blood clotting mechanism in the general circulation, resulting in formation of small clots throughout the body, leading to organ failure.
Chapter 27 Short answer #3	What activities of humans are likely to expose them to tularemia?	Hunting, trapping, hiking and other activities that expose them to ticks and biting flies.
Chapter 27 Short answer #4	Why is brucellosis a threat to big-game hunters?	The causative organism is found in wild life and large game all over the United States; hunters can contract the disease from skinning them and cutting up their flesh.
Chapter 27 Short answer #5	Why might the *Yersinia pestis* from a patient with pneumonic plague be more dangerous than the same organism from fleas?	The organism acquired this way is already fully virulent, so is especially dangerous. Also, it can be transmitted by aerosol droplets
Chapter 27 Short answer #6	Why might rodent burrows be a source of plague months after they are abandoned?	Fleas and dried flea feces can remain infectious for extended periods of time.
Chapter 27 Short answer #7	What type of leukocytes does EBV infect?	B lymphocytes
Chapter 27 Short answer #8	Travelers to and from which areas of the world should have certificates of yellow fever vaccination?	Parts of Central and South America, and parts of Africa.
Chapter 27 Short answer #9	Why is a second infection with dengue virus more serious than the first?	Can lead to dengue hemorrhagic fever, which is potentially fatal.
Chapter 27 Short answer #10	Which *Plasmodium* species causes the most dangerous form of malaria?	*Plasmodium falciparum.*
Ch 27 Multiple Choice #1	Which of the following infection fighters are found in lymph? a) Leukocytes b) Antibodies c) Complement d) Interferon	E

	e) All of the above	
Ch 27 Multiple Choice #2	Which of the following statements about the spleen is *false*? a) It is located low on the right side of the abdomen. b) It cleanses the blood of foreign material and damaged cells. c) It provides an immune response to circulating pathogens. d) It can help produce new blood cells. e) It enlarges in a number of infectious diseases.	A
Ch 27 Multiple Choice #3	Which one of the following statements about SBE is *false*? a) It is generally a chronic illness characterized by fatigue and slight fever. b) It is usually caused by normal microbiota of the mouth or skin. c) Infection typically occurs on the left side of the heart. d) Injected-drug abuse can be a risk factor in developing the disease. e) It can lead to a stroke.	C
Ch 27 Multiple Choice #4	Choose the one *true* statement about sepsis. a) It is a rare healthcare-associated disease. b) The output of urine increases if shock develops. c) It can be caused only by anaerobic bacteria. d) An antibiotic that kills the causative organism can be depended on to cure the disease. e) Lung damage is an important cause of death.	E

Ch 27 Multiple Choice #5	Which of these statements about tularemia is *false*? a) It can be contracted from muskrats and bobcats. b) Biting insects and ticks can transmit the disease. c) The causative organism is closely related to *E. coli.* d) A steep-walled ulcer at the site of entry of the bacteria and enlargement of nearby lymph nodes is characteristic. e) Without treatment, 9 out of 10 people can be expected to survive.	C
Ch 27 Multiple Choice #6	Which of the following statements about brucellosis is *false*? a) fevers that come and go over a long period of time gave it the name "undulant fever." b) the causative agent can infect via mucous membranes. c) the causative agent is readily killed by phagocytes. d) the disease in cattle is characterized by chronic infection of the mammary glands and uterus. e) butchers are advised to wear goggles or a face shield to help protect against the disease.	C
Ch 27 Multiple Choice #7	Which statement about *Yersinia pestis* is *false*? a) Growth conditions inside human phagocytes activate virulence genes. b) The bacterium can form biofilms in the flea digestive system. c) Yops protein increases	C

	phagocytosis. d) The organism resembles a safety pin in certain stained preparations. e) It was responsible for the "black death" in Europe during the 1300s.	
Ch 27 Multiple Choice #8	Which of the following statements about yellow fever is *false*? a) There is no animal reservoir. b) The name "yellow" comes from the fact that many victims have jaundice. c) Certain mosquitoes are biological hosts for the causative agent. d) Outbreaks of the disease could occur in the United States because a suitable vector is present. e) An attenuated vaccine is widely used to prevent the disease.	A
Ch 27 Multiple Choice #9	The malarial form infectious for mosquitoes is called a a) gametocyte. b) trophozoite. c) sporozoite. d) schizont. e) merozoite.	A
Ch 27 Multiple Choice #10	Which of the following statements about malaria is *true*? a) Transmission cannot occur in temperate climates. b) Transmission usually occurs with the bite of a male *Anopheles* mosquito. c) The disease is currently well controlled in tropical Africa. d) *P. falciparum* infects only old RBCs and therefore causes milder disease than other *Plasmodium* species.	E

	e) The characteristic recurrent fevers are associated with release of merozoites from RBCs.	
Ch 27 Applications #1	Some years ago, dentists and doctors began noticing an association between subacute bacterial endocarditis and prior dental work, and they began advising that an antibiotic be administered at the time of dental procedures to those with known or suspected heart defects. What was the rationale for this advice?	It was known that dental procedures often cause bacteremia, presumably because of small wounds created by dental instruments on surfaces heavily populated by normal microbiota. It was reasoned that the numbers of these bacteria could be reduced markedly by administering an antibiotic, and this would decrease or eliminate the bacteremia and therefore the risk of SBE.
Ch 27 Applications #2	A healthcare worker in Honduras is concerned about a potential outbreak of yellow fever in his town. A laborer from a jungle area known to be endemic for the disease had come to the town 2 weeks earlier to work and subsequently developed yellow fever. Several coworkers reported getting mosquito bites while working with him. Why is it important that the healthcare worker determine how long it is since the workers were bitten by the mosquitoes?	There would be little risk of an outbreak if the coworkers were bitten only a few days after the sick man's arrival. Usually 10 days or more must elapse before infected mosquitoes are able to transmit the disease.
Ch 27 Critical Thinking #1	The finding that there is an association between *Chlamydophila pneumoniae* infection and arteriosclerotic lesions raised hopes that new methods to combat arteriosclerosis could be developed. An investigator reviewing this research, however, stated that even a perfect correlation between	Yes. Demonstrating a parallel effect between infection and lesion formation, whether by simple correlation, or association with antibiotic treatment, does not establish a cause and effect relationship between the infectious agent and the formation of lesions. This is because both the infection and the lesion could be affected by

	infection and lesion formation would not prove that infection causes arteriosclerosis. Moreover, even showing that therapeutic antibiotics could prevent infection and lesion formation would not be definitive proof. Is the investigator justified in making this argument? Why or why not?	some other unknown factor. For example, in the question above, the antibiotic could inhibit some bodily process that induces arteriosclerosis and at the same time kill *C. pneumoniae*; improvement in arteriosclerosis would have nothing to do with killing the bacterium even though there appeared to be a cause-and-effect relationship.
Ch 27 Critical Thinking #2	Even though genetically engineered mosquitoes might be developed that do not allow the reproduction of malaria protozoa, these mosquitoes would have little, if any, immediate effect on the spread of the disease. Why should this be so? What would have to happen for these mosquitoes to significantly affect the spread of malaria?	To affect the spread of malaria, these mosquitoes would have to be introduced into and displace the natural population to a significant extent. Unless there were some selective advantages for the survival of these genetically engineered mosquitoes over the natural population, they would not displace the natural population, which would continue to spread the disease.
Chapter 28		
Chapter 28 Short answer #1	What is the main symptom of patients with lymphadenopathy syndrome (LAS)?	Large lymph nodes. They provided a way to detect AIDS cases before the causative agent was known and practical diagnostic methods became available.
Chapter 28 Short answer #2	Which cells of the immune system are prime targets of HIV?	CD4+ cells, especially T helper cells and macrophages.
Chapter 28 Short answer #3	What role do asymptomatic people with HIV disease play in the epidemiology of AIDS?	They can unknowingly spread the disease for years.
Chapter 28 Short answer #4	Why might the infant son of a hemophiliac man develop AIDS when the son's parents were strictly monogamous non-abusers of drugs?	HIV is transmitted in blood and blood products. The father might have contracted HIV disease from clotting factor VIII prepared from pooled donated blood, infected his wife through sexual intercourse, and his son contracted the disease from his mother at the time of birth.

Chapter 28 Short answer #5	Give two reasons it is a good idea to know whether you are infected with HIV.	One can take steps to avoid infecting others, and one can receive optimal treatment to slow disease progression and protect against infectious complications.
Chapter 28 Short answer #6	What are the three main types of malignant tumors that complicate HIV disease?	Kaposi's sarcoma, lymphomas, carcinomas of the uterine cervix and rectum.
Chapter 28 Short answer #7	How do physicians prevent pneumocystis in AIDS patients?	By administering a medication such as trimethoprim-sulfamethoxasole when the CD4+ lymphocyte count drops to 200 cells per microliter.
Chapter 28 Short answer #8	In AIDS patients with toxoplasmosis, which part of the body is affected in more than half the cases?	Brain
Chapter 28 Short answer #9	Name a feared complication of cytomegalovirus infection in AIDS patients.	Blindness
Chapter 28 Short answer #10	Where in an AIDS patient's surroundings might MAC organisms be found?	Food, water, soil, dust
Ch 28 Multiple Choice #1	HIV can be spread by all of the following *except* a) blood products. b) hypodermic syringes. c) insect bites. d) sexual intercourse. e) organ transplants.	C
Ch 28 Multiple Choice #2	All of the following signs and symptoms are characteristic of the AIDS-related complex (ARC) *except* a) fever. b) fatigue. c) diarrhea. d) blindness. e) weight loss.	D
Ch 28 Multiple Choice #3	Which one of the following is *true* of Kaposi's sarcoma? a) KSHV is necessary for development of the tumor. b) HIV-1 is necessary for development of the tumor. c) Both KSHV and HIV-1 are necessary for development of the tumor.	A

