Concepts of Biology 1st edition Fowler Solutions Manual

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INSTRUCTOR ANSWER GUIDE

Concepts of Biology

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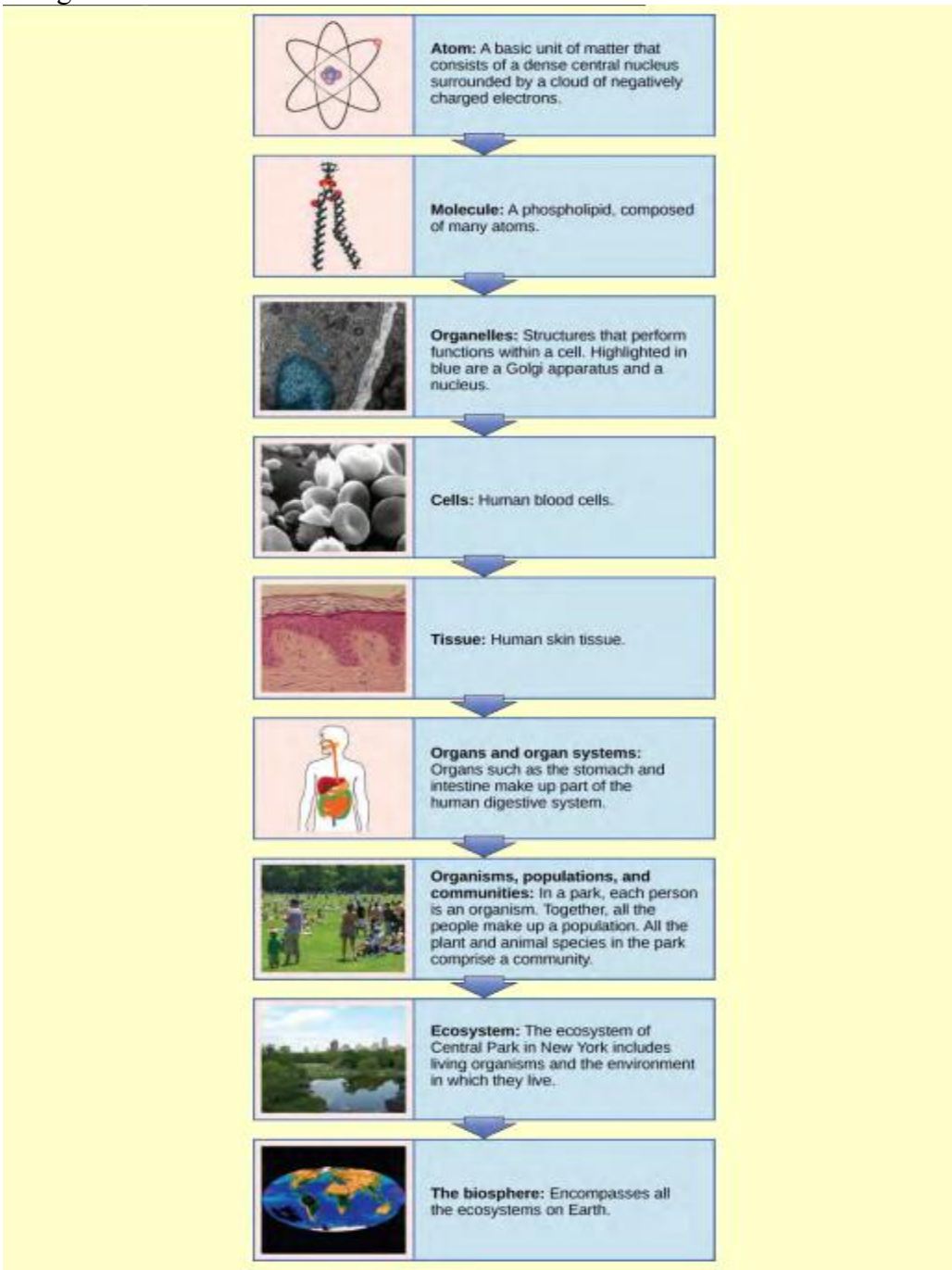
Concepts of Biology
Unit 1. The Cellular Foundation of Life
Chapter 1: Introduction to Biology

Art Connection Questions

1. Figure 1.8



Which of the following statements is false?

