The Chemistry of Life
Matter and Organic Compounds
Biochemical Reactions

Cellular Structure and Function
Introduction to Cells
Cell Structure
Cell Transport and Homeostasis
2.1 Matter and Organic Compounds

Lesson 2.1: True or False

Write true if the statement is true or false if the statement is false.

1. An atom is smaller than an element.
2. Organic compounds are found in living organisms.
3. Proteins are made out of amino acids.
4. Proteins speed up chemical reactions.
5. The DNA code carries instructions for the correct sequence of nucleic acids in a protein.
6. Sugars and phosphate groups form the middle of a nucleic acid chain.
7. DNA (and RNA) is made out of nucleotides.
8. A protein consists of one or more polypeptide chains.
9. Lipids include fats, oils, and sugars.
10. Carbohydrates are the most common type of organic compound.
11. Peanut oil is an unsaturated fatty acid.
12. Cytosine and adenine are complementary bases in DNA.
13. A double helix is like a spiral staircase.
14. Phospholipids form cell membranes.
15. Carbohydrates are made out of monosaccharides.

Lesson 2.1: Critical Reading

Read these passages from the text and answer the questions that follow.

The Significance of Carbon

A compound found mainly in living things is known as an organic compound. Organic compounds make up the cells and other structures of organisms and carry out life processes. Carbon is the main element in organic compounds, so carbon is essential to life on Earth. Without carbon, life as we know it could not exist. Why is carbon so basic to life? The reason is carbon’s ability to form stable bonds with many elements, including itself. This property allows carbon to form a huge variety of very large and complex molecules. In fact, there are nearly 10 million carbon-based compounds in living things! However, the millions of organic compounds can be grouped into just four major types: carbohydrates, lipids, proteins, and nucleic acids. You can compare the four types in Table 2.1. Each type is also described below.
Table 2.1: **Types of Organic Compounds**

<table>
<thead>
<tr>
<th>Type of Compound</th>
<th>Examples</th>
<th>Elements</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>sugars, starches</td>
<td>carbon, hydrogen, oxygen</td>
<td>provides energy to cells, stores energy, forms body structures</td>
</tr>
<tr>
<td>Lipids</td>
<td>fats, oils</td>
<td>carbon, hydrogen, oxygen</td>
<td>stores energy, forms cell membranes, carries messages</td>
</tr>
<tr>
<td>Proteins</td>
<td>enzymes, antibodies</td>
<td>carbon, hydrogen, oxygen, nitrogen, sulfur</td>
<td>helps cells keep their shape, makes up muscles, speeds up chemical reactions, carries messages and materials</td>
</tr>
<tr>
<td>Nucleic Acids</td>
<td>DNA, RNA</td>
<td>carbon, hydrogen, oxygen, nitrogen, phosphorus</td>
<td>contains instructions for proteins, passes instructions from parents to offspring, helps make proteins</td>
</tr>
</tbody>
</table>

**Carbohydrates**
Carbohydrates are the most common type of organic compound. A carbohydrate is an organic compound such as sugar or starch, and is used to store energy. Like most organic compounds, carbohydrates are built of small, repeating units that form bonds with each other to make a larger molecule. In the case of carbohydrates, the small, repeating units are called monosaccharides.

**Lipids**
A lipid is an organic compound such as fat or oil. Organisms use lipids to store energy, but lipids have other important roles as well. Lipids consist of repeating units called fatty acids. There are two types of fatty acids: saturated fatty acids and unsaturated fatty acids.

**Proteins**
A protein is an organic compound made up of small molecules called amino acids. There are 20 different amino acids commonly found in the proteins of living things. Small proteins may contain just a few hundred amino acids, whereas large proteins may contain thousands of amino acids.
Nucleic Acids
A nucleic acid is an organic compound, such as DNA or RNA, that is built of small units called nucleotides. Many nucleotides bind together to form a chain called a polynucleotide. The nucleic acid DNA (deoxyribonucleic acid) consists of two polynucleotide chains. The nucleic acid RNA (ribonucleic acid) consists of just one polynucleotide chain.

Questions
1. List two functions of organic compounds.

2. Which two categories of organic compounds store energy? Which of these organic compounds is more common?

3. What is a main difference between DNA and RNA?

4. Describe a difference between large and small proteins.

5. Why is carbon considered the essential element of life?

Lesson 2.1: Multiple Choice
Circle the letter of the correct choice.

1. Water (H₂O) is a(n)
(a) element.
(b) atom.
(c) compound.
(d) carbohydrate.

2. A process that changes some chemical substances into others is a
(a) chemical bond.
(b) chemical reaction.
(c) chemical equation.
(d) chemical formula.

3. The main difference between saturated and unsaturated fatty acids is
(a) the amount of energy found in the fatty acid.
(b) saturated fatty acids are liquids.
(c) unsaturated fatty acids can be packed together very tightly.
(d) the number of hydrogen atoms bonded to the carbon atoms.
4. The function of proteins can include
   (a) helping cells keep their shape.
   (b) helping to destroy foreign substances.
   (c) speeding up biochemical reactions.
   (d) all of the above

5. The characteristics of DNA includes which of the following?
   (a) DNA is made of nucleotides consisting of a sugar, a phosphate group, and a carbon base.
   (b) DNA is made of a single polynucleotide chain, which winds into a double helix.
   (c) DNA is how inherited characteristics are passed from one generation to the next.
   (d) all of the above

6. Which category of organic compound is the major component of cell membranes?
   (a) carbohydrate
   (b) lipid
   (c) protein
   (d) nucleic acid

7. The cell wall of plants is made out of
   (a) starch.
   (b) glycogen.
   (c) cellulose.
   (d) chitin.

8. The main element of organic compounds is
   (a) hydrogen.
   (b) oxygen.
   (c) nitrogen.
   (d) carbon.

Lesson 2.1: Vocabulary I

Match the vocabulary word with the proper definition.

Definitions
   ____ 1. an organic compound that stores energy, forms cell membranes, carries messages
   ____ 2. an organic compound that contains instructions for proteins
   ____ 3. an organic compound that provides energy to cells, stores energy, forms body structures
   ____ 4. an organic compound that helps cells keep their shape
   ____ 5. a pure substance, like carbon
   ____ 6. may contain just a few simple sugars or thousands
   ____ 7. subunit that make up proteins
   ____ 8. subunit used to make nucleic acids
Lesson 2.1: Vocabulary II

Fill in the blank with the appropriate term.

1. A substance that consists of two or more elements is a __________.
2. The information in __________ is passed from parents to offspring when organisms reproduce.
3. __________ are proteins which bind to foreign substances such as bacteria and target them for destruction.
4. __________ compounds make up the cells and other structures of organisms and carry out __________ processes.
5. __________ is the monosaccharide used for energy by the cells of most organisms.
6. __________ are the most common type of organic compound.
7. __________ is a protein that binds with oxygen molecules.
8. The shape of DNA is that of a __________.
9. __________ is used by plants to store energy.
10. __________ is used by plants to form rigid walls around cells.
11. DNA contains __________ instructions for proteins, and __________ helps assemble the proteins.
12. Matter is anything that takes up space and has __________.
Describe the main functions of each of the four classes of organic compounds.
2.1 Matter and Organic Compounds

Lesson Quiz

Multiple Choice

Circle the letter of the correct choice.