	d) KSHV alone is sufficient for development of the tumor. e) Both KSHV and HIV-1 together are sufficient for the tumor to develop.	
Ch 28 Multiple Choice #4	All of the following are HIV accessory genes *except* a) *tat.* b) *env.* c) *vpr.* d) *rev.* e) *vpu.*	B
Ch 28 Multiple Choice #5	When was AIDS first recognized as representing a new disease? a) 1973 b) 1959 c) 1981 d) 1989 e) 1999	C
Ch 28 Multiple Choice #6	All of the following are AIDS-defining conditions *except* a) influenza. b) herpes simplex of the esophagus. c) *Pneumocystis jiroveci* pneumonia. d) invasive cancer of the uterine cervix. e) Kaposi's sarcoma.	A
Ch 28 Multiple Choice #7	Which of the following types of cells can be infected by HIV? a) Helper T cells b) Cytotoxic T cells c) B lymphocytes d) CD 8+ cells e) All of the above	A
Ch 28 Multiple Choice #8	All of the following are HIV antigens *except* a) CD4. b) TM. c) RT. d) MA. e) CA.	A
Ch 28 Multiple Choice #9	Which of the following is a cause of helper T-cell death in HIV disease? a) Replication of HIV lyses the cell. b) Infected cells are destroyed by cytotoxic T	E

	cells (TC). c) Infected cells are attacked by natural killer cells. d) Cells are killed by fusion and syncytium formation. e) All of the above	
Ch 28 Multiple Choice #10	Highly active antiretroviral therapy (HAART) is less than ideal because a) it does not eliminate latent HIV infection. b) its cost is too great for the majority of AIDS sufferers. c) it often has severe side effects. d) some HIV strains are resistant to it. e) All of the above	E
Ch 28 Applications #1	An epidemiologist from the CDC was presenting a report on the status of AIDS to a congressional committee. In concluding her remarks, she noted that from an epidemiological perspective it was more important to focus on HIV infection than on AIDS, and urged that the Congress consider redirecting funding of AIDS research to reflect this fact. What was the rationale for her request?	AIDS is a late stage of HIV disease and therefore only reflects the status of the epidemic years earlier. The HIV disease epidemic can change substantially during the interval, attacking different populations, employing different modes of spread, and requiring different approaches for control.
Ch 28 Applications #2	A historian researching the influence of society on the spread of communicable disease began to speculate on what it would be like if AIDS had appeared at a different time. What differences might one expect, for example, if AIDS had appeared in 1928 instead of 1978?	AIDS would have been much more difficult to study for both scientific and social reasons. Only primitive knowledge of viruses was available, and even less of the structure and importance of DNA. The causative agent could not have been identified, and the epidemiology might be more difficult to define because of the stigma attached to sexual promiscuity, drug use, and homosexuality. Spread of the disease might be slower because of

		less permissive attitudes about sexual expression. Finding an effective treatment could only occur by good luck.
Ch 28 Critical Thinking #1	Vaccines have effectively prevented many viral diseases. Attempts over many years to develop an effective vaccine against HIV disease and AIDS, however, have so far met with little success. Why is this so?	There are many different strains of the virus, and the virus also readily mutates within a single host; therefore, it has been impossible to develop a vaccine that gives protection against even the most common strains. The antigens identified as being involved in virulence have generally evoked only a poor and short lived immune response.
Ch 28 Critical Thinking #2	Why is reverse transcriptase needed in order for HIV to become a provirus?	HIV is an RNA virus and can only be incorporated into the DNA of the host genome if a DNA copy of the virus is made.
Chapter 29		
Chapter 29 Short answer #1	Describe why a microbial mat has green, reddish-pink, and black layers.	The layers indicate the growth of different groups of microorganisms. The green layer is typically composed of cyanobacteria; the pink layer consists of purple sulfur bacteria; and the black layer results from the metabolic activities of sulfate-reducers.
Chapter 29 Short answer #2	Why do lakes in temperate regions stratify during the summer months?	Oligotrophic lakes in temperate climates can have anaerobic layers due to thermal stratification resulting from seasonal temperature changes. During the summer months, the surface water warms, decreasing the density of the water, causing it to form a distinct layer that does not mix with the cooler, denser water below. The upper layer is generally O_2-rich, while the lower layer is generally anaerobic.
Chapter 29 Short answer #3	Why is there a high concentration of microbes in the rhizosphere?	The rhizosphere is rich in nutrients.
Chapter 29 Short answer #4	What dictates whether a form of an element is suitable for use as an energy source	The oxidation state. Reduced forms of elements are oxidized to transform energy; the oxidized

	versus a terminal electron acceptor?	forms become reduced when they serve as terminal electron acceptors.
Chapter 29 Short answer #5	Why does wood resting at the bottom of a bog resist decay?	Aerobic conditions are required for the degradation of lignin, a major component of wood.
Chapter 29 Short answer #6	What is the importance of nitrogen fixation?	Nitrogen fixation is essential to replace the nitrogen that is continually being removed from the soil. Nitrogen fixation by symbiotic microorganisms is the most efficient way to use atmospheric nitrogen.
Chapter 29 Short answer #7	Describe the relationship between ammonia oxidizers and nitrite oxidizers.	Ammonium oxidizers use ammonium as an energy source, oxidizing it to nitrate. The nitrate produced then serves as the energy source for nitrite oxidizers.
Chapter 29 Short answer #8	How do hydrothermal vents support thriving communities of microbes, clams, and tube worms?	Reduced compounds such as hydrogen sulfide serve as an energy source for sulfur-oxidizing prokaryotes. These chemolithoautotrophs are primary producers— they fix carbon, providing an organic carbon source that serves as an energy source for chemoorganoheterotrophs. Some sulfur-oxidizers live in symbiotic association with large tubeworms and clams, providing the animals with both carbon and ATP.
Chapter 29 Short answer #9	Give examples of free-living and symbiotic nitrogen-fixing microorganisms. Are these prokaryotic or eukaryotic?	*Azotobacter* and *Beijerinckia* are free-living nitrogen fixers; *Anabaena* and the rhizobia are symbiotic nitrogen fixers. All of these are prokaryotic.
Chapter 29 Short answer #10	Describe the steps that lead to the formation of the symbiotic relationship between rhizobia and legumes.	*Rhizobium* cells attach to cells of the root hair. NOD factors, produced by the bacteria, induce the root hairs to branch and curl and produce a cellulose infection thread. The bacteria invade the plant cells through the thread, multiply and develop into bacteroids. Bacteroids and plant cells multiply, forming the nodule.
Ch 29	Cyanobacteria are	A

Multiple Choice #1	a) primary producers. b) consumers. c) herbivores. d) decomposers. e) more than one of the above.	
Ch 29 Multiple Choice #2	Which of the following is *false*? a) Culture techniques are an accurate way of determining which members in a microbial community are most common. b) Fluorescence *in situ* hybridization (FISH) can be used to distinguish subsets of prokaryotes that contain a specific nucleotide sequence. c) Polymerase chain reaction (PCR) can be used to distinguish subsets of prokaryotes based on their 16S rRNA sequences. d) Denaturing gradient gel electrophoresis (DGGE) can be used to separate PCR products. e) Studying the genome of one organism can give insights into the characteristics of another.	A
Ch 29 Multiple Choice #3	Which of the following pairs that relate to aquatic environments does not match? a) Oligotrophic—nutrient poor b) Hypoxic—oxygen poor c) Epilimnion—O2 poor d) Hypolimnion—lower layer e) Eutrophic—nutrient rich.	C
Ch 29 Multiple Choice #4	Adding high levels of nutrients to a lake or inshore area would have all of the following effects in that environment *except*	D

	a) death of clams and crabs. b) increased growth of heterotrophic microbes. c) increased growth of photosynthetic organisms. d) increased levels of dissolved O2.	
Ch 29 Multiple Choice #5	Which of the following pairs that relate to terrestrial environments does not match? a) Soil—minimal biodiversity b) *Bacillus*—endospores c) *Streptomyces*—geosmin production d) Fungi—lignin degradation e) Rhizosphere—soil that adheres to plant root	A
Ch 29 Multiple Choice #6	Atmospheric nitrogen can be used a) directly by all living organisms. b) only by aerobic bacteria. c) only by anaerobic bacteria. d) in symbiotic relationships between rhizobia and plants. e) in photosynthesis.	D
Ch 29 Multiple Choice #7	Which process converts ammonium (NH4+) into nitrate (NO3–)? a) Nitrogen fixation b) Ammonification c) Nitrification d) Denitrification e) Anammox	C
Ch 29 Multiple Choice #8	Energy for ecosystems can come from a) sunlight via photosynthesis. b) oxidation of reduced inorganic chemicals by chemoautotrophs. c) both a and b.	C

Ch 29 Multiple Choice #9	Mycorrhizas represent associations between plant roots and microorganisms that a) are antagonistic. b) help plants take up phosphorus and other nutrients from soil. c) involve algae in the association with plant roots. d) form nodules on the plant's leaves. e) lead to the production of antibiotics.	B
Ch 29 Multiple Choice #10	In symbiotic nitrogen fixation by rhizobia and legumes a) the amount of nitrogen fixed is much greater than by non-symbiotic organisms. b) neither the bacteria nor the legume can exist independently. c) the bacteria enter the leaves of the legume. d) the bacteria operate independently of the legume.	A
Ch 29 Applications #1	A farmer who was growing soybeans, a type of legume, saw an Internet site advertising an agricultural product for safely killing soil bacteria. The ad claimed that soil bacteria were responsible for most crop losses. The farmer called the agricultural extension office at a local university for advice. Explain what the extension office adviser most likely told the farmer about the usefulness of the product.	Killing the soil bacteria would kill not just plant pathogens, but also beneficial bacteria such as rhizobia. Rhizobia can grow in a symbiotic relationship with legumes, fixing nitrogen and thereby providing the plants with that essential nutrient. Killing the soil bacteria would kill the rhizobia, prevent nitrogen fixation, and prevent the legumes from growing well. The benefit from killing potential plant pathogens would not exceed the loss due to killing the rhizobia.
Ch 29 Applications #2	Recent reports suggest that human activities, such as the generous use of nitrogen	Too much fixed nitrogen could contribute to eutrophication and to gases that contribute to the