A. Tissues exist within organs which exist within organ systems.
B. Communities exist within populations which exist within ecosystems.
C. Organelles exist within cells which exist within tissues.

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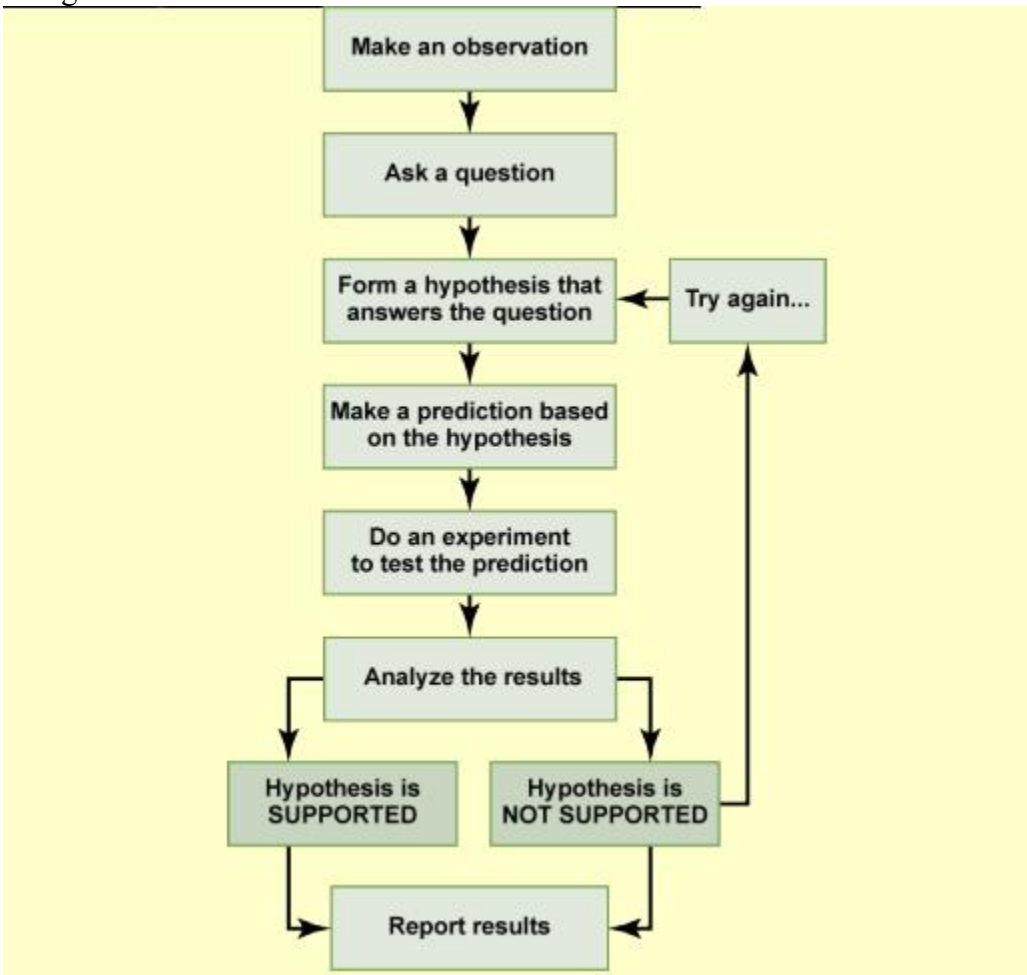
D. Communities exist within ecosystems which exist in the biosphere.

Answer

B. Communities exist within populations which exist within ecosystems.

2. Figure 1.18



In the example below, the scientific method is used to solve an everyday problem. Which part in the example below is the hypothesis? Which is the prediction? Based on the results of the experiment, is the hypothesis supported? If it is not supported, propose some alternative hypotheses.