1. Which of the following are functions of nucleic acids?
(a) They help make proteins.
(b) They contain instructions for proteins.
(c) They pass instructions from parents to offspring.
(d) all of the above

2. Types of lipids include:
(a) triglycerides.
(b) polysaccharides.
(c) amino acids.
(d) nucleotides.

3. The characteristics of DNA include which of the following?
(a) DNA is made of nucleotides consisting of a sugar, a phosphate group, and a carbon base.
(b) DNA is made of a single polynucleotide chain, which winds into a double helix.
(c) DNA is how inherited characteristics are passed from one generation to the next.
(d) all of the above

4. Differences between DNA and RNA include all of the following, except that
(a) thymine is a base in DNA, uracil is a base in RNA.
(b) RNA consists of just one polynucleotide chain, DNA consists of two chains.
(c) DNA uses the information in RNA to assemble the correct amino acids and help make proteins.
(d) All of the above are correct.

5. A(n) __________ cannot be broken down into other types of substances.
(a) element
(b) compound
(c) molecule
(d) metal

6. Functions of proteins include
(a) giving cells their shape.
(b) targeting foreign substances for destruction.
(c) speeding up biochemical reactions.
(d) all of the above.
7. In a DNA molecule, adenine always pairs with
   (a) cytosine.
   (b) guanine.
   (c) thymine.
   (d) nucleotide.

8. DNA nucleotides contain all of the following, except
   (a) uracil.
   (b) a phosphate group.
   (c) a sugar.
   (d) thymine.

9. The main difference between saturated and unsaturated fatty acids is
   (a) the amount of energy found in the fatty acid.
   (b) saturated fatty acids are liquids.
   (c) unsaturated fatty acids can be packed together very tightly.
   (d) the number of hydrogen atoms bonded to the carbon atoms.

10. Complex carbohydrates are made out of subunits called __________.
    (a) starch
    (b) monosaccharides
    (c) amino acids
    (d) nucleotides

11. Proteins are made out of subunits called __________.
    (a) polypeptides
    (b) monosaccharides
    (c) amino acids
    (d) nucleotides

12. Nucleic acids are made out subunits called __________.
    (a) DNA
    (b) monosaccharides
    (c) amino acids
    (d) nucleotides

**True or False**

Write true if the statement is true or false if the statement is false.

_____ 13. Carbon is the main element in organic compounds.

_____ 14. Starch is a monosaccharide, a type of carbohydrate.

_____ 15. Lipids are the major components of cell membranes.

_____ 16. The four major types of organic compounds include carbohydrates, lipids, proteins, and amino acids.

_____ 17. An element cannot be broken down into other types of substances.
Fill in the Blanks

*Fill in the blank with the term that best completes the sentence.*

18. There are just _________ different amino acids commonly found in the proteins of living things.

19. A chemical _________ is a process that changes some chemical substances into others.

20. The Periodic Table of the Elements arranges elements in groups based on their _________.

21. _________ consist of repeating units called fatty acids.

22. An alpha helix describes the secondary structure of a _________.

23. _________ and _________ are two examples of nucleic acids.

24. The shape of DNA can be described as a _________.

25. Matter is anything that takes up space and has _________.

Short Answer

*Answer each question in the space provided.*

26. Discuss why carbon is essential to life on Earth.

27. Describe the structures of proteins and nucleic acids, and discuss the functional relationship between these two types of organic compounds.
2.2 Biochemical Reactions

Lesson 2.2: True or False

Write true if the statement is true or false if the statement is false.

_____ 1. A substance that forms as a result of a chemical reaction is called a reactant.

_____ 2. Only some chemical reactions need energy to get started.

_____ 3. Biochemical reactions take place inside the cells.

_____ 4. A chemical reaction that releases heat is an exothermic reaction.

_____ 5. Most biochemical reactions need help to get started.

_____ 6. Anabolic reactions give off energy.

_____ 7. Metabolism is the sum of all the biochemical reactions in an organism.

_____ 8. In a chemical reaction, the quantity of an element may change.

_____ 9. During a chemical reaction, some bonds break and new bonds form.

_____ 10. Activation energy is the energy needed to start a chemical reaction.

_____ 11. An enzyme speeds up the reaction by lowering the activation energy.

_____ 12. In a chemical reaction, the number of atoms on one side of the arrow may differ from the number of atoms on the other side.

_____ 13. Matter is always conserved.

_____ 14. Understanding chemistry is needed to understand fully the processes within the cell.

_____ 15. In a chemical reaction, the quantity of each element does not change.

Lesson 2.2: Critical Reading

Read these passages from the text and answer the questions that follow.

Biochemical Reactions and Enzymes

Biochemical reactions are chemical reactions that take place inside the cells of living things. Biochemistry is a relatively new field that emerged at the interface of biology and chemistry. Its emergence shows that knowledge of chemistry as well as biology is needed to understand fully the life processes of organisms at the level of the cell. The sum of all the biochemical reactions in an organism is called metabolism. It includes both exothermic and endothermic reactions.

Types of Biochemical Reactions

Exothermic reactions in organisms are called catabolic reactions. These reactions break down molecules into smaller units and release energy. An example of a catabolic reaction is the breakdown of glucose, which releases energy that cells need to carry out life processes. Endothermic reactions in organisms are called anabolic reactions. These reactions build up bigger molecules from smaller ones. An example of an anabolic reaction is the joining of amino acids to form a protein. Which type of reactions—catabolic or anabolic—do you think occur when your body digests food?
**Enzymes**
Most biochemical reactions in organisms need help in order to take place. Why is this the case? For one thing, temperatures are usually too low inside living things for biochemical reactions to occur quickly enough to maintain life. The concentrations of reactants may also be too low for them to come together and react. Where do the biochemical reactions get the help they need to proceed? The help comes from enzymes. An **enzyme** is a protein that speeds up a biochemical reaction. An enzyme works by reducing the amount of activation energy needed to start the reaction. Less activation energy is needed when the correct enzyme is present than when it is not present. Enzymes are involved in most biochemical reactions, and they do their job extremely well. A typical biochemical reaction could take several days to occur without an enzyme. With the proper enzyme, the same reaction can occur in just a split second! Without enzymes to speed up biochemical reactions, most organisms could not survive. The activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings. Some enzymes work best at an acidic pH, while others work best in neutral environments.