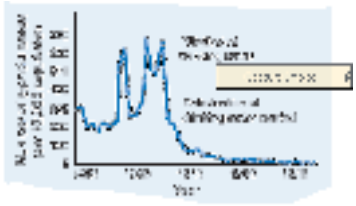
	fertilizers, have doubled the rate at which elemental nitrogen is fixed, raising concerns of environmental overload of nitrogen. What problems could arise from too much fixed nitrogen, and what could be done about this situation?	greenhouse effect. Denitrifying bacteria, such as some species of *Pseudomonas*, can convert the fixed nitrogen compounds to nitrogen gas, which would escape into the atmosphere.
Ch 29 Critical Thinking #1	Each colony growing on an agar plate arises from a single cell (see photo). Colonies growing close together are much smaller than those that are well separated. Why would this be so?	Nutrients are limiting when cells that are close together begin to multiply, so colonies are smaller because of competition for nutrients. In areas where few cells are inoculated, the colonies are far apart and do not have to compete, so they are larger.
Ch 29 Critical Thinking #2	An entrepreneur found an economically feasible way of collecting large amounts of sulfur from underwater hot vents in the Pacific Ocean. The sulfur will be harvested from the microorganisms found in the vent areas. A group of ecologists argued that the project would destroy the fragile ecosystem by depleting it of usable sulfur. The entrepreneur argued that the environment would not be harmed because the vents produce more than enough sulfur for the clams and tube worms in the area. Explain who is correct.	The ecologists are correct because they recognize that the sulfur is made useable to the organisms by prokaryotic processing. The sulfur coming directly out of the vents has no value unless it has been processed by the prokaryotes that are the sole food source of many other creatures around the vent.
Chapter 30		
Chapter 30 Short answer #1	Describe how the BOD of a water sample is determined.	The O_2 level in a well-aerated sample of microbe-containing test water is measured. The sample is then incubated in a sealed container in the dark under standard conditions of time and temperature. The O_2 level is then determined

		again. The difference between the dissolved O_2 at the beginning of the test and at the end reflects the BOD of the sample.
Chapter 30 Short answer #2	Which step of wastewater treatment removes most of the BOD?	Secondary treatment
Chapter 30 Short answer #3	Compare and contrast the activated sludge process and the trickling filter system used in secondary treatment of wastewater.	Both provide an abundance of air to microorganisms, allowing them to oxidize the wastes, generating CO_2, H_2O, and cell mass. In the activated sludge process the microbes grow as flocs suspended in the aerated wastewater; in the trickling filter system the microbes grow as a biofilm on a bed of coarse gravel and rocks, over which the wastewater is sprayed.
Chapter 30 Short answer #4	Why is it beneficial to remove nitrates and phosphates in wastewater?	The nitrates and phosphates could otherwise serve as a source of nutrients for photosynthetic organisms, allowing their overgrowth and leading to eutrophication.
Chapter 30 Short answer #5	How does a septic system work?	Wastewater is collected in a large tank in which much of the solid material settles and is degraded by anaerobic microorganisms. The fluid overflow from the tank then passes through a drainage field of sand and gravel designed to allow oxidation of the organic material.
Chapter 30 Short answer #6	What is an aquifer?	Aquifers are water-containing underground layers of rock, sand and gravel.
Chapter 30 Short answer #7	Why do water-testing procedures look for coliforms rather than pathogens?	It is not feasible to test for all of the pathogens, so indicator organisms such as coliforms function as surrogates.
Chapter 30 Short answer #8	How does the ONPG/MUG test allow a sample to be assayed simultaneously for the presence of both total coliforms and *E. coli*?	Coliforms hydrolyze ONPG, producing a yellow-colored compound; *E. coli* produces an enzyme that hydrolyzes MUG, generating a fluorescent compound (in addition to hydrolyzing ONPG).
Chapter 30	What aspect of 2,4,5-T	2,4,5-T has an additional chlorine

Short answer #9	makes it more likely to persist in the environment than 2,4-D?	atom (on the #5 carbon)
Chapter 30 Short answer #10	Describe the use of bioremediation in the cleanup of oil spills.	Biostimulation is the method most commonly used in bioremediation; an oil-adherent fertilizer that contains nitrogen and phosphorus is added to the spill to foster the growth of indigenous microbes.
Ch 30 Multiple Choice #1	A marked decrease in BOD during secondary treatment indicates a) lack of oxidation during treatment. b) effective aerobic decomposition during treatment. c) effective anaerobic decomposition during treatment. d) removal of all pathogenic bacteria. e) removal of all toxic chemicals.	B
Ch 30 Multiple Choice #2	Advanced treatment is often designed to remove a) BOD. b) nitrates and phosphates. c) bacteria. d) protozoa. e) methane.	B
Ch 30 Multiple Choice #3	Which of the following is not a matching pair? a) Potable water—presence of pathogens b) High BOD—high organic content c) Stabilized sludge—fertilizer d) Primary treatment—removal of material that settles e) Bulking—growth of filamentous bacteria	A
Ch 30 Multiple Choice #4	Which of the following is *false*? a) Bulking interferes with	A

	trickling filter systems. b) Artificial wetlands provide a habitat for wildlife. c) Removal of nitrates by microorganisms requires anaerobic conditions. d) Methane is a by-product of anaerobic digestion.	
Ch 30 Multiple Choice #5	Which of the following is not a matching pair? a) Surface water—watershed b) Groundwater—aquifer c) Sand and gravel filters—removes organic chemicals d) Alum—causes suspended material to coagulate e) Disinfection—chlorine, ozone, or ultraviolet light	C
Ch 30 Multiple Choice #6	Septic tanks should be placed a) as close to the well as possible. b) at least 500 feet from the house. c) under the house. d) in deep clay soil. e) where the outflow cannot contaminate any water supply.	E
Ch 30 Multiple Choice #7	Which of the following about coliform testing methods is *true*? a) All determine the number of *E. coli* present in a sample. b) The MPN procedure precisely indicates the concentration of coliforms. c) The media used test for the ability to ferment lactose. d) A positive test indicates that pathogens are definitely present in the sample. e) All coliforms hydrolyze ONPG and MUG.	C

Ch 30 Multiple Choice #8	Landfills are often used to dispose of a) household wastewater. b) commercial wastewater. c) solid wastes. d) petroleum wastes. e) wastewater effluent.	C
Ch 30 Multiple Choice #9	Backyard composting is an excellent way to dispose of a) cooking fats. b) garden debris. c) spoiled meats. d) insecticides. e) cleaning supplies.	B
Ch 30 Multiple Choice #10	Synthetic compounds are most likely to be biodegradable if they a) are totally different from anything found in nature. b) have three chlorine atoms per molecule. c) are plastics. d) are present in very large amounts. e) are chemically similar to naturally occurring substances.	E.
Ch 30 Applications #1	A developer is interested in building vacation homes on 150 acres of oceanfront property. A priority is to retain as much natural beauty of the area as possible. Safe and effective wastewater treatment must be part of the plan. What advantages and disadvantages of each of the following options must the developer consider before selecting one? a) Individual septic systems for each home b) Trickling filter system c) Constructed wetlands	Advantages of septic tanks are that each homeowner could have his own system, and lot owners who want to build later do not have to pay for a community system they won't be using for a while. It would be a real disadvantage if the soil on some of the lots were not suitable for drainage fields, because these lots would not be useable for construction and would have little value. A trickling filter should be effective. The disadvantage is that it requires maintenance and is probably not suitable for such a small community. Constructed wetlands could be used, with the advantage of making more but smaller lots and having an attractive common park and pond area. The

		disadvantage is maintenance and higher maintenance costs.
Ch 30 Applications #2	A public health official is investigating waterborne diseases in Illinois. She notes that over half of the cases of waterborne diseases originating from drinking water were caused by *Giardia lamblia.* Other data showed that most cases of gastroenteritis attributed to exposure to recreational waters were caused by *Cryptosporidium parvum.* What does this suggest about controlling waterborne diseases?	It suggests that parasites survive in water better than some other organisms. It also suggests that these parasites are more resistant to disinfection than other organisms.
Ch 30 Critical Thinking #1	Why is oil not degraded when in a natural habitat underground yet is susceptible to bioremediation in an oil spill?	Breakdown of the oil requires O_2.
Ch 30 Critical Thinking #2	The accompanying figure shows the effects of different treatments of drinking water on the incidence of typhoid fever in Philadelphia, 1890–1935. If filtration of drinking water caused such a dramatic decrease in the disease incidence, was it necessary to introduce chlorination a few years later? Why or why not? 	Filtration probably does not completely remove the typhoid microorganisms from the water. Moreover, microorganisms remaining in the water after filtration could possibly reproduce before the water reaches the consumer. Chlorination, as a second treatment, would eliminate the organisms from the water supply and prevent the disease being spread via drinking water.
Chapter 31		
Chapter 31 Short answer #1	What is the purpose of rennin in cheese-making?	The enzyme hastens protein coagulation.
Chapter 31 Short answer #2	What causes the bluish-green veins to form in blue cheese?	The macroscopic appearance of the molds used in the cheese

		production.
Chapter 31 Short answer #3	What causes the holes to form in Swiss cheese?	CO_2 gas produced during fermentation by *Propionibacterium shermanii.*
Chapter 31 Short answer #4	What is the difference between traditional acidophilus milk and sweet acidophilus milk?	Traditional acidophilus milk is fermented so it has a tangy taste due to the lactic acid that is produced. In sweet acidophilus milk, the culture is simply added just before the milk is packaged; because of the storage conditions (refrigeration), fermentation does not occur.
Chapter 31 Short answer #5	What is the purpose of the mashing step in beer-making?	During mashing, the enzymes of malted barley degrade starches, converting them to fermentable sugars.
Chapter 31 Short answer #6	Explain how *Alcaligenes* species cause "ropiness" in raw milk.	Some species synthesize a glycocalyx, causing strings of slime.
Chapter 31 Short answer #7	Explain the significance of *Aspergillus flavus* in grain products.	Some species produce aflatoxin, a potent carcinogen.
Chapter 31 Short answer #8	Explain the typical sequence of events that lead to botulism.	Improper canning processes do not destroy *Clostridium botulinum* endospores, which then germinate if the pH of the food is neutral. The vegetative cells multiply and produce botulinum toxin, which is one of the most lethal toxins known. Consumption of even small amounts of this neurotoxin can cause a fatal disease.
Chapter 31 Short answer #9	Explain the typical sequence of events that lead to staphylococcal food poisoning.	A *Staphylococcus aureus* carrier does not wash his or her hands before preparing a meal and thus inoculates the organism onto a food. The food is left at room temperature for several hours during which time *S. aureus* grows and produces a toxin. The toxin causes nausea and vomiting when it is consumed.
Chapter 31 Short answer #10	How does canning differ from pasteurization?	Canning uses a process that is designed to destroy all microorganisms that can grow under normal storage conditions;