1. My toaster doesn't toast my bread.
2. Why doesn't my toaster work?
3. There is something wrong with the electrical outlet.
4. If something is wrong with the outlet, my coffeemaker also won't work when plugged into it.
5. I plug my coffeemaker into the outlet.
6. My coffeemaker works.

Answer

The hypothesis is #3 (there is something wrong with the electrical outlet), and the prediction is #4 (if something is wrong with the outlet, then the coffeemaker also won't work when plugged into the outlet). The original hypothesis is not supported, as the coffee maker works when plugged into the outlet. Alternative hypotheses may include (1) the toaster might be broken or (2) the toaster wasn't turned on

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Review Questions

3. The smallest unit of biological structure that meets the functional requirements of "living" is the _____.

Answer
C. cell

4. Which of the following sequences represents the hierarchy of biological organization from the most complex to the least complex level?

Answer
D. biosphere, ecosystem, community, population, organism

5. A suggested and testable explanation for an event is called a _____.

Answer
A. hypothesis

6. The type of logical thinking that uses related observations to arrive at a general conclusion is called _____.

Answer
D. inductive reasoning

Critical Thinking Questions

7. Using examples, explain how biology can be studied from a microscopic approach to a global approach.

Answer
Researchers can approach biology from the smallest to the largest, and everything in between. For instance, an ecologist may study a population of individuals, the population's community, the community's ecosystem, and the ecosystem's part in the biosphere. When studying an individual organism, a biologist could examine the cell and its organelles, the tissues that the cells make up, the organs and their respective organ systems, and the sum total—the organism itself.

8. Give an example of how applied science has had a direct effect on your daily life.

Answer
Answers will vary. One example of how applied science has had a direct effect on daily life is the presence of vaccines. Vaccines to prevent diseases such polio, measles, tetanus, and even the influenza affect daily life by contributing to individual and societal health.

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Concepts of Biology
Unit 1. The Cellular Foundation of Life
Chapter 2: Chemistry of Life