**Questions**
1. What is an enzyme?

2. How are biochemistry and metabolism related?

3. Which type of reactions — catabolic or anabolic — do you think occur when your body digests food?

4. How do enzymes work?

5. What is activation energy?

**Lesson 2.2: Multiple Choice**
*Circle the letter of the correct choice.*

1. Reactants in the burning of methane include
   (a) CH₄ and 2O₂.
   (b) CO₂ and 2H₂O.
   (c) CH₄ and CO₂.
   (d) CO₂ and 2O₂.
2. Activities of enzymes depend on
   (a) pH.
   (b) temperature.
   (c) ionic conditions.
   (d) all of the above

3. An enzyme is a ____________.
   (a) carbohydrate
   (b) lipid
   (c) protein
   (d) nucleic acid

4. Reactions that take place inside cells are
   (a) cellular reactions.
   (b) enzyme reactions.
   (c) metabolic reactions.
   (d) biochemical reactions.

5. What is the main difference between an endothermic reaction and an exothermic reaction?
   (a) An endothermic reaction gives off energy and an exothermic reaction absorbs energy.
   (b) An exothermic reaction gives off energy and an endothermic reaction absorbs energy.
   (c) An endothermic reaction does not need activation energy.
   (d) Only endothermic reactions involve enzymes.

6. Another name for a “biological catalyst” could be a(n)
   (a) enzyme.
   (b) reactant.
   (c) activator.
   (d) metabolism.

7. The joining of amino acids to form a protein is a(n)
   (a) anabolic reaction.
   (b) catabolic reaction.
   (c) amino acid reaction.
   (d) polypeptide reaction.

8. The “push” needed to start a chemical reaction is the
   (a) enzymatic energy.
   (b) endothermic energy.
   (c) activation energy.
   (d) reactant energy.
Lesson 2.2: Vocabulary I
Match the vocabulary word with the proper definition.

Definitions
++1. represents a chemical reaction
++2. a protein that speeds up a biochemical reaction
++3. a substance that forms as a result of a chemical reaction
++4. a substance that starts a chemical reaction
++5. sum of all the biochemical reactions in an organism
++6. a process that changes some chemical substances into others
++7. exothermic reactions in organisms
++8. endothermic reactions in organisms
++9. chemical reactions that take place inside the cells of living things
++10. a chemical reaction that releases energy
++11. a chemical reaction that absorbs energy
++12. the energy needed to start a chemical reaction

Terms
a. activation energy
b. anabolic reaction
c. biochemical reaction
d. catabolic reaction
e. chemical equation
f. chemical reaction
g. enzyme
h. endothermic
i. exothermic
j. metabolism
k. product
l. reactant

Lesson 2.2: Vocabulary II
Fill in the blank with the appropriate term.
1. Biochemical reactions are chemical reactions that take place inside the _________ of living things.
2. During a chemical reaction, the _________ are used up to create the products.
3. All chemical reactions need _________ to get started.
4. _________ reactions in organisms are called catabolic reactions.
5. _________ energy provides the push needed to start a chemical reaction.
6. Your _________ includes both exothermic and endothermic reactions.
7. A chemical reaction involves the breaking and forming of _________.
8. In a chemical reaction, all matter is _________.
9. Energy can be released during a chemical reaction in the form of _________ and light.
10. In a chemical reaction, there is the same amount of each _________ in the products as there was in the reactants.
11. An _________ reaction builds up bigger molecules from smaller ones.
12. An _________ works by reducing the amount of activation energy needed to start the reaction.
Lesson 2.2: Critical Writing

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Describe the roles of enzymes in biochemical reactions. Use specifics in discussing how enzymes work.

Provide an example of a biochemical reaction involving an enzyme.
2.2 Biochemical Reactions
Lesson Quiz
Multiple Choice
Circle the letter of the correct choice.
1. CH$_4$ + 2O$_2$ → CO$_2$ + 2H$_2$O. The products in this reaction include
(a) methane and oxygen.
(b) carbon dioxide and water.
(c) carbon dioxide and oxygen.
(d) methane and water.

2. The “push” needed to start a chemical reaction is the
(a) enzymatic energy.
(b) endothermic energy.
(c) activation energy.
(d) reactant energy.

3. Enzymes are
(a) carbohydrates that store biological energy.
(b) lipids that form biological membranes.
(c) proteins that speed up biochemical reactions.
(d) nucleic acids that have the information to make proteins.

4. In the photosynthesis reaction, 6CO$_2$ + 6H$_2$O → C$_6$H$_{12}$O$_6$ + 6O$_2$, there are 18 oxygen atoms in the reactants. How many oxygen atoms are in the products?
(a) 6
(b) 12
(c) 18
(d) 24

5. Organisms need enzymes because
(a) temperatures may too low inside organisms for reactions to occur without enzymes.
(b) the levels of reactants may be too low for them to react without assistance from enzymes.
(c) they need biochemical reactions to speed up to occur quickly enough to maintain life.
(d) all of the above

6. An example of a catabolic reaction is
(a) making starch from monosaccharides.
(b) the formation of proteins from amino acids.
(c) the breakdown of glucose to release energy.
(d) the joining of nucleotides in the copying of DNA.
7. Without enzymes, you could not
(a) burn methane into carbon dioxide and water.
(b) photosynthesize and make glucose from carbon dioxide and water.
(c) break down glucose into carbon dioxide and water.
(d) You could do all of the above without enzymes.

8. Activation energy is required in which of the following reactions?
(a) biochemical reactions only
(b) only endothermic reactions
(c) only exothermic reactions
(d) all chemical reactions

9. The action of enzymes is crucial to life. Enzymes act by
(a) lowering the activation energy needed to start the reaction.
(b) reducing the amount of energy absorbed during a biochemical reaction.
(c) reducing the amount of heat released during a biochemical reaction.
(d) conserving matter in a biochemical reaction, such that the number of atoms in the reactants equals the number in the products.

10. Which represents the correct depiction of a exothermic reaction?
(a) Reactants + Heat → Products
(b) Reactants → Products + Heat
(c) Reactants + Products → Heat
(d) Products + Heat → Reactants

11. The activities of enzymes depend on
(a) temperature.
(b) ionic conditions.
(c) pH of the surroundings.
(d) all of the above.

12. What is the main difference between an endothermic reaction and an exothermic reaction?
(a) An endothermic reaction gives off energy and an exothermic reaction absorbs energy.
(b) An exothermic reaction gives off energy and an endothermic reaction absorbs energy.
(c) An endothermic reaction does not need activation energy.
(d) Only an endothermic reaction involves enzymes.
True or False

Write true if the statement is true or false if the statement is false.

___ 13. An enzyme speeds up biochemical reactions by lowering the activation energy.
___ 14. The number of atoms in the reactants of a chemical reaction is always the same as the number of atoms in the products.
___ 15. Not all chemical reactions involve energy.
___ 16. The joining of amino acids to form a protein is a catabolic reaction, building up bigger molecules from smaller ones.
_______ 17. Enzymes are necessary for life.

Fill in the Blanks

Fill in the blank with the term that best completes the sentence.