		the resulting product is commercially sterile. Pasteurization significantly decreases the number of spoilage microbes and eliminates pathogens; however, viable organisms still remain.
Ch 31 Multiple Choice #1	The *a*w of a food product reflects which of the following? a) Acidity of the food b) Presence of antimicrobial constituents such as lysozyme c) Amount of water available d) Storage atmosphere e) Nutrient content	C
Ch 31 Multiple Choice #2	Most spoilage bacteria cannot grow below an *a*w of a) 0.3. b) 0.5. c) 0.7. d) 0.9. e) 1.0.	D
Ch 31 Multiple Choice #3	What is a generally minimum pH for growth and toxin production by *Clostridium botulinum* and other foodborne pathogens? a) 8.5 b) 7.0 c) 6.5 d) 4.5 e) 2.0	D
Ch 31 Multiple Choice #4	Benzoic acid is an antimicrobial chemical naturally found in which of the following foods? a) Apples b) Cranberries c) Eggs d) Milk e) Yogurt	B
Ch 31 Multiple Choice #5	Which of the following is often added to wine to inhibit growth of the natural microbial population of grapes? a) Benzoic acid b) Lactic acid c) Carbon dioxide d) Sulfur dioxide e) Oxygen	D
Ch 31 Multiple Choice #6	In the brewing process, the sugar and nutrient extract obtained by soaking	E

	germinated grain in warm water is called a) baker's yeast. b) hops. c) malt. d) must. e) wort.	
Ch 31 Multiple Choice #7	Which of the following genera is used in bread, wine, and beer production? a) *Lactobacillus* b) *Pseudomonas* c)*Saccharomyces* d) *Streptococcus* e) *Staphylococcus*	C
Ch 31 Multiple Choice #8	Which group of organisms most commonly spoils breads, fruits, and dried foods? a) *Acetobacter* b) Fungi c) Lactic acid bacteria d) *Pseudomonas* e) *Saccharomyces*	B
Ch 31 Multiple Choice #9	Which of the following organisms cause foodborne intoxication? a) *E. coli* O157:H7 b) *Campylobacter* species c) *Lactobacillus* species d) *Salmonella* species e) *Staphylococcus aureus*	E
Ch 31 Multiple Choice #10	Canned pickles require less stringent heat processing than canned beans, because pickles a) contain fewer nutrients. b) are more acidic. c) have a lower *a*w. d) contain antimicrobial chemicals. e) are less likely to be contaminated with endospores.	B
Ch 31 Applications #1	A small cheese-manufacturing company in Wisconsin is looking for ways to reduce the costs of disposing of whey, a cheese	The liquid whey is rich in nutrients and can be sold for many purposes. It has potential as feed for agricultural animals or can be used as a food additive for cereals,

	by-product. As a food microbiologist, what would you suggest that the company do with the thousands of liters of whey being produced per month so the company can actually profit from it?	breads and nutritional supplement drinks. Whey is also a good fermentation material for the production of alcohol.
Ch 31 Applications #2	A microbiologist is troubleshooting a batch of home-brewed ale that did not ferment properly. She noticed that the alcohol content was only 2%, well below the desired level. Microscopic examination showed numerous yeast cells. Chemical analysis indicated low levels of sugar, high levels of CO2, and large amounts of protein in the liquid. What did the microbiologist conclude as the probable cause of the beer not coming out properly?	The top of the fermentation vessel may not have been anaerobic. If O_2 were available, the top yeast could carry out aerobic respiration, generating additional CO_2 rather than alcohol.
Ch 31 Critical Thinking #1	It has been argued that the nature of the growth of fungi in Roquefort cheese, indicated by the appearance of bluish-green veins, is evidence that these fungi require O2 for growth. How does this evidence lead to the conclusion?	The fungi grow on the surface of cracks extending throughout the cheese. These cracks allow O_2 to diffuse from the outside environment throughout the extent of the crack. Thus, fungi are able to grow on the surface of the cracks because oxygen is available.
Ch 31 Critical Thinking #2	In the production of sauerkraut, a natural succession of lactic acid bacteria is observed growing in the product. What causes the succession? What does this tell you about the optimal growth conditions of the different species of lactic acid bacteria?	The first species of lactic acid bacteria that colonizes the sauerkraut probably does so because the optimal conditions of pH and nutrients exist for that particular species. As this organism grows, lactic acid is produced and changes the pH so that it is no longer optimal for this organism but is optimal for another lactic acid species. This second species now

		becomes dominant due to faster growth and produces more lactic acid. As the lactic acid production continues, the pH conditions become less than optimal for the second species but the pH now favors the growth of a third species. Thus, by their own metabolic action, the different bacteria create conditions that promote the succession of several species.

Figure number	Question	Answer
1.1	If the broth in Pasteur's swan-necked flasks had contained endospores, what results would have been observed?	Growth might occur in the flask without tipping if the spores were not killed by heating
1.2	What is the Golden Age of Microbiology?	The time period when most infectious disease causing microbes were identified and early work on viruses had begun.
1.3	Why might the gauze masks not protect against the influenza virus?	Viruses are small enough to pass through gauze
1.4	Why might so many of the "new" diseases first appear or be identified in the United States and Western European countries?	Methods for isolating and identifying the causative agents are more advanced in these countries
1.6	What general features of algae distinguish them from other eukaryotic microorganisms?	Algae are photosynthetic and so can harvest the energy of light.
1.7	What type of cells make up molds and mushrooms?	Eukaryotic cells
1.8	How do protozoa differ from both fungi and algae?	They do not have a cell wall
1.9	Why can viruses be so much smaller than cells and still replicate?	Viruses use the machinery and enzymes of the cells they invade to replicate
1.10	How does a viroid differ from a virus?	Viroids consist only of RNA whereas viruses consist of protein and RNA or DNA
1.11	Why are prions visible here when normal cellular proteins are not?	The prions in the fig. consist of protein aggregates.
1.12	The members of which two domains cannot be distinguished microscopically?	*Bacteria* and *Archaea*
1.13	Why is a logarithmic scale necessary when comparing sizes of members of the microbial world?	The range in size of members of the microbial world is so great that their sizes can only be compared on a logarithmic graph
Ch 2:		
2.1	How does the number of electrons in an atom compare to the number of protons?	They are the same.
2.2	How would the Lewis structure of hydrogen be different from that of carbon?	The symbol would be H and there would be only a single electron
2.3	Which of the ions in this figure is an anion, and which is a cation?	The anion is Cl- and the cation is Na+
2.4	In terms of its bonding properties, why is carbon such an important element in biological systems?	Having 4 valence electrons allows it to bond covalently with many other atoms.
2.5	Why is the oxygen atom in a water molecule more electron-rich than the hydrogen atoms?	It has a greater attraction for electrons than does the H atoms
2.6	Explain why two identical atoms joined by a covalent bond cannot form a hydrogen bond.	Neither of the atoms is electronegative, a requirement for hydrogen bonding.
2.7	Why would it be important for certain molecules to be held together by hydrogen bonds instead of covalent bonds?	-The weak bonds can break and reform readily and do not require the action of enzymes. They

		form the basis for recognition between molecules.
2.8	Why does water expand as it freezes?	The water molecules move further from one another
2.9	If water were not polar, would it dissolve sodium chloride? Explain.	No; dissolving depends on the hydrogen bonding between water molecules and the polar salt.
2.10	Does the H+ concentration increase or decrease when the pH drops from 5 to 4? What about the OH– concentration?	The H+ concentration increases and the OH- decreases when the pH drops from 5 to 4
2.11	Why are the bonds between the phosphate groups of ATP "high energy"?	The covalent bond joining the O and P in the first and second phosphate group and the same bond joining the second and third phosphate group.
2.12	What are the four major classes of macromolecules?	DNA, RNA, proteins and polysaccharides
2.13	Which portion of an amino acid is responsible for the unique properties of the molecule?	The side chain represented by the R group
2.14	What chemical groups characterize a hydrophobic amino acid? A hydrophilic amino acid?	Hydrophobic groups are C-H and C-S; Hydrophilic groups are C-OH and ionized amino and carboxyl groups.
2.15	Which form (l or d) is found in proteins?	The L form is found in proteins
2.16	What two chemical groups are involved in the formation of a peptide bond?	A carboxyl and amino group.
2.17	Which of the four levels of structure are especially important in determine the properties of a protein?	The primary structure
2.18	Which levels of protein structure determine the properties of domains?	The secondary structure which is determined by the primary structure
2.19	Describe two environmental conditions that can denature a protein.	Heat to temperatures near boiling and high pH
2.20	What is the major chemical difference between ribose and deoxyribose?	Ribose has a –OH group attached to carbon 2 whereas deoxyribose has a H atom
2.21	What is a structural isomer?	Two molecules that have the same atomic composition but the atoms are arranged differently, leading to different properties of the two molecules
2.22	When are the α and β forms not interconvertible?	Once the carbon atom is joined to another sugar molecule
2.23	What type of reaction would reverse the step shown in this diagram?	The addition of water; a hydration reaction
2.24	Where are the three polysaccharides shown found in nature?	Cellulose is found in the trunks of trees; glycogen is the storage form of glucose found in many animals and dextran is a storage form of glucose found in bacteria.
2.25	What are the three components of a nucleotide?	-the sugar ribose or deoxyribose, a purine or pyrimidine (nucleobase) and a phosphate molecule