Art Connection Questions

1. Figure 2.3. How many neutrons do (K) potassium-39 and potassium-40 have, respectively?

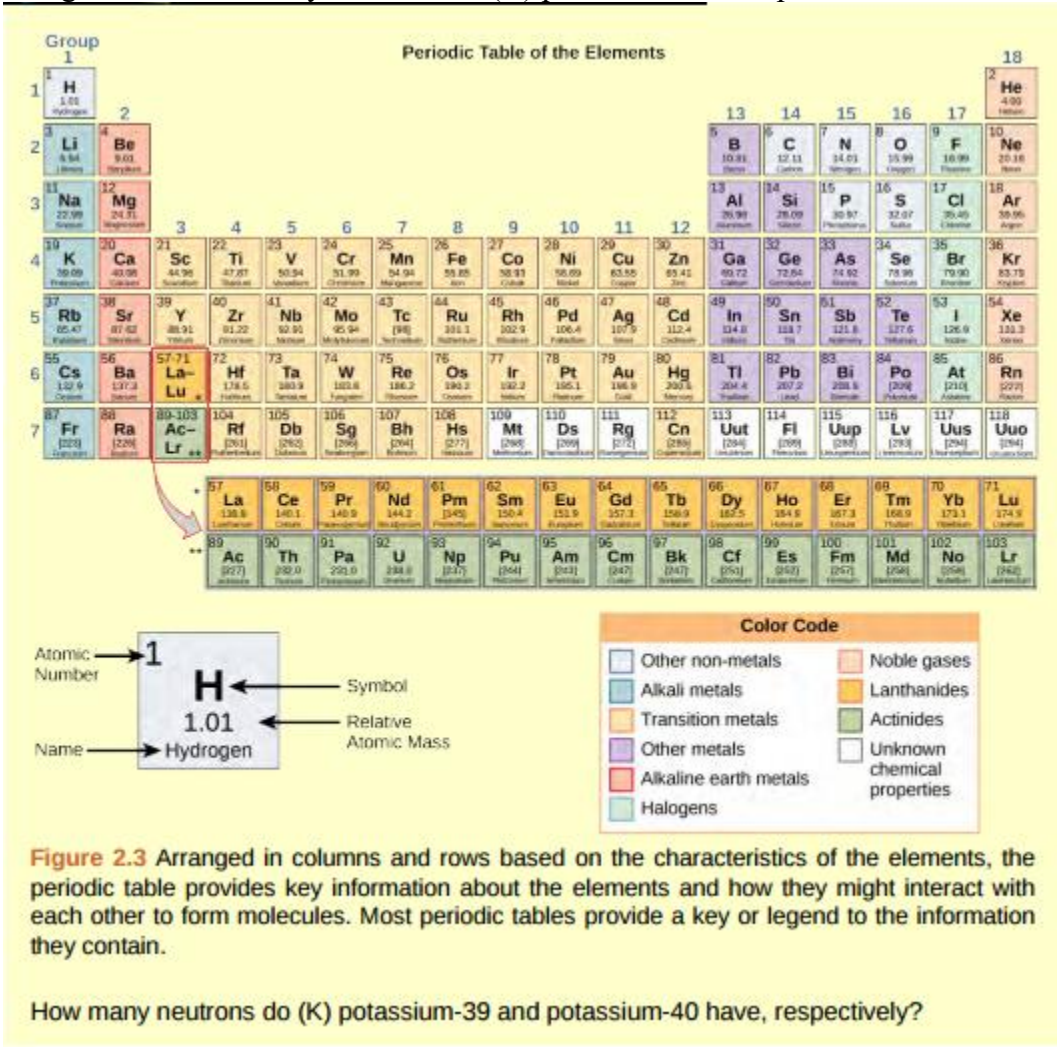

Figure 2.3 Arranged in columns and rows based on the characteristics of the elements, the periodic table provides key information about the elements and how they might interact with each other to form molecules. Most periodic tables provide a key or legend to the information they contain.

How many neutrons do (K) potassium-39 and potassium-40 have, respectively?

Answer
Potassium-39 has twenty neutrons. Potassium-40 has twenty one neutrons.

Review Questions

2. Magnesium has an atomic number of 12. Which of the following statements is true of a neutral magnesium atom?

Answer
A. It has 12 protons, 12 electrons, and 12 neutrons.

3. Which type of bond represents a weak chemical bond?

Answer
A. hydrogen bond

4. An isotope of sodium (Na) has a mass number of 22. How many neutrons does it have?

Answer

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A. 11

5. Which of the following statements is not true?

Answer

D. Water is the most abundant atom in Earth's atmosphere.

6. Using a pH meter, you find the pH of an unknown solution to be 8.0. How would you describe this solution?

Answer

C. weakly basic

7. The pH of lemon juice is about 2.0, whereas tomato juice's pH is about 4.0. Approximately how much of an increase in hydrogen ion concentration is there between tomato juice and lemon juice?

Answer

C. 100 times

8. An example of a monosaccharide is _____.

Answer

D. all of the above (fructose, glucose, galactose)

9. Cellulose and starch are examples of _____.

Answer

D. polysaccharides

10. Phospholipids are important components of _____.

Answer

A. the plasma membrane of cells

11. The monomers that make up proteins are called _____.

Answer

C. amino acids

Critical Thinking Questions

12. Why are hydrogen bonds and van der Waals interactions necessary for cells?

Answer

Hydrogen bonds and van der Waals interactions form weak associations between different molecules. They provide the structure and shape necessary for proteins and DNA within cells so that they function properly. Hydrogen bonds also give water its unique properties, which are necessary for life.

13. Why can some insects walk on water?

Answer

Some insects can walk on water, although they are heavier (denser) than water, because of the surface tension of water. Surface tension results from cohesion, or the attraction between water molecules at the surface of the body of water [the liquid-air (gas) interface].