18. ________ reactions are chemical reactions that take place inside cells.
19. ________ reactions in organisms are called catabolic reactions.
20. ________ energy is the energy needed to start a chemical reaction.
21. The sum of all the ________ in an organism is called metabolism.
22. In a reaction involving sodium and chlorine, table salt (sodium chloride) is the ________.
23. During a chemical reaction, ________ is always conserved.
24. A(n) ________ is a protein that speeds up a biochemical reaction.
25. A substance that is used to start a chemical reaction is called a ________.

Short Answer

Answer each question in the space provided.

26. What is a chemical reaction? Use correct vocabulary in your response, and provide an example.

27. Discuss enzymes. Include a definition, a description of the role of enzymes, and a discussion of how an enzyme works.
3.1 Introduction to Cells

Lesson 3.1: True or False

Write true if the statement is true or false if the statement is false.

_____ 1. All organisms are made of more than one cell.
_____ 2. Early microscopes created by Leeuwenhoek were almost as strong as modern light microscopes.
_____ 3. Proteins are made on ribosomes.
_____ 4. Prokaryotic cells have a nucleus.
_____ 5. The plasma membrane forms the physical boundary between the cell and its environment.
_____ 6. For cells, a smaller size is more efficient.
_____ 7. Compared to eukaryotic cells, prokaryotic cells are very complex.
_____ 8. Organelles are located within the cytoplasm.
_____ 9. Viruses are similar to prokaryotic cells.
_____ 10. All cells have a plasma membrane, cytoplasm, and ribosomes.
_____ 11. DNA is located in the nucleus of prokaryotic cells.
_____ 12. Organelles allow eukaryotic cells to carry out more functions than prokaryotic cells.
_____ 13. Viruses are considered living organisms.
_____ 14. Most cells are about the size of the period at the end of this sentence.
_____ 15. Observation of cork helped in the discovery of cells.

Lesson 3.1: Critical Reading

Read these passages from the text and answer the questions that follow.

Two Types of Cells

There is another basic cell structure that is present in many but not all living cells: the nucleus. The nucleus of a cell is a structure in the cytoplasm that is surrounded by a membrane (the nuclear membrane) and contains DNA. Based on whether they have a nucleus, there are two basic types of cells: prokaryotic cells and eukaryotic cells.

Prokaryotic Cells

Prokaryotic cells are cells without a nucleus. The DNA in prokaryotic cells is in the cytoplasm rather than enclosed within a nuclear membrane. Prokaryotic cells are found in single-celled organisms, such as bacteria. Organisms with prokaryotic cells are called prokaryotes. They were the first type of organisms to evolve and are still the most common organisms today.

Eukaryotic Cells

Eukaryotic cells are cells that contain a nucleus. Eukaryotic cells are usually larger than prokaryotic cells, and they are found mainly in multicellular organisms. Organisms with eukaryotic cells are called eukaryotes, and they range from fungi to people. Eukaryotic cells also contain other organelles besides the nucleus. An
**organelle** is a structure within the cytoplasm that performs a specific job in the cell. Organelles called mitochondria, for example, provide energy to the cell, and organelles called vacuoles store substances in the cell. Organelles allow eukaryotic cells to carry out more functions than prokaryotic cells can.

**Viruses: Prokaryotes or Eukaryotes?**

Viruses are tiny particles that may cause disease. Human diseases caused by viruses include the common cold and flu. Do you think viruses are prokaryotes or eukaryotes? The answer may surprise you. Viruses are not cells at all, so they are neither prokaryotes nor eukaryotes. Viruses contain DNA but not much else. They lack the other parts shared by all cells, including a plasma membrane, cytoplasm, and ribosomes. Therefore, viruses are not cells, but are they alive? All living things not only have cells; they are also capable of reproduction. Viruses cannot reproduce by themselves. Instead, they infect living hosts, and use the hosts’ cells to make copies of their own DNA. For these reasons, most scientists do not consider viruses to be living things.

**Questions**

1. What is one main difference between prokaryotic and eukaryotic cells?

2. Give an example of a prokaryotic organism.

3. What is an organelle? Give three examples. (*Hint: See the Eukaryotic Cell figure in the textbook.*)

4. Describe the nucleus. What can be found inside the nucleus?

5. Are viruses alive? Discuss why or why not.
Lesson 3.1: Multiple Choice

Circle the letter of the correct choice.

1. Organelles in prokaryotic cells include the
   (a) mitochondria.
   (b) cytoskeleton.
   (c) Golgi complex.
   (d) none of the above

2. A major difference between prokaryotic and eukaryotic cells is that
   (a) prokaryotic cells have a flagellum.
   (b) eukaryotic cells have a nucleus.
   (c) prokaryotic cells have cytoplasm.
   (d) eukaryotic cells have ribosomes.

3. Robert Hooke was the first person to observe cells. He observed these cells in
   (a) a piece of cork.
   (b) a slice of honeycomb.
   (c) human blood.
   (d) plaque from his own teeth.

4. Cell size is limited by the
   (a) amount of cytoplasm.
   (b) cell’s ability to get rid of wastes.
   (c) the size of the nucleus.
   (d) the size of the plasma membrane.

5. The spikes on pollen grains probably
   (a) allow the pollen grain to stick to insects.
   (b) allow the pollen grain to fly through the air.
   (c) protect the pollen grain from being eaten.
   (d) allow insects to stick to the pollen grain.

6. All cells have the following:
   (a) plasma membrane, cytoplasm, and ribosomes.
   (b) plasma membrane, nucleus, and DNA.
   (c) DNA, ribosomes, and cell wall.
   (d) plasma membrane, cytoplasm, and nucleus.

7. The first microscopes were made around
   (a) 1965.
   (b) 1665.
   (c) 1950.
   (d) 1776.
8. The cell theory states that
(a) all organisms are made of one or more cells.
(b) all cells come from already existing cells.
(c) all the life functions of organisms occur within cells.
(d) all of the above

Lesson 3.1: Vocabulary I
Match the vocabulary word with the proper definition.

Definitions
_____ 1. organism that has cells containing a nucleus and other organelles
_____ 2. an organelle inside eukaryotic cells where the DNA is located
_____ 3. cell without a nucleus
_____ 4. a structure within the cytoplasm of a cell that is enclosed within a membrane and performs a specific job
_____ 5. phospholipid bilayer that surrounds and encloses a cell
_____ 6. first person to use the word “cell”
_____ 7. tiny, non-living particles that may cause disease
_____ 8. the material inside the plasma membrane of a cell
_____ 9. cell that contains a nucleus and other organelles
_____ 10. organelle where proteins are made
_____ 11. discovered human blood cells
_____ 12. a single-celled organism that lacks a nucleus

Terms
a. Anton van Leeuwenhoek
b. cytoplasm
c. eukaryote
d. eukaryotic cell
e. nucleus
f. organelle
g. plasma membrane
h. prokaryote
i. prokaryotic cell
j. ribosome
k. Robert Hooke
l. virus

Lesson 3.1: Vocabulary II
Fill in the blanks with the appropriate term.
1. All organisms are made up of one or more _________.
2. All cells have certain parts in common, including a plasma membrane, _________, _________, and DNA.
3. Proteins are made on the _________.
4. A _________ is a typical prokaryotic cell.
5. _________ cells are usually larger than _________ cells.
6. Leeuwenhoek discovered _________ by looking at the plaque from his own teeth.
7. _________ contain DNA, but do not contain cytoplasm or ribosomes.
8. In an eukaryotic cell, DNA is found in the _________.
9. _________ is the genetic instructions that cells need to make proteins.
10. The plasma membrane is a bilayer of ___________ that surrounds a cell.
11. A cell’s shape is generally related to the cell’s ___________.
12. ___________ are cells without a nucleus.