2.26	Which of the nucleobases are found in DNA? In RNA?	In DNA, the nucleobases are adenine, guanine, cytosine and thymine. In RNA, uracil replaces thymine.
2.27	What parts of the nucleotides are joined together?	A bond forms between the sugar and phosphate
2.28	Which would require a higher temperature to denature—a DNA strand composed primarily of A-T base pairs or one that is the same length but composed primarily of G-C base pairs?	The number of hydrogen bonds joining each guanine to cytosine is more that joining adenine to thymine so a higher temperature is required to denature the DNA containing the higher G-C DNA
2.29	What characteristic of the fat in this figure makes it a triglyceride?	Three fatty acids are joined to the glycerol making it a triglyceride.
2.30	What about the structure of a phospholipid makes one portion hydrophilic and the other hydrophobic?	The polar head group contains primarily ionized atoms making it hydrophilic; the tail of the fatty acids consist of C-H groups, which confer hydrophobic properties on this portion of the molecule.
2.31	Why are steroids classified as lipids?	They are insoluble in water..
Ch 3:		
3.1	What are the two sets of magnifying lenses called, and how do these relate to total magnification?	Objective lens and ocular lens. The total magnification is the product of each lens' magnification.
3.2	Which type of microscope—a light microscope or an electron microscope—has the higher resolving power?	Electron microscope
3.3	What would the pencil in part (a) look like if oil were in the glass instead of water?	It would not look bent, because oil has the same refractive index as glass
3.4	How does a dark-field microscope increase contrast?	It illuminates the object from the side, and therefore the object stands out against a dark background
3.5	How does a phase-contrast microscope increase contrast?	It amplifies the slight difference between the refractive index of dense material and that of the surrounding medium
3.6	How does a DIC microscope increase contrast?	Like the phase contrast microscope, it amplifies the slight difference between the refractive index of dense material and that of the surrounding medium; it has a device that separates light into two beams that pass through the specimen and then recombine, causing the image to appear three dimensional
3.7	What is an epifluorescence microscope?	A fluorescence microscope that projects UV light onto the specimen rather than through it.
3.8	How is multiphoton microscopy different from confocal microscopy?	It uses lower energy light
3.9	Some electron micrographs are “color enhanced.” What does this mean?	The normally black and white image is artificially colored.
3.10	How is thin-sectioning different from freeze-etching?	In thin-sectioning, the specimen is treated with a preservative, dehydrated, and then embedded in plastic before cutting it into exceptionally thin slices In freeze etching, the specimen is rapidly frozen, fractured by hitting it with a knife blade, and dried slightly under vacuum to allow underlying regions to be exposed, before the section is coated with a layer of carbon to create a replica of the surface.
3.11	In what way is scanning electron microscopy different from transmission electron microscopy?	In SEM a beam of electrons scans back and forth over the surface of the specimen. In TEM a beam of electrons either pass through the specimen or are scattered.
3.12	How does the resolving power of atomic force microscopy compare to that of electron	12. the resolving power of the atomic force microscope is much greater than that of an electron microscope

	microscopy?	
3.13	What is the purpose of heating the smear?	It fixes (attaches) the smear to the slide
3.14	Which step of the Gram stain is most critical with respect to timing?	Decolorization with alcohol
3.15	What characteristic of Mycobacterium cells makes them acid-fast?	They have a high concentration of mycolic acid, a waxy fatty acid.
3.16	How is the India ink capsule stain an example of a negative stain?	It stains the background, not the cells.
3.17	What color would Escherichia coli cells be with the endospore stain shown in the photo?	Pink
3.18	How can the flagella stain be helpful in identifying bacteria?	Bacteria that have flagella can have them in different arrangements, so the presence and distribution can be used as identifying features
3.19	How can fluorescent dyes and tags be used to identify bacteria?	Some fluorescent dyes bind to compounds found in only certain cells; also, a fluorescently labeled antibody can be used to tag unique proteins that identify a specific bacterium.
3.20	What are the two most common shapes of bacteria?	Rods and cocci
3.21	Why would aquatic microbes need maximal surface area?	They grow in dilute environments so they need a large surface area to absorb nutrients more easily
3.22	Why would aquatic microbes need maximal surface area?	The number of planes in which the cell divides.
3.23	How does the function of the cytoplasmic membrane differ from that of the cell wall?	The cytoplasmic membrane is the permeability barrier that defines the boundary of the cell whereas the cell wall provides the strength to keep the cell from lysing
3.24	Which part of the membrane is hydrophobic?	The region between the two phosopholipid layers, where the hydrophobic tails come together
3.25	What might happen in part (a) if the cell wall were weakened?	They are repelled by the hydrophobic interior of the membrane.
3.26	Which part of the membrane is hydrophobic?	The cell would burst.
3.27	Why is proton motive force a form of energy?	It is an electrochemical gradient, meaning that there's a separation of chemicals as well as electric charges (positively-charged protons and negatively changed hydroxyl groups), analogous to a battery.
3.28	What types of molecules do prokaryotic cells bring in?	Small molecules such as sugars and amino acids, which serve as nutrients.
3.29	Why is facilitated diffusion relatively uncommon in prokaryotes?	Because prokaryotes typically grow in dilute solutions, so nutrients must be moved against the concentration gradient.
3.30	Why would a cell secrete enzymes rather than bring intact macromolecules into the cell?	Macromolecules are too large to transport across the membrane, so instead cells secrete enzymes to break the molecules down, and they then transport the resulting subunits into the cell.
3.31	Why is peptidoglycan medically important?	It is unique to bacteria, so it provides a target for antimicrobial medications.
3.32	What connects the glycan chains in peptidoglycan?	Covalent bonds form between tetrapeptide chains of adjacent NAM molecules
3.33	Why is lipopolysaccharide medically significant?	The lipid A portion is recognized by the body's defense system, and the response can be life-threatening if too vigorous. The composition of the O-antigen varies, so it can be used to distinguish different bacteria.
3.34	Would lysozyme or penicillin affect M. pneumoniae?	No, because the bacterium lacks peptidoglycan.
3.35	What is the function of capsules and slime layers?	In many cases, attachment. Some capsules allow bacteria to avoid the host defense systems.
3.36	How can flagella affect a microbe's ability to cause disease?	Flagella can propel bacteria through mucous layers that otherwise prevent invasion.
3.37	What is the role of flagellin?	It is the structural subunit that makes up the filament.
3.38	What mechanism causes a cell to tumble?	The switch from counterclockwise rotation of flagella to clockwise
3.39	Why would magnetotaxis benefit a cell?	They move downward, into the sediments where O_2 levels are low

3.40	How does the structure and function of pili compare to that of flagella?	Both consist of subunits arranged helically to form a long molecule with a hollow core, but pili are considerably thinner and shorter.
3.41	What is the gel-like region formed by the chromosome called?	Nucleoid
3.42	What is the function of ribosomes?	Facilitates protein synthesis
3.43	How would storage granules benefit a cell?	They Allow an organism to store nutrients it has in relative excess
3.44	What is the function of an endospore?	It is a survival form; it survives heating, drying, and lack of nutrients.
3.45	Approximately how long does the sporulation process take?	About 8 hours
3.46	Which organelle contains the cell's genetic information?	Nucleus
3.47	The lumen is which part of an organelle?	The inside
3.48	How is pinocytosis different from phagocytosis?	Pinocytosis takes in liquids; phagocytosis takes in in particulate matter.
3.49	What is the role of actin filaments?	Movement of the cell's cytoplasm
3.50	How is the structure of a eukaryotic flagellum different from its prokaryotic counterpart?	Eukaryotic flagella are composed of long microtubules and are technically inside of the cell because they are covered by the plasma membrane; prokaryotic flagella are composed of protein subunits anchored to the cell wall and membrane.
3.51	What is the function of nuclear pores?	They allow large molecules to be transported in and out of the nucleus
3.52	What were the first pieces of evidence that led scientists to conclude that mitochondria evolved from bacterial cells?	They have 70S ribosomes and divide by binary fission.
3.53	Chloroplasts evolved from which group of bacteria?	Cyanobacteria
3.54	What causes the bumpy appearance of the rough endoplasmic reticulum?	Ribosomes attached to the surface
3.55	How are the modified macromolecules transported from the Golgi apparatus to other sites?	In vesicles
Ch 4:		
4.1	How does the process of binary fission relate to the generation time?	During binary fission, one cell divides to become two cells; those two divide to become four; those four divide to become eight, and so on. Generation time is the time that it takes a population to double in number, so it is the time required for the cell to divide.
4.2	Why would microbes in biofilms be more resistant to antibiotics and disinfectants than their planktonic counterparts?	The EPS shields the cells from the harmful chemicals.
4.3	What are extracellular polymeric substances (EPS)?	Hydrophilic polymers including polysaccharides and DNA.
4.4	What is the purpose of agar in the medium?	It is a gelling agent used to solidify media.
4.5	What is the purpose of obtaining isolated colonies?	To obtain a pure culture. An isolated colony likely contains only cells descended from a single cell, in which case it would be a pure culture.
4.6	During which phase is generation time measured?	Log (exponential) phase
4.7	What is the most commercially valuable secondary metabolite?	Antibiotics
4.8	Most pathogens fall into which group on this chart?	Mesophiles
4.9	What is plasmolysis?	Dehydration of the cytoplasm, causing it to shrink from the cell wall.
4.10	Which type of hemolysis characterizes Streptococcus pyogenes, the bacterium that	Beta hemolysis

	causes strep throat?	