14. Explain why water is an excellent solvent.

Answer

Water molecules are polar, meaning they have separated partial positive and negative charges. Because of these charges, water molecules are able to surround charged particles created when a substance dissociates. The surrounding layer of water molecules stabilizes the ion and keeps differently charged ions from reassociating, so the substance stays dissolved.

15. Explain at least three functions that lipids serve in plants and/or animals.

Answer

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Fat serves as a valuable way for animals to store energy. It can also provide insulation. Phospholipids and steroids are important components of cell membranes.

16. Explain what happens if even one amino acid is substituted for another in a polypeptide chain. Provide a specific example.

Answer

A change in gene sequence can lead to a different amino acid being added to a polypeptide chain instead of the normal one. This causes a change in protein structure and function. For example, in sickle cell anemia, the hemoglobin β chain has a single amino acid substitution. Because of this change, the disc-shaped red blood cells assume a crescent shape, which can result in serious health problems.

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Concepts of Biology
Unit 1. The Cellular Foundation of Life
Chapter 3: Cell Structure and Function

Art Connection Questions

1. Figure 3.7. What structures does a plant cell have that an animal cell does not have? What structures does an animal cell have that a plant cell does not have?

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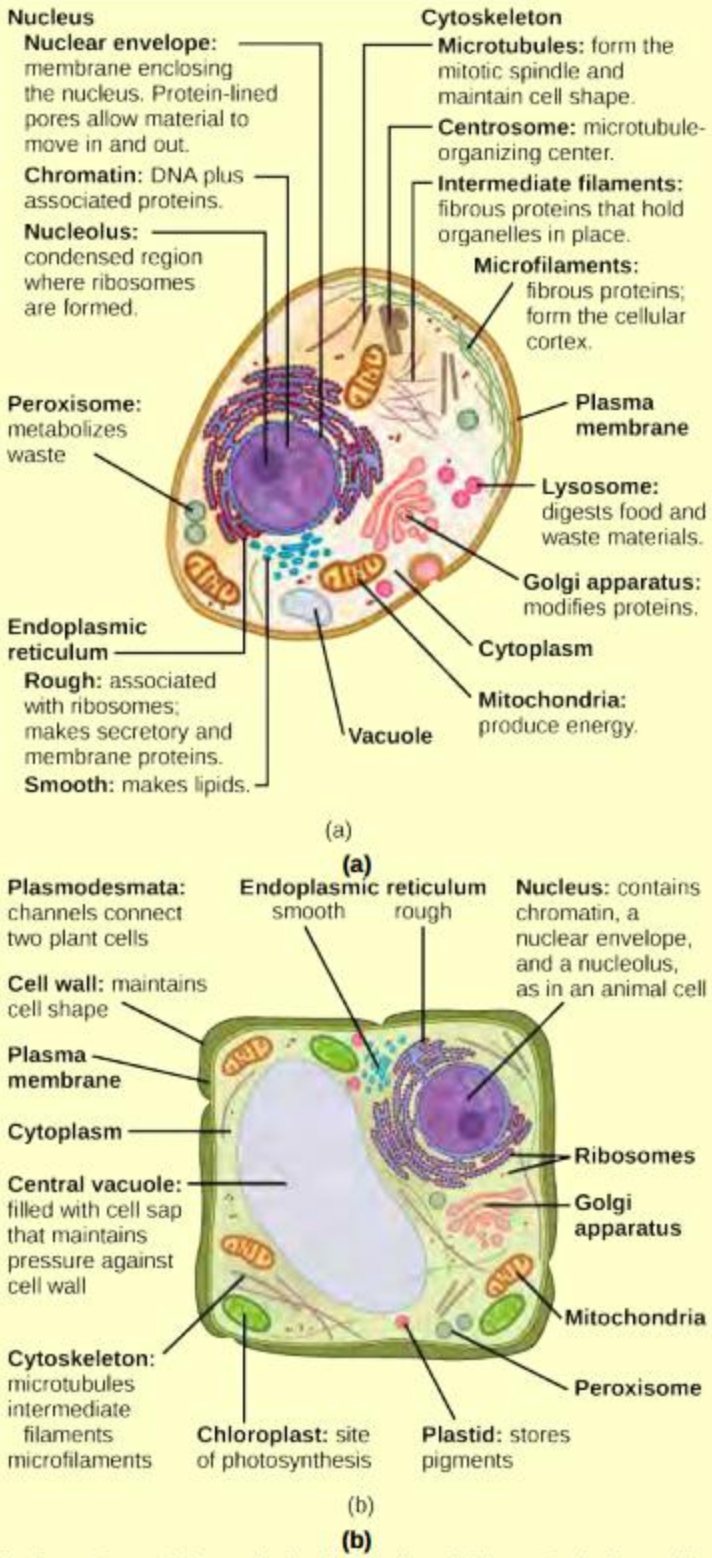