Lesson 3.1: Critical Writing

Name___________________ Class__________________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast eukaryotic cells with prokaryotic cells. Include at least 5 specific similarities and/or differences.
3.1 Introduction to Cells
Lesson Quiz
Multiple Choice

Circle the letter of the correct choice.

1. Which of the following structures are present in all cells?
   (a) ribosomes
   (b) cytoplasm
   (c) plasma membrane
   (d) all of the above

2. The first cells observed were from
   (a) tiny animals.
   (b) plaque.
   (c) cork.
   (d) leaves.

3. How do you think the spikes help the pollen grains do their job?
   (a) The spikes help the insects stick to the pollen grains.
   (b) The spikes help the pollen grains stick to insects.
   (c) The spikes help the pollen grains fly through the air.
   (d) The spikes help the pollen grains stay attached to the plant.

4. What is the best description of an organelle?
   (a) The mitochondria, Golgi apparatus, and endoplasmic reticulum are examples of organelles.
   (b) Organelles are structures located in the cytoplasm.
   (c) Organelles are structures that allow eukaryotic cells to carry out more functions than prokaryotic cells.
   (d) An organelle is a structure that performs a specific job in the cell.

5. Which of the following is a characteristic of all living cells?
   (a) reproduction
   (b) obtaining energy
   (c) responding to their environment
   (d) all of the above

6. What is one main difference between eukaryotic cells and prokaryotic cells?
   (a) Eukaryotic cells are cells that contain a nucleus.
   (b) Prokaryotic cells have many internal structures, whereas eukaryotic cells are simpler.
   (c) Prokaryotic cells can be large, whereas eukaryotic cells are usually smaller.
   (d) All of the above are differences between eukaryotic cells and prokaryotic cells.
7. Which of the following are characteristics of ribosomes?
   (a) Ribosomes are where proteins are made.
   (b) Ribosomes are found only in eukaryotic cells.
   (c) Ribosomes can be found attached to the Golgi apparatus.
   (d) As viruses need proteins to function, they must have ribosomes.

8. If a cell is shaped like a cube, and has a side that is 2nm, what is the surface area:volume ratio?
   (a) 2
   (b) 3
   (c) 4
   (d) 6

9. Which is true of the nucleus?
   (a) It is an organelle surrounded by the nuclear membrane.
   (b) DNA is found in the nucleus.
   (c) It is only found in eukaryotic cells.
   (d) All of the above are true.

10. Which of the following is located in the cytoplasm?
    (a) the plasma membrane
    (b) a eukaryotic cell’s DNA
    (c) the Golgi apparatus
    (d) all of the above

11. It can be argued that viruses are not living. What is the best evidence to support this?
    (a) Viruses are only tiny particles.
    (b) Viruses are not made of cells.
    (c) Viruses only contain DNA.
    (d) Viruses are small, like prokaryotes.

12. Which of the following is not part of the cell theory?
    (a) All organisms are made of one or more cells.
    (b) All the life functions of organisms occur within cells.
    (c) All cells contain the functional structures necessary for life.
    (d) All cells come from already existing cells.

True or False
Write true if the statement is true or false if the statement is false.

______ 13. Prokaryotic cells are usually larger than eukaryotic cells.
______ 14. All cells have ribosomes, cytoplasm, and a plasma membrane.
______ 15. The word “cell” was first used in 1965.
______ 16. Cells are small because small cells are more efficient than larger cells.
17. Since all living things have DNA, and as viruses have DNA, they are considered alive.

**Fill in the Blanks**

*Fill in the blank with the term that best completes the sentence.*

18. By looking through one of the first microscopes, __________ discovered cells.
19. The first cells were observed in a sample taken from ___________.
20. The __________ is the defining organelle in eukaryotic cells, as prokaryotic cells do not have them.
21. __________ are the most common organisms alive today.
22. Mitochondria, the Golgi apparatus, and the endoplasmic reticulum are examples of ___________
23. The plasma membrane is made out of a thin coat of ___________.
24. __________ are tiny DNA-containing particles that may cause disease.
25. The __________ states that all organisms are made of one or more cells.

**Short Answer**

*Answer each question in the space provided.*

26. Describe three differences between prokaryotic and eukaryotic cells.

27. Are viruses considered to be alive? Discuss why or why not.
3.2 Cell Structures
Lesson 3.2: True or False

Write true if the statement is true or false if the statement is false.

_____ 1. The water-hating hydrophobic tails of the phospholipid bilayer face the outside of the cell membrane.

_____ 2. The cytoplasm essentially acts as a “skeleton” inside the cell.

_____ 3. Roundworms have organ system-level organization, in which groups of organs work together to do a specific job.

_____ 4. Plant cells have special structures that are not found in animal cells, including a cell membrane, a large central vacuole, and plastids.

_____ 5. Centrioles help organize chromosomes before cell division.

_____ 6. Ribosomes can be found attached to the endoplasmic reticulum.

_____ 7. ATP is made in the mitochondria.

_____ 8. Many of the biochemical reactions of the cell occur in the cytoplasm.

_____ 9. Animal cells have chloroplasts, organelles that capture light energy from the sun and use it to make food.

_____ 10. Small hydrophobic molecules can easily pass through the plasma membrane.

_____ 11. In cell-level organization, different cells are specialized for different functions.

_____ 12. The flagella on your lung cells sweep foreign particles and mucus toward the mouth and nose.

_____ 13. Mitochondria contains its own DNA.

_____ 14. The plasma membrane is a single phospholipid layer that supports and protects a cell and controls what enters and leaves it.

_____ 15. The cytoskeleton is made from thread-like filaments and tubules.

Lesson 3.2: Critical Reading

Read these passages from the text and answer the questions that follow.

Plasma Membrane

The plasma membrane forms a barrier between the cytoplasm inside the cell and the environment outside the cell. It protects and supports the cell and also controls everything that enters and leaves the cell. It allows only certain substances to pass through, while keeping others in or out. The ability to allow only certain molecules in or out of the cell is referred to as selective permeability or semipermeability. To understand how the plasma membrane controls what crosses into or out of the cell, you need to know its composition.
Phospholipid Bilayer
The plasma membrane is composed mainly of phospholipids, which consist of fatty acids and alcohol. The phospholipids in the plasma membrane are arranged in two layers, called a phospholipid bilayer. As shown in the figure below, each phospholipid molecule has a head and two tails. The head “loves” water (hydrophilic) and the tails “hate” water (hydrophobic). The water-hating tails are on the interior of the membrane, whereas the water-loving heads point outwards, toward either the cytoplasm or the fluid that surrounds the cell. Molecules that are hydrophobic can easily pass through the plasma membrane, if they are small enough, because they are water-hating like the interior of the membrane. Molecules that are hydrophilic, on the other hand, cannot pass through the plasma membrane — at least not without help — because they are water-loving like the exterior of the membrane.