MicroAssessment number (Question#)	Question	Answer
1.1 (1)	Give two reasons why it took so long to disprove spontaneous generation.	(1) Heat resistant spores were present in some broths, and (2) some stoppers (corks) used to seal flasks were not effective.
1.1 (2)	What experiment disproved the notion that a "vital force" in air was responsible for spontaneous generation?	Pasteur's experiment showing that sterile medium in swan necked flasks open to the air would remain sterile indefinitely if they were not tipped.
1.1 (3)	What conclusions could Tyndall reach on the properties of the agent that entered the broth from hay?	They were not killed by heating and they were not visible to the naked eye.
1.2 (4)	Describe two microbial activities essential to life and three that make our lives more comfortable.	Essential activities—(1) Conversion of nitrogen of the air into a form that is useable by plants and animals, and (2) replenishment of O_2 in the atmosphere by photosynthetic microorganisms. Non-essential activities—(1) Synthesis of many products used in every day life (amino acids, vitamins, etc), (2) involvement in food and beverage production, and (3) degradation of environmental pollutants
1.2 (5)	Describe three reasons why some diseases re-emerge.	Diseases re-emerge because: (1) Reduction of vaccination against certain diseases, (2) diseases under control by antimicrobial medications become resistant to the medications, and (3) the aging population is more susceptible to infectious diseases
1.2 (6)	Why would it seem logical, even inevitable, that at least some	The human body is an ecological location that

	bacteria would attack the human body and cause disease?	provides many of the requirements that bacteria require to grow. Organisms that have the ability to invade our cells or damage our tissues have access to additional nutrients.
1.3 (7)	Name one feature that distinguishes members of the Bacteria from the Archaea.	Bacteria contain the unusual compound peptidoglycan in their cell wall whereas the Archea do not.
1.3 (8)	List two features that distinguish prokaryotes from eukaryotes.	(1) Prokaryotes have no true nucleus; eukaryotes do, and (2) prokaryotes rarely, if ever have membrane bounded internal structures
1.3 (9)	The binomial system of classification uses both a genus and a species name. Why are two names used?	The genus name identifies a group of organisms that share features in common. The species name separates organisms in the genus into individuals that differ in their individual properties from all other organisms in the genus. To identify a specific organism requires both names
1.4 (10)	Describe the chemical composition of viruses, viroids, and prions.	Viruses consist of a protein coat surrounding either DNA or RNA; viroids consist of only RNA; and prions consist of only protein
1.4 (11)	Which of the non-living members of the microbial world seems to be the least threat to human health?	Viroids have not been shown to cause any human disease and prions are responsible rarely for diseases in humans.
1.5 (12)	Place in order with respect to typical size (arrange from smallest to largest) bacteria, eukaryotic cells, and viruses.	Viruses, bacteria, eukaryotic cells
1.5 (13)	What factor limits the size of free-living cells?	Free living organisms must have the necessary equipment to sustain life, including all of the required

		macromolecules. They must be large enough to contain these macromolecules.
Chapter 2		
2.1 (#1)	Why are electrons not considered in determining the mass number of an element?	They are too light to contribute to the atomic mass
2.1 (#2)	What is the "octet rule" and its biologically important exception?	Atoms of biological importance contain a maximum of 8 electrons in their outer shell to achieve maximum stability.The exception is the H atom which has only a single shell which is filled with a maximum of 2 electrons.
2.1 (#3)	Why is the energy level of an electron higher the farther it is from the nucleus?	The further from the nucleus, the less attraction from the protons in the nucleus
2.2 (#4)	Compare the relative strengths of covalent, hydrogen, and ionic bonds.	Covalent bonds are the strongest; hydrogen and ionic bonds are far weaker in an aqueous solution,. In a solid compound, ionic bonds are strong.
2.2 (#5)	Which type of bond requires an enzyme to break it?	Covalent bond
2.2 (#6)	Which type of bond requires an enzyme to break it?	The loss of a negative charge gives the uncharged atom a positive charge. The proton in the nucleus gives the atom the positive charge.
2.3 (#7)	Why is water a polar molecule? Give two examples of why this property is important in microbiology.	Because the oxygen atom has a greater attraction for electrons than does the hydrogen atom. Because of this polarity, water is an excellent solvent and liquid water is denser than ice, so ice floats.
2.3 (#8)	Name the four important classes of large molecules in cells.	Nucleic acids, proteins, polysaccharides and lipids
2.3 (#9)	In pure water, what must be done to	Add an acidic material (H+

	decrease the OH- concentration? To decrease the H+ concentration?	) to decrease the OH- concentration. Add a base (OH-) to decrease the H+ concentration.
2.4 (#10)	What type of bond joins amino acids to form proteins?	Peptide bond which is a covalent bond
2.4 (#11)	Describe five roles of proteins.	Acidic and basic amino acids.
2.4 (#12)	What elements must all amino acids contain? What element will only some amino acids contain?	All amino acids contain C,H,O,N; some amino acids contain S
2.5 (#13)	Distinguish between structural isomers and stereoisomers.	A structural isomer contains the same atoms in the same concentrations but they are arranged differently in the molecule. A stereoisomer is a mirror image of another molecule resulting from the C atom being joined to four different atoms
2.5 (#14)	What is the general name given to a single sugar? How can single sugars differ from another?	Monosaccharide. Monosaccharides can differ from one another in the number of atoms they contain, the arrangement of the atoms, what functional groups they contain, whether they are in a ring or linear form, and the relative position oft he –OH group joined to the number 1 carbon atom (alpha or beta form).
2.5 (#15)	How can you distinguish sucrose and lactose from a protein molecule by identifying the elements in the molecules?	The two sugars do not contain any N atoms whereas the protein molecule does.
2.6 (#16)	How do the nucleotides of DNA differ from those of RNA?	DNA contains thymine whereas RNA contains uracil.
2.6 (#17)	How does the structure of DNA differ from that of RNA?	DNA is a long double stranded helix in which the two strands are held together by many hydrogen bonds. RNA is a much

		shorter single stranded molecule with little, if any hydrogen bonding.
2.6 (#18)	If the DNA molecule were placed in boiling water, how would the molecule change?	The molecule would denature into single strands because of the breakage of the hydrogen bonds holding the two strands together.
2.7 (#19)	What are the main functions of lipids in cells?	They prevent the entrance into the cell and the exit out of the cell of hydrophilic molecules. As a small molecule, water can enter and exit.
2.7 (#20)	What features in the chemical composition of phospholipids make them ideal components of the cytoplasmic membrane?	The two layers of phospholipids give the membrane different properties. The outer hydrophilic layers are in contact with the aqueous region of the outside environment and the internal contents of the cell. The opposing layers of fatty acids face inward and prevent water soluble molecules from entering or exiting.
2.7 (#21)	How could you determine if a solid compound were a lipid or a carbohydrate based on its solubility properties?	A lipid is insoluble in water whereas a carbohydrate is soluble.
Chapter 3		
3.1 (#1)	Why must oil be used to obtain the best resolution with a 100× lens?	Oil displaces the air, so that the light does not refract as it travels to the lens.
3.1 (#2)	What are some drawbacks of electron microscopes?	They are expensive and bulky, and specimen preparation is time consuming and difficult.
3.1 (#3)	If an object being viewed under the phase-contrast microscope has the same refractive index as the background material, how would it appear?	It would be difficult to see because the phase contrast microscope amplifies differences in the refractive index.
3.2 (#4)	What are the functions of a primary stain and a counterstain?	The primary stain dyes all cells, and the counterstain dyes the cells that were rendered colorless by the

		decolorizing agent.
3.2 (#5)	Describe one error in the staining procedure that would result in a Gram-positive bacterium appearing pink.	Overdecolorizing is the most common error, and it would result in a Gram-positive bacterium appearing pink. Forgetting the primary stain would give the same result.
3.2 (#6)	What color would a Gram-negative bacterium be in an acid-fast stain?	Blue. All cells other than acid-fast ones are blue.
3.3 (#7)	What shape are Escherichia coli cells?	Rods
3.3 (#8)	What determines whether a group of dividing cells will form chains or clusters?	Some cells stick together following division, and the number of planes in which the cells divide determines the groupings.
3.4 (#9)	Explain the fluid mosaic model.	The lipid bilayer is a liquid, so proteins can move around in the membrane.
3.4 (#10)	Name three molecules that pass freely through the lipid bilayer.	Gases, small hydrophobic molecules, and water
3.4 (#11)	Why do the protons ejected by the electron transport system stay close to the membrane, rather than float away?	The hydroxyl ions, which are negatively charged, attract the positively charged protons.
3.5 (#12)	Why do the protons ejected by the electron transport system stay close to the membrane, rather than float away?	Prokaryotes typically grow in very dilute environments, so transport systems that expend energy must be used to move substances into the cell (up the concentration gradient)
3.5 (#13)	Why would a cell need to secrete proteins?	Cells secrete proteins to break down extracellular macromolecules so that the components subunits can then be brought into the cell. Cells also need to secrete proteins to make extracellular structures such as flagella.
3.5 (#14)	Can you argue that group translocation is a form of active transport?	Yes. A high-energy phosphate bond is expended to bring the substance into the cell.
3.6 (#15)	What is the significance of lipid A?	It is the part of the LPS molecule that is recognized by our host defenses; when large amounts accumulate (such as in a bloodstream infection), the response by the defense system itself can be deadly.
3.6 (#16)	How does the action of penicillin differ from that of lysozyme?	16. Penicillin interferes with the synthesis of peptidoglycan (prevents the cross-linking

		from occurring), whereas lysozyme breaks bonds that connect the NAG and NAM subunits

Chapter # and Question type	**Question**	**Answer**
Chapter 1 Short answer #1.	How did Louis Pasteur help disprove spontaneous generation?	Pasteur demonstrated that swan necked flasks containing sterile growth medium would remain sterile indefinitely if the bend in the flask did not come in contact with the medium.
Chapter 1 Short answer #2.	Give three reasons why life could not exist without the activities of microorganisms.	• Nitrogen would not be available in a form that humans and plants could use. • The supply of oxygen would be depleted after about 20 years if microorganisms were not available to replenish it. • A wide variety of materials would pile up if microorganisms were not present to degrade them.
Chapter 1 Short answer #3.	List five beneficial applications of bacteria.	• Their role in food and beverage production • Role in pollutant degradation • Synthesis of commercially valuable products • Their importance in synthesizing medically important products, following genetic modification • Their importance as model organisms for the study of universal biological processes
Chapter 1 Short answer #4.	State three reasons why there is a resurgence of infectious diseases today.	• Aging population is more susceptible to disease • Organisms controlled by antimicrobial medications have become resistant to the medications • Children are not being routinely vaccinated against many diseases
Chapter 1 Short answer #5.	Name the prokaryotic groups in the microbial world.	*Bacteria* and *Archaea*