Figure 3.7 This figure shows (a) a typical animal cell and (b) a typical plant cell.

Answer

Plant cells have plasmodesmata, a cell wall, a large central vacuole, chloroplasts, and plastids. Animal cells have lysosomes and centrosomes.

2. Figure 3.13. Why does the *cis* face of the Golgi not face the plasma membrane?

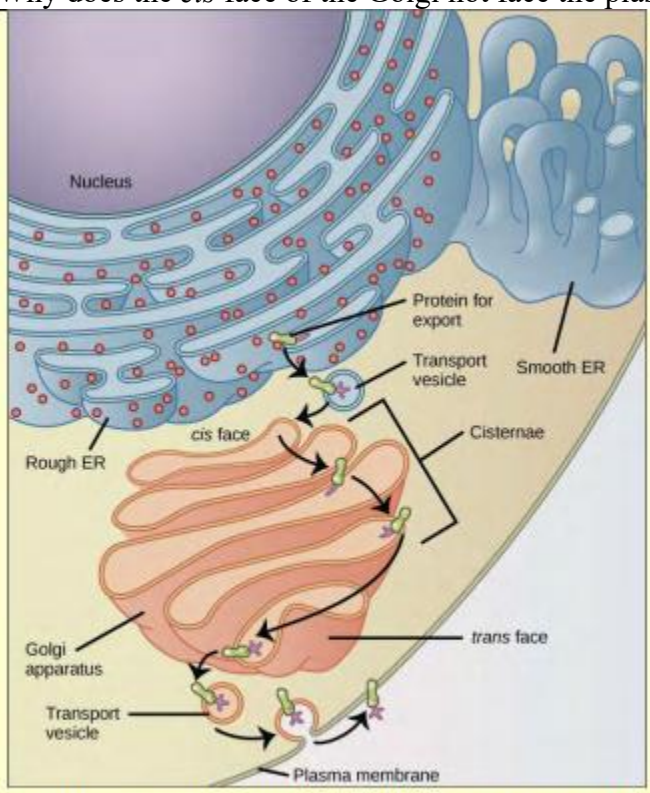

Figure 3.13 The endomembrane system works to modify, package, and transport lipids and proteins. (credit: modification of work by Magnus Manske)

Answer

Because that face receives chemicals from the ER, which is toward the center of the cell.

3. Figure 3.22. A doctor injects a patient with what he thinks is isotonic saline solution. The patient dies, and autopsy reveals that many red blood cells have been destroyed. Do you think the solution the doctor injected was really isotonic?