The phospholipid bilayer consists of two layers of phospholipids (left), with a hydrophobic, or water-hating, interior and a hydrophilic, or water-loving, exterior. A single phospholipid molecule is depicted on the right.  
(Image courtesy of CK-12 Foundation and under the Creative Commons license CC-BY-NC-SA 3.0.)

Other Molecules in the Plasma Membrane
The plasma membrane also contains other molecules, primarily other lipids and proteins. The green molecules in the figure above, for example, are the lipid cholesterol. Molecules of cholesterol help the plasma membrane keep its shape. Many of the proteins in the plasma membrane assist other substances in crossing the membrane.

Extensions of the Plasma Membrane
The plasma membrane may have extensions, such as whip-like flagella or brush-like cilia. In single-celled organisms, the membrane extensions may help the organisms move. In multicellular organisms, the extensions have other functions. For example, the cilia on human lung cells sweep foreign particles and mucus toward the mouth and nose.
Questions
1. What is the plasma membrane?

2. What is the meaning of *semipermeability*?

3. Discuss why the plasma membrane must be a bilayer.

4. What are some of the “other” molecules in the plasma membrane? Describe their function.

5. What are cilia and flagella?

Lesson 3.2: Multiple Choice
*Circle the letter of the correct choice.*
1. The “power plant” of the cell is the
   (a) nucleus.
   (b) ribosome.
   (c) chloroplast.
   (d) mitochondria.

2. Which organelle ensures that after cell division each daughter cell has the correct number of chromosomes?
   (a) the nucleus
   (b) the endoplasmic reticulum
   (c) the centriole
   (d) the cytoskeleton

3. Structures specific in plant cells but not in animal cells include
   (a) a large central vacuole.
   (b) the mitochondria.
   (c) the cell membrane.
   (d) the cytoplasts.

4. Having tissues that digest food, such as in the jellyfish, is an example of
   (a) cell-level organization.
   (b) tissue-level organization.
   (c) organ-level organization.
   (d) organ system-level organization.
5. The plasma membrane contains which of the following?
(a) phospholipids
(b) cholesterol molecules
(c) many proteins
(d) all of the above

6. Which of the following is true of the nucleus?
(a) The nucleus is considered the control center of the cell.
(b) The nucleus contains all the cell’s DNA.
(c) All cells have a nucleus.
(d) all of the above

7. Which structure determines what molecules can enter and leave the cell?
(a) the plasma membrane
(b) the cell wall
(c) the nucleus
(d) all of the above

8. Which organelle may have allowed early eukaryotes to make food and produce oxygen?
(a) the Golgi apparatus
(b) the central vacuole
(c) the plastids
(d) the cell wall

Lesson 3.2: Vocabulary I

Match the vocabulary word with the proper definition.

Definitions
____ 1. the arrangement of phospholipids in the plasma membrane
____ 2. helps make and transport proteins and lipids
____ 3. stores and transports protein and lipid molecules
____ 4. helps the cell maintain its shape and holds cell organelles in place within the cytoplasm
____ 5. layer that surrounds the plasma membrane of a plant cell
____ 6. help organize the chromosomes before cell division
____ 7. organelle that processes proteins and prepares them for use both inside and outside the cell
____ 8. larger of the sac-like organelles that store and transport materials in the cell
____ 9. describes the formation of eukaryotic cells
____ 10. energy-carrying molecule
____ 11. stores substances such as water, enzymes, and salts in plant cells
____ 12. “power plant” of the cell
Lesson 3.2: Vocabulary II

*Fill in the blank with the appropriate term.*

1. The __________ is often considered to be the cell’s control center.
2. The __________ consists of everything inside the plasma membrane of the cell.
3. The plasma membrane forms a __________ between the inside and outside of the cell.
4. The __________ is essentially a “skeleton” inside the cell.
5. The rough endoplasmic reticulum is covered with __________.
6. Lysosomes use __________ to break down foreign matter and dead cells.
7. __________ cells specifically have a cell wall, a large central vacuole, and chloroplasts.
8. The endoplasmic reticulum is an organelle that helps make and transport __________ and lipids.
9. Mitochondria are sometimes referred to as the __________ of the cell.
10. Human beings have __________-level organization, in which groups of organs work together to do a certain job.
11. Centrioles help make sure each daughter cell has the correct number of __________ after the cell divides.
12. Cilia and __________ are extensions of the plasma membrane of many cells.

Lesson 3.2: Critical Writing

*Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.*

Discuss the properties of the plasma membrane that allow it to act as a barrier around the cell. Include the specifics of the phospholipid bilayer.
3.2 Cell Structures
Lesson Quiz

Circle the letter of the correct choice.

1. Functions of the cytoplasm include
   (a) suspending cell organelles.
   (b) providing a site for many of the biochemical reactions of the cell.
   (c) pushing against the plasma membrane to help the cell keep its shape.
   (d) all of the above.

2. The largest organelle in an eukaryotic cell is the
   (a) endoplasmic reticulum.
   (b) nucleus.
   (c) mitochondria.
   (d) cytoplasm.

3. The plasma membrane has the phospholipids’
   (a) hydrophilic tails on the interior and hydrophobic heads pointing outwards.
   (b) hydrophilic heads on the interior and hydrophobic tails pointing outwards.
   (c) hydrophobic tails on the interior and hydrophilic heads pointing outwards.
   (d) hydrophobic heads on the interior and hydrophilic tails pointing outwards.

4. Functions of plastids include which of the following?
   (a) Some plastids capture light energy from the sun and use it to make food.
   (b) Some plastids store substances such as the monomers used to make proteins.
   (c) Some plastids make and store other pigments.
   (d) All of the above are characteristics of plastids.

5. Organization in which different cells are specialized for different functions, but each cell works alone, is characteristic of
   (a) cell-level organization.
   (b) tissue-level organization.
   (c) organ-level organization.
   (d) organ system-level organization.

6. Organelles specific to plant cells include which of the following?
   (a) chloroplasts
   (b) the cell wall
   (c) peroxisomes
   (d) centrioles
7. Which organelle helps make and transport proteins and lipids?
(a) the ribosome
(b) the endoplasmic reticulum
(c) the Golgi apparatus
(d) the vesicle

8. Which of the following statements about energy is true?
(a) Cells use energy from glucose to make ATP.
(b) Cells use energy from ATP to make glucose.
(c) Chloroplasts capture light energy from the sun and use it to make ATP.
(d) Glucose is made in the mitochondria.