Chapter 1 Short answer #6.	Name one location where you could isolate members of the Archaea.	The hot springs of Yellowstone National Park
Chapter 1 Short answer #7.	How might you distinguish a prokaryotic cell from a eukaryotic cell?	The prokaryotic cell does not have a nucleus whereas the eukaryotic cell does.
Chapter 1 Short answer #8.	In the designation *Escherichia coli* B, what is the genus? What is the species? What is the strain?	*Escherichia* is the genus; *coli* is the species and *B* is the strain.
Chapter 1 Short answer #9.	Why are viruses not microorganisms?	. Viruses do not have all of the machinery necessary to live and so they must use that of a host cell in order to replicate.
Chapter 1 Short answer #10.	Name three non-living groups in the microbial world and describe their major properties.	• Viruses contain a protein coat and either DNA or RNA. They are obligate intracellular parasites of all forms of life. • Viroids contain only a short RNA molecule. They cause serious plant diseases Prions consist only of protein that is a misfolded version of normal cellular protein found in the brain of animals. They are resistant to the commonly used sterilizing procedures that kill viruses and bacteria. They are responsible for fatal neurological diseases
Chapter 1 Multiple Choice #1	The property of endospores that led to confusion in the experiments on spontaneous generation is their a) small size. b) ability to pass through cork stoppers. c) heat resistance. d) presence in all infusions. e) presence on cotton plugs.	. (C)
Chapter 1 Multiple Choice #2	The "Golden Age of Microbiology" was the time when a) microorganisms were first used to make bread. b) microorganisms were first used to make cheese.	. (C)

	c) most pathogenic bacteria were identified. d) a vaccine against influenza was developed. e) antibiotics became available.	
Chapter 1 Multiple Choice #3	Microorganisms play a role in a) disease. b) biodegradation. c) cheese production. d) nitrogen recycling. e) all of the above.	(E)
Chapter 1 Multiple Choice #4	Which disease was once thought to be due to stress but is now known to be caused by a bacterium? a) smallpox b) peptic ulcers c) AIDS d) plague e) influenza	. (B)
Chapter 1 Multiple Choice #5	The prokaryotic members of the microbial world include 1. algae. 2. fungi. 3. prions. 4. bacteria. 5. archaea. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	(D)
Chapter 1 Multiple Choice #6	The Archaea 1. are microscopic. 2. are commonly found in extreme environments. 3. contain peptidoglycan. 4. contain mitochondria. 5. are most commonly found in the soil. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	(A)
Chapter 1 Multiple Choice #7	Prokaryotes typically do not have a) cell walls. b) flagella. c) a nuclear membrane. d) specific shapes. e) genetic information.	. (C)
Chapter 1 Multiple Choice #8	Nucleoids are associated with 1. genetic information. 2. prokaryotes. 3. eukaryotes. 4. viruses. 5. prions. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	. (A)
Chapter 1 Multiple Choice # 9	Viruses 1. contain both protein and nucleic acid.	(A)

	2. infect all domains of life. 3. can grow in the absence of living cells. 4. are generally the same size as prokaryotes. 5. always kill the cells they infect. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	
Chapter 1 Multiple Choice #10	Antony van Leeuwenhoek could not have observed a) roundworms. b) Escherichia coli. c) yeasts. d) viruses.	(D)
Chapter 1 Applications #1	The American Society for Microbiology is preparing a "Microbe-Free" banquet to emphasize the importance of microorganisms in the diet. What foods could not be on the menu?	. Nothing would be available to eat. Microorganisms are needed for crop production, so vegetables or fruits would not be available to eat. Cattle, chickens, pigs and other animals need microorganisms to assist with the digestion of food. They would be undernourished and not provide quality meat or products adequate for human consumption. Do not look for fish or any other lake or ocean products because these ecosystems are needed for their survival. Milk and alcoholic beverages would be off the menu. Any beverage prepared with water would be unsafe to consume. Water is cleaned and treated to be disease-free with microorganisms.
Chapter 1 Applications #2	If you were asked to nominate one of the individuals mentioned in this chapter for the Nobel Prize, who would it be? Make a statement supporting your choice.	Any answer that is supported.
Chapter 1 Critical Thinking #1	A microbiologist obtained two pure biological samples: one of a virus, and the other of a viroid. Unfortunately, the labels had been lost. The microbiologist felt she could distinguish the two by analyzing for the presence or absence of a single molecule.	Test for proteins.

	What molecule would she search for and why?	
Chapter 1 Critical Thinking #2	Why is the bacterium that causes anthrax such an effective agent of bioterrorism?	Spores, in general, are an effective agent of bioterrorism because they are environmentally tough, "invisible" and can be readily delivered through the air, all of which enables them to potentially infect large numbers of people easily.
Chapter 2		
Chapter 2 Short Answer #1	Differentiate between an atom, a molecule, and a compound.	An atom is the basic unit of all matter. A molecule is composed of two or more atoms joined through chemical bonds. A compound consists of molecules of two or more different elements.
Chapter 2 Short Answer #2	Why is water a good solvent?	Because of its polar nature, water can form hydrogen bonds with all all polar molecules thereby preventing the association of the atoms comprising the molecules.
Chapter 2 Short Answer #3	Which solution is more acidic, one with a pH of 4 or a pH of 5? What is the concentration of H+ ions in each? The concentration of OH- ions?	A pH of 4 is more acidic. A solution of 4 has a H+ concentration of 10-4 and a 10-10 0H- concentration.A solution with a pH of 5 has a H+ concentration of 10-5 and an 0H concentration of 10-9.
Chapter 2 Short Answer #4	Name the subunits of proteins, polysaccharides, and nucleic acids.	Subunits of proteins are amino acids; subunits of polysaccharides are monosaccharides; subunits of nucleic acids are nucleotides
Chapter 2 Short Answer #5	Give an example of dehydration synthesis. Give an example of a hydrolysis reaction. How are these reactions related?	Dehydration synthesis is involved in the joining together of two amino acids with the loss of water in the chemical reaction. Hydrolysis is involved in the splitting part of the two amino acidswith the addition of H+ to one amino acid and OH- to the other. Dehydration synthesis is the reverse of hydrolysis.
Chapter 2 Short Answer #6	List four functions of proteins.	Catalyse enzymatic reactions Move the cell Serve as components of certain cell

		structures Turn genes off and on
Chapter 2 Short Answer #7	What are the four levels of protein structure, and what is the distinguishing feature of each?	Primary structure—The sequence of amino acids comprising the protein Secondary structure—The three--dimensional shape of localized regions Tertiary structure---The three—dimensional shape of the entire molecule Quarternary structure—The three-dimensional shape of a protein molecule consisting of more than one polypeptide chain.
Chapter 2 Short Answer #8	How do the two types of nucleic acids differ from one another in (a) composition, (b) size, and (c) function?	(a) DNA contains deoxyribose; RNA contains ribose. (b)DNA is much longer than RNA (c) DNA codes for all of the genetic information of the cell. RNA is involved in decoding the information in DNA.
Chapter 2 Short Answer #9	What are the two major groups of lipids? Give an example of each group. What feature is common to all lipids?	Simple and compound Fats are simple lipids; phospholipids are compound. All lipids are insoluble in water.
Chapter 2 Short Answer #10	What features do all lipids share?	All lipids are heterogeneous in their chemical composition and insoluble in water but soluble in organic solvents.
Chapter 2 Multiple Choice #1	Choose the list that goes from the lightest to the heaviest: a) proton, atom, molecule, compound, electron. b) atom, proton, compound, molecule, electron. c) electron, proton, atom, molecule, compound. d) atom, electron, proton,	C

	molecule, compound. e) proton, atom, electron, molecule, compound.	
Chapter 2 Multiple Choice #2	The strongest chemical bonds between two atoms in solution are a) covalent. b) ionic. c) hydrogen bonds. d) hydrophobic interactions.	. A
Chapter 2 Multiple Choice #3	Dehydration synthesis is involved in the synthesis of all of the following except a) DNA. b) proteins. c) polysaccharides. d) lipids. e) monosaccharides.	. E
Chapter 2 Multiple Choice #4	The primary structure of a protein relates to its a) sequence of amino acids. b) length. c) shape. d) solubility. e) bonds between amino acids.	A
Chapter 2 Multiple Choice #5	Pure water has all of the following properties except a) polarity. b) ability to dissolve lipids. c) pH of 7. d) covalent joining of its atoms. e) ability to form hydrogen bonds.	. B
Chapter 2 Multiple Choice #6	The macromolecules that are composed of carbon, hydrogen, and oxygen in an approximate ratio of 1:2:1 are a) proteins. b) lipids. c) polysaccharides. d) DNA. e) RNA.	. C
Chapter 2 Multiple Choice #7	In proteins, α helices and β pleatedstructures are associated with the a) primary structure. b)	. B

	secondary structure. c) tertiary structure. d) quaternary structure. e) multiprotein complexes.	
Chapter 2 Multiple Choice #8	Complementarity plays a major role in the structure of a) proteins. b) lipids. c) polysaccharides. d) DNA. e) RNA.	D
Chapter 2 Multiple Choice #9	A bilayer is associated with a) proteins. b) DNA. c) RNA. d) complex polysaccharides. e) phospholipids.	D.
Chapter 2 Multiple Choice #10	Isomers are associated with 1. carbohydrates. 2. amino acids. 3. nucleotides. 4. RNA. 5. fatty acids. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	. A
Chapter 2 Applications #1	A group of prokaryotes known as thermophiles thrive at high temperatures that would normally destroy other organisms. Yet these thermophiles cannot survive well at the lower temperatures normally found on the earth. Propose an explanation for this observation.	The enzymes can function well at the high temperatures but function poorly at the lower temperatures.
Chapter 2 Applications #2	Microorganisms use hydrogen bonds to attach to surfaces. Many of the cells lose hold of the surface because of the weak nature of these bonds. Contrast the benefits and disadvantages of using covalent bonds as a means of attaching to surfaces.	The weak hydrogen bonds allow the organisms to detach and reattach very quickly and so the organisms can respond very quickly to changing conditions in the environment. Further, very little energy is required to attach and detach from surfaces.
Chapter 2 Critical Thinking #1	What properties of the carbon atom make it ideal as the key atom for all molecules in organisms?	Carbon is the major building block of all matter because it can form four covalent bonds with other atoms including carbon atoms. Since these bonds can be single, double or triple bonds, with a variety of elements, a wide variety of different molecules can be formed. The bonds can be polar or non polar so a wide variety of molecules with different weak