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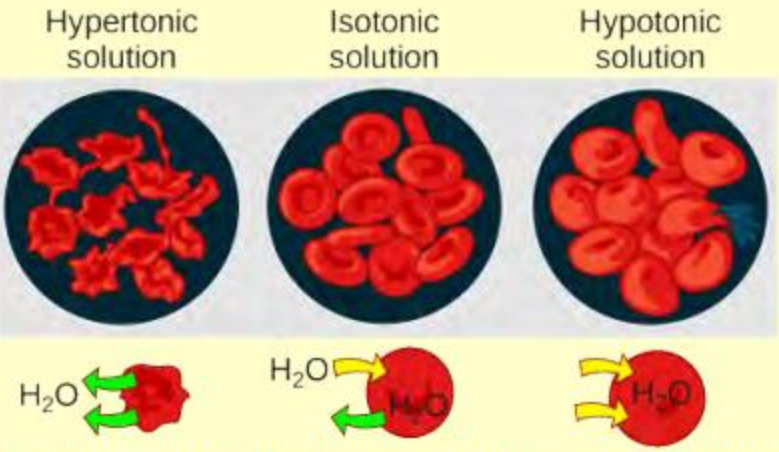

Figure 3.22 Osmotic pressure changes the shape of red blood cells in hypertonic, isotonic, and hypotonic solutions. (credit: modification of work by Mariana Ruiz Villarreal)

Answer
No, it must have been hypotonic, as a hypotonic solution would cause water to enter the cells, thereby making them burst.

Review Questions

4. When viewing a specimen through a light microscope, scientists use _____ to distinguish the individual components of cells.

Answer
C. special stains

5. The _____ is the basic unit of life.

Answer
B. cell

6. Which of these do all prokaryotes and eukaryotes share?

Answer
D. plasma membrane

7. A typical prokaryotic cell _____ compared to a eukaryotic cell.

Answer
A. is smaller in size by a factor of 100

8. Which of the following is found both in eukaryotic and prokaryotic cells?

Answer
D. ribosome

9. Which of the following is not a component of the endomembrane system?

Answer
A. mitochondrion

10. Which plasma membrane component can be either found on its surface or embedded in the membrane structure?

Answer
A. protein

11. The tails of the phospholipids of the plasma membrane are composed of _____ and are _____?

Answer

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D. fatty acid groups; hydrophobic

12. Water moves via osmosis _____.

Answer
C. from an area with a low concentration of solutes to an area with a higher one

13. The principal force driving movement in diffusion is _____.

Answer
A. temperature

14. Active transport must function continuously because _____.

Answer
D. diffusion is constantly moving the solutes in the other direction

Critical Thinking Questions

15. What are the advantages and disadvantages of light, transmission, and scanning electron microscopes?

Answer
The advantages of light microscopes are that they are easily obtained, and the light beam does not kill the cells. However, typical light microscopes are somewhat limited in the amount of detail that they can reveal. Electron microscopes are ideal because you can view intricate details, but they are bulky and costly, and preparation for the microscopic examination kills the specimen. Transmission electron microscopes are designed to examine the internal structures of a cell, whereas a scanning electron microscope only allows visualization of the surface of a structure.

16. Describe the structures that are characteristic of a prokaryote cell.

Answer
Prokaryotic cells are surrounded by a plasma membrane and have DNA, cytoplasm, and ribosomes, like eukaryotic cells. They also have cell walls and may have a cell capsule. Prokaryotes have a single large chromosome that is not surrounded by a nuclear membrane. Prokaryotes may have flagella or motility, pili for conjugation, and fimbriae for adhesion to surfaces.

17. In the context of cell biology, what do we mean by form follows function? What are at least two examples of this concept?

Answer
“Form follows function” refers to the idea that the function of a body part dictates the form of that body part. As an example, organisms like birds or fish that fly or swim quickly through the air or water have streamlined bodies that reduce drag. At the level of the cell, in tissues involved in secretory functions, such as the salivary glands, the cells have abundant Golgi.

18. Why is it advantageous for the cell membrane to be fluid in nature?

Answer
The fluidity of the cell membrane is necessary for the operation of some enzymes and transport mechanisms within the membrane.

19. Why does osmosis occur?

Answer
Water moves through a semipermeable membrane in osmosis because there is a concentration gradient across the membrane of solute and solvent. The solute cannot effectively move to balance the concentration on both sides of the membrane, so water moves to achieve this balance.

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