9. Complete the following sentence: DNA “lives” in the ________, proteins are made on the__________, and the ________ consists of everything inside the plasma membrane of the cell.
(a) nucleus, ribosomes, cytoskeleton
(b) mitochondria, ribosomes, cytoskeleton
(c) mitochondria, endoplasmic reticulum, central vacuole
(d) nucleus, ribosomes, cytoplasm

10. An organized structure composed of many cells, in which all of the cells live and work together, is characteristic of
(a) a single-celled organism.
(b) a biofilm.
(c) a colony.
(d) a multicellular organism.

11. Which organelle transfers the energy in glucose into molecules of ATP?
(a) the mitochondria
(b) the Golgi apparatus
(c) the endoplasmic reticulum
(d) the chloroplast

12. In a plant cell, DNA can be found in
(a) mitochondria.
(b) the nucleus.
(c) chloroplasts.
(d) all of the above.

**True or False**
Write true if the statement is true or false if the statement is false.

_____ 13. The plasma membrane controls everything that enters and leaves the cell.
_____ 14. Small, hydrophilic molecules cannot just flow into the cell, they need help to pass through the plasma membrane.
15. The mitochondrion, where the cell’s energy is made, is often considered to be the cell’s control center.
16. The nucleus is the largest organelle in a eukaryotic cell.
17. All eukaryotic cells have chloroplasts.

**Fill in the Blanks**
*Fill in the blank with the term that best completes the sentence.*

18. The endoplasmic reticulum is an organelle that helps make and ________ proteins and lipids.
19. The ________ theory describes how small prokaryotic cells began to “live” inside larger cells.
20. The ________ can make up as much as 90% of a plant cell’s volume.
21. Chloroplasts that contain the green pigment ________, which makes a plant green.
22. In some cells, a cell ________ is outside the plasma membrane,
23. The two layers of phospholipids in the plasma membrane are called a phospholipid ________-
24. ________ are organelles where proteins are made.
25. A ________ organism has different types of cells that are specialized for various functions.

**Short Answer**
*Answer each question in the space provided.*

26. Discuss the major differences between a plant cell and an animal cell.

27. List three organelles found in animal cells, and describe their functions.
3.3 Cell Transport and Homeostasis

Lesson 3.3: True or False

Write true if the statement is true or false if the statement is false.

____ 1. Passive transport needs energy.
____ 2. Active transport needs energy.
____ 3. Carrier proteins change shape when they transport substances.
____ 4. Diffusion does not require any help from other molecules.
____ 5. Facilitated diffusion does not require any help from other molecules.
____ 6. Endocytosis removes large molecules from the cell.
____ 7. In diffusion, substances move from an area of lower concentration to an area of higher concentration.
____ 8. The sodium-potassium pump is a type of channel protein.
____ 9. Ions can easily flow through a carrier protein.
____ 10. Diffusion is the osmosis of water.
____ 11. Endocytosis and exocytosis are types of vesicle transport.
____ 13. Transport of substances across the cell membrane helps maintain homeostasis by keeping the cell’s conditions within normal ranges.
____ 14. Channel proteins and carrier proteins are both transport proteins.
____ 15. The plasma membrane controls what enters and leaves the cell.

Lesson 3.3: Critical Reading

Read these passages from the text and answer the questions that follow.

Passive Transport

Passive transport occurs when substances cross the plasma membrane without any input of energy from the cell. No energy is needed because the substances are moving from an area where they have a higher concentration to an area where they have a lower concentration. Concentration refers to the number of particles of a substance per unit of volume. The more particles of a substance in a given volume, the higher the concentration. A substance always moves from an area where it is more concentrated to an area where it is less concentrated. It’s a little like a ball rolling down a hill. It goes by itself without any input of extra energy.

Simple Diffusion

Diffusion is the movement of a substance across a membrane, due to a difference in concentration, without any help from other molecules. The substance simply moves from the side of the membrane where it is more concentrated to the side where it is less concentrated. Substances that can squeeze between the lipid molecules in the plasma membrane by simple diffusion are generally very small, hydrophobic molecules, such as molecules of oxygen and carbon dioxide.
Osmosis

Osmosis is a special type of diffusion—the diffusion of water molecules across a membrane. Like other molecules, water moves from an area of higher concentration to an area of lower concentration. Water moves in or out of a cell until its concentration is the same on both sides of the plasma membrane.

Facilitated Diffusion

Water and many other substances cannot simply diffuse across a membrane. Hydrophilic molecules, charged ions, and relatively large molecules, such as glucose, all need help with diffusion. The help comes from special proteins in the membrane known as transport proteins. Diffusion with the help of transport proteins is called facilitated diffusion. There are several types of transport proteins, including channel proteins and carrier proteins.

- Channel proteins form pores, or tiny holes, in the membrane. This allows water molecules and small ions to pass through the membrane without coming into contact with the hydrophobic tails of the lipid molecules in the interior of the membrane.
- Carrier proteins bind with specific ions or molecules, and in doing so, they change shape. As carrier proteins change shape, they carry the ions or molecules across the membrane.

Questions

1. Explain why passive transport does not require energy.

2. What is a main difference between diffusion and facilitated diffusion?

3. Describe how simple diffusion proceeds. What kind of molecules can move across the membrane by simple diffusion?

4. How is water transported across the membrane?

5. What are the two types of transport proteins? Describe how they function.
Lesson 3.3: Multiple Choice

Circle the letter of the correct choice.

1. Controlling what enters and leaves the cell in an important function of the
(a) nucleus.
(b) vesicle.
(c) plasma membrane.
(d) Golgi apparatus.

2. During diffusion, substances move from an area of __________ concentration to an area of __________ concentration.
(a) higher, lower
(b) lower, higher
(c) higher, equal
(d) lower, equal

3. A channel protein does which of the following?
(a) Carries ions or molecules across the membrane.
(b) Forms tiny holes in the membrane.
(c) Changes shape as it transports molecules.
(d) all of the above

4. The sodium-potassium pump
(a) uses energy to move sodium ions out of the cell and potassium ions into the cell.
(b) uses energy to move potassium ions out of the cell and sodium ions into the cell.
(c) moves sodium ions out of the cell and potassium ions into the cell without using energy.
(d) moves potassium ions out of the cell and sodium ions into the cell without using energy.

5. Osmosis
(a) is the diffusion of water.
(b) is the diffusion of water and other small molecules.
(c) is the diffusion of water and small ions.
(d) is the diffusion of small molecules and ions.