		bonding properties can be formed.
Chapter 2 Critical Thinking #2	A biologist determined the amounts of several amino acids in two separate samples of pure protein. The data are shown here: **Amino Acid Leucine Alanine Histidine Cysteine Glycine** Protein A 7% 12% 4% 2% 5% Protein B 7% 12% 4% 2% 5% The scientist concluded that protein A and protein B were the same protein. Do you agree with this conclusion? Justify your answer.	No. The amino acids might be arranged differently so the two proteins would be quite different and have different properties.
Chapter 2 Critical Thinking #3	This table indicates the freezing and boiling points of several molecules: **Molecule Freezing Point (°C) Boiling Point (°C)** Water 0 100 Carbon tetrachloride (CCl_4) – 23 77 Methane (CH_4) – 182 – 164 Carbon tetrachloride and methane are non-polar molecules. How does the polarity and non-polarity of these molecules explain why the freezing and boiling points for methane and carbon tetrachloride are so much lower than those for water?	Because of the hydrogen bonding between water molecules, much energy is required in the form of heat to break the bonds and convert the liquid into a gas. If there is no hydrogen bonding between molecules, less energy (a lower temperature) is required. Further, as the temperature drops, weak hydrogen bonds between water molecules are broken less frequently until a crystalline structure (ice) is formed in which hydrogen bonding between molecules is most stable. Molecules that can not form hydrogen bonds between molecules must reach lower temperatures to achieve stability between molecules and form a crystalline structure.
Chapter 3		
Chapter 3 Short Answer #1	Explain why resolving power is important in microscopy.	The resolving power, which is the minimum distance that can exist between two objects when those objects can still be observed as separate entities, determines how much detail actually can be seen.
Chapter 3 Short Answer #2	Explain why basic dyes are used more frequently than	Basic dyes carry a positive charge; opposite charges attract, so these

	acidic dyes in staining.	dyes are drawn to the many negatively charged components of cells, including nucleic acid and many proteins. Acidic dyes carry a negative charge and are repelled by those cell components.
Chapter 3 Short Answer #3	Describe what happens at each step in the Gram stain.	#1 Crystal violet is the primary stain, entering the cytoplasm and imparting a color to all cells that can be stained. #2 Iodine complexes with the crystal violet within the cell, acting as a "mordant" to enhance the affinity of the cellular components for a dye. #3 Acetone/alcohol removes the crystal violet-iodine complex from Gram-negative cells making them colorless. #4 Safranin serves as a counterstain that imparts a pink color to the otherwise colorless Gram-negative cells.
Chapter 3 Short Answer #4	Compare and contrast ABC transport systems with group translocation.	An ABC transport system is an active transport mechanism that requires the energy of ATP to drive the accumulation of molecules against a concentration gradient; the process does not alter the transported molecule. Group translocation chemically alters a molecule during passage, often by phosphorylating it; the energy expended to phosphorylate the molecule can be regained when that sugar is later broken down to provide energy.
Chapter 3 Short Answer #5	Give two reasons why the outer membrane of Gram-negative bacteria is medically significant.	#1 The outer membrane prevents entry of important antimicrobial drugs such as vancomycin. #2 The Lipid A component of lipopolysaccharide (LPS) is responsible for many of the

		symptoms associated with Gram-negative infections, which is why the LPS-containing outer membrane is called endotoxin.
Chapter 3 Short Answer #6	Compare and contrast penicillin and lysozyme.	Penicillin interferes with the synthesis of peptidoglycan; it binds to proteins involved in cell wall synthesis (penicillin-binding proteins). This prevents the cross-linking of adjacent glycan chains. Lysozyme destroys existing bonds in the glycan chain; it breaks the bond that links the alternating *N*-acetylglucosamine and *N*-acetylmuramic acid molecules. Both penicillin and lysozyme result in a weakened cell wall, ultimately causing the cell to lyse. However, penicillin works only on actively growing cells, while lysozyme can cause lysis of both growing and nongrowing cells.
Chapter 3 Short Answer #7	Describe how a plasmid can help a cell.	Plasmids encode genetic characteristics such as antibiotic resistance that may be advantageous in certain situations. However, excess genetic information can slow a cell's replication, which can put the cell at a competitive disadvantage when the information does not provide an advantage.
Chapter 3 Short Answer #8	How is an organ different from tissue?	Cells of plants and animals function in cooperative associations called tissues; examples include muscle, connective, nerve, epithelial, blood and lymphoid. Combinations of various tissues function together to make up larger units, organs, including skin, heart and liver.
Chapter 3 Short Answer #9	How is receptor-mediated endocytosis different from phagocytosis?	Receptor-mediated endocytosis allows cells to internalize relatively small extracellular molecules that

		bind to the cell's receptors. Certain regions of the cell membrane are lined with a protein called clathrin and studded with receptors. These regions are internalized to form an endocytic vesicle, bringing with them the receptors along with their bound ligands. In contrast, phagocytosis allows a cell to bring in relatively large particles, including bacteria. The cells send out arm-like extensions, pseudopods, which surround and enclose extracellular material. This action envelopes the material, bringing it into the cell in an enclosed compartment called a phagosome.
Chapter 3 Short Answer #10	Explain how the Golgi apparatus cooperatively functions with the endoplasmic reticulum.	Macromolecules such as proteins and lipids are synthesized in the endoplasmic reticulum and then transported in vesicles to the Golgi apparatus. There, they are modified, sorted and packaged in vesicles for transport to other cellular locations or to the outside of the cell.
Chapter 3 Multiple Choice #1	Which of the following is most likely to be used in a typical microbiology laboratory? a) Bright-field microscope b) Confocal scanning microscope c) Phase-contrast microscope d) Scanning electron microscope e) Transmission electron microscope	A
Chapter 3 Multiple Choice #2	When a medical technologist wants to determine if a	A

	clinical specimen contains a Mycobacterium species, which should be used? a) Acid-fast stain b)Capsule stain c) Endospore stain d) Gram stain e) Simple stain	
Chapter 3 Multiple Choice #3	When a medical technologist wants to determine if a clinical specimen contains a Mycobacterium species, which should be used? a) Acid-fast stain b)Capsule stain c) Endospore stain d) Gram stain e) Simple stain	E
Chapter 3 Multiple Choice #4	Endotoxin is associated with a) Gram-positive bacteria. b) Gram-negative bacteria. c) the cytoplasmic membrane. d) the endospore.	B
Chapter 3 Multiple Choice #5	The "O157" in the name *E.* coli O157:H7 refers to the type of O antigen. From this information you know that E. coli a) has a capsule. b) is a rod. c) is a coccus. d) is Gram-positive. e) is Gram-negative.	E
Chapter 3 Multiple Choice #6	Eliminating which structure is always deadly to cells? a) Flagella b) Capsule c) Cell wall d) Cytoplasmic membrane e) Fimbriae	D
Chapter 3 Multiple Choice #7	Which of the following do bacterial cells use for attachment? 1.Capsule 2. Pilus 3.Cytoplasmic membrane.	A

	4.Periplasm 5. Peptidoglycan a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	
Chapter 3 Multiple Choice #8	Endocytosis is associated with a) mitochondria. b) prokaryotic cells. c) eukaryotic cells. d) chloroplasts. e) ribosomes.	C
Chapter 3 Multiple Choice #9	Protein synthesis is associated with 1. lysosomes. 2. the cytoplasmic membrane. 3. the Golgi apparatus. 4. rough endoplasmic reticulum. 5. ribosomes. a) 1, 2 b) 2, 3 c) 3, 4 d) 4, 5 e) 1, 5	D
Chapter 3 Multiple Choice #10	If a eukaryotic cell were treated with a chemical that destroys tubulin, all of the following would be directly affected except a) actin. b) cilia. c) eukaryotic flagella. d) microtubules. e) More than one of these.	A
Chapter 3 Applications #1	You are working in a laboratory producing new antibiotics for human and veterinary use. One compound with potential value inhibits the action of prokaryotic ribosomes. The compound, however, was shown to inhibit the growth of animal cells in culture. What is one possible explanation for its effect on animal cells?	The antibiotic could be entering the cells and acting on the mitochondria. Mitochondria, like bacteria, have 70S ribosomes.
Chapter 3 Applications #2	A research laboratory is investigating environmental factors that inhibit the growth of archaea. They wonder if penicillin would be effective in controlling their growth. Explain the probable	Penicillin interferes with the synthesis of peptidoglycan. The cell walls of archaea do not have peptidoglycan so they are probably not affected by penicillin.

	results of an experiment in which penicillin is added to a culture of archaea.	
Chapter 3 Critical Thinking #1	This graph shows facilitated diffusion of a compound across a cytoplasmic membrane and into a cell. As the external concentration of the compound is increased, the rate of uptake increases until it reaches a point where it slows and then begins to plateau. This is not the case with passive diffusion, where the rate of uptake continually increases. Why does the rate of uptake slow and then eventually plateau with facilitated diffusion?	In facilitated diffusion, transported compounds combine with a transporter or carrier on the outside surface of the cytoplasmic membrane, resulting in translocation of the compound across the membrane. When the external concentration of a compound is low, carrier molecules are readily available; solute molecules can easily "find" a free carrier. When the external concentration is high, competition for free carriers occurs. Eventually, all carriers will become saturated, and the rate of transport will be constant. At this point, the number of carriers and the time it takes the carriers to translocate the compound across the membrane limits transport.
Chapter 3 Critical Thinking #2	Most medically useful antibiotics interfere with either peptidoglycan synthesis or ribosome function. Why would the cytoplasmic membrane be a poor target for antibacterial medications?	The structure of the cytoplasmic membrane of prokaryotes is similar to that of eukaryotes: a phospholipid bilayer. Thus, medications that damage the prokaryotic membrane would likely adversely impact mammalian membranes as well. In contrast, peptidoglycan is unique to prokaryotes, and the prokaryotic ribosome (70S) is different from that of eukaryotic cells (80S) (although it is the same as the mitochondrial ribosomes).
Chapter 4		
Chapter 4 Short Answer #1	Describe a detrimental and a beneficial effect of biofilms.	Detrimental effect — dental plaque. Beneficial effect — bioremediation and sewage treatment
Chapter 4	Define a pure culture.	A population of organisms that are

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Short Answer #2		descended from a single cell.

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