6. Types of passive transport include which of the following? (1) simple diffusion, (2) osmosis, (3) facilitated diffusion, (4) active transport, and (5) vesicle transport.
(a) 1 and 2
(b) 1, 2, and 3
(c) 4 and 5
(d) 1, 2, 3, 4, and 5
7. Endocytosis and exocytosis
(a) are both a type of vesicle transport.
(b) move very large molecules either in or out of the cell.
(c) are both a form of active transport.
(d) all of the above

8. Which of the following needs energy? (1) passive transport, (2) active transport, (3) exocytosis, and (4) osmosis.
(a) 1 only
(b) 2 only
(c) 2 and 3
(d) 2, 3, and 4

**Lesson 3.3: Vocabulary I**
*Match the vocabulary word with the proper definition.*

**Definitions**

<table>
<thead>
<tr>
<th>Number</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>transport across a membrane without any additional energy requirement</td>
</tr>
<tr>
<td>2</td>
<td>the diffusion of water</td>
</tr>
<tr>
<td>3</td>
<td>type of vesicle transport that moves a substance into the cell</td>
</tr>
<tr>
<td>4</td>
<td>type of vesicle transport that moves a substance out of the cell</td>
</tr>
<tr>
<td>5</td>
<td>special proteins in the membrane that aid diffusion</td>
</tr>
<tr>
<td>6</td>
<td>membrane protein that forms a small hole that allows ions to pass through</td>
</tr>
<tr>
<td>7</td>
<td>an active transport protein</td>
</tr>
<tr>
<td>8</td>
<td>diffusion with the help of transport proteins</td>
</tr>
<tr>
<td>9</td>
<td>the movement of a substance across a membrane without any help from other molecules</td>
</tr>
<tr>
<td>10</td>
<td>the transport of very large molecules, such as proteins</td>
</tr>
<tr>
<td>11</td>
<td>transport across a membrane in which energy is required</td>
</tr>
</tbody>
</table>

**Terms**

<table>
<thead>
<tr>
<th>Letter</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>active transport</td>
</tr>
<tr>
<td>b</td>
<td>channel protein</td>
</tr>
<tr>
<td>c</td>
<td>diffusion</td>
</tr>
<tr>
<td>d</td>
<td>endocytosis</td>
</tr>
<tr>
<td>e</td>
<td>exocytosis</td>
</tr>
<tr>
<td>f</td>
<td>facilitated diffusion</td>
</tr>
<tr>
<td>g</td>
<td>osmosis</td>
</tr>
<tr>
<td>h</td>
<td>passive transport</td>
</tr>
<tr>
<td>i</td>
<td>sodium-potassium pump</td>
</tr>
<tr>
<td>j</td>
<td>transport protein</td>
</tr>
<tr>
<td>k</td>
<td>vesicle transport</td>
</tr>
</tbody>
</table>
Lesson 3.3: Vocabulary II

*Fill in the blank with the appropriate term.*

1. By moving substances into and out of cells, ____________, the process of keeping stable conditions inside a cell, is maintained.

2. A ____________ protein changes shape as it carries ions or molecules across the membrane.

3. Exocytosis is the type of ____________ transport that moves a substance out of the cell.

4. ________ transport is movement across the plasma membrane that does not require an input of energy.

5. The sodium-potassium ____________ is involved in the active-transport of ions.

6. Facilitated diffusion needs the help of ____________ proteins

7. ________ refers to the number of particles of a substance per unit of volume.

8. ________ is the type of vesicle transport that moves a substance into the cell.

9. Energy for active transport is supplied by molecules of ________.

10. ________ is the diffusion of water.

11. During active transport, a substance is moving from an area of ________ concentration to an area of ________ concentration.

12. Moving molecules in and out of the cell is an important role of the ____________.

Lesson 3.3: Critical Writing

*Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.*

Discuss passive and active transport. Describe the main differences between these two types of transport, and provide examples of each type.
3.3 Cell Transport and Homeostasis

Lesson Quiz

Multiple Choice

Circle the letter of the correct choice.

1. What is the main difference between passive transport and active transport?
   (a) Passive transport needs energy, active transport does not.
   (b) Active transport needs energy, passive transport does not.
   (c) Only passive transport involves a protein.
   (d) Only active transport can transport ions across the cell membrane.

2. Which of the following are involved in facilitated diffusion? (1) channel proteins, (2) carrier proteins, (3) pumps, (4) vesicles.
   (a) 1 only
   (b) 1 and 2
   (c) 3 and 4
   (d) 1, 2, and 4

3. If there are 10,000 calcium ions inside the cell and 2,000 calcium ions outside the cell, in which direction will these ions naturally flow?
   (a) They will flow from outside the cell in.
   (b) They will flow from inside the cell out.
   (c) They will flow from the inside of one cell into the next cell.
   (d) Calcium ions cannot flow in or out of the cell.

4. Osmosis is the
   (a) diffusion of ions and small molecules.
   (b) diffusion of glucose and proteins.
   (c) diffusion of water.
   (d) active transport of water, ions, or small molecules.

5. Which of the following are types of active transport? (1) the sodium-potassium pump, (2) exocytosis, (3) endocytosis, (4) osmosis.
   (a) 1 only
   (b) 2 and 3
   (c) 1, 2, and 3
   (d) 1, 2, 3, and 4

6. What part of the cell determines what enters and leaves the cell?
   (a) the plasma membrane
   (b) the nucleus
   (c) the vesicles
   (d) the Golgi apparatus
7. Which of the following proteins changes shape as it transfers materials across the membrane?
   (a) channel proteins  
   (b) carrier proteins  
   (c) vesicles  
   (d) osmosis proteins

8. Which of the following is a type of passive transport?
   (a) osmosis  
   (b) facilitated diffusion  
   (c) simple diffusion  
   (d) all of the above

9. Which process plays an important role in homeostasis?
   (a) facilitated diffusion  
   (b) osmosis  
   (c) exocytosis  
   (d) all of the above

10. During active transport, molecules move from an area of _________ concentration to an area of _________ concentration.
    (a) higher, lower  
    (b) lower, higher  
    (c) higher, the same  
    (d) lower, the same

True or False
Write true if the statement is true or false if the statement is false.

____ 11. Osmosis is the diffusion of small molecules.

____ 12. Oxygen and carbon dioxide can squeeze between the phospholipid molecules in the plasma membrane.

____ 13. The energy for passive transport comes from ATP.

____ 14. The sodium-potassium pump actually changes shape as it shuttles ions across the cell membrane.

____ 15. The plasma membrane controls everything that enters and leaves the cell.

____ 16. Endocytosis is a type of active transport that moves a substance out of the cell.

____ 17. Channel proteins and carrier proteins are both a type of transport protein.
Fill in the Blanks
*Fill in the blank with the term that best completes the sentence.*
18. ________ diffusion involves transport proteins.
19. ________ transport does not need an input of energy from the cell.
20. ________ proteins form pores, or tiny holes, in the membrane.
21. Carrier proteins transport specific ________ or molecules across the cell membrane.
22. The sodium-potassium pump transports ________ ions out of the cell, and ________-____ ions into the cell.
23. The process of maintaining a stable environment (or condition) inside a cell is ________.
24. ________ is the diffusion of water.
25. Exocytosis is the type of ________ transport that moves a substance out of the cell.

Short Answer
*Answer each question in the space provided.*
26. Describe active transport and provide an example.
27. Discuss three methods of passive transport.