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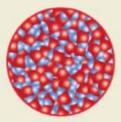
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Science Content Background

Lesson 1

Substances and Mixtures

Matter: Substances and Mixtures Scientists often put materials Parts of Solutions A homogeneous mixture is also known as other and different from other materials. Elements and compoundand the solute(s). A solvent is the substance that exists in the are two examples of substances. A substance has a fixed composition, which means it is always made of the same things that lution are called solutes. combine in the same way. This differs from a mixture, which contains two or more substances that have not bonded together. Aypes of Solutions Students often think that solutions are always used to make it don't always combine in the same way. There are They can be solids, liquids, or gases. The state of the solvent two types of mixtures—homogeneous mixtures are evenly mixed determines the state of the solution. and heterogeneous mixtures are not.



How do compounds and mixtures differ? Mixing is a physical: change, not a chemical change. The substances that make up a mixture do not chemically bond together. As a result, they retain their properties in the mixture and can be separated from each other using physical methods. In contrast, a chemical change occurs when elements bond together to form compounds. The: properties of the elements are not observable in the compound and the compound cannot be separated into elements using physical methods.

Lesson 2

Properties of Solutions

into categories in order to understand how they are similar to each solution. Solutions have two different types of parts—the solvent greatest quantity in a solution. All the other substances in a

mixture has a variable composition, which means the substances liquids. However, solutions can exist in all three states of matter.

Water as a Solvent In nature, water almost always exists as an aqueous solution. Water often acts as a solvent. The reason many solutes dissolve in water has to do with the fact that water is made of polar molecules. Each water molecule has a positive end and a negative end.

Like Dissolves Like Water dissolves many substances, but it can't dissolve everything. Polar compounds, such as rubbing alcohol. easily dissolve in water. This is because "like dissolves like." When rubbing alcohol and water mix, the positive ends of the water molecules attract the negative ends of the alcohol molecules. Also the negative ends of water molecules attract the positive ends of alcohol molecules. Ionic compounds, such as table salt, which have alternating negative and positive ions, also mix with water in a similar way. However, nonpolar molecules, such as vegetable oil, do not dissolve in water.

Science Content Backgroun

Concentration—How much is dissolved? Concentration is the amount of a particular solute in a solution—the greater the amount of solute, the higher the concentration. When a solution is composed of a solid solute and a liquid solvent, concentration is the mass of solute in a given volume of solution. Any unit of massWhat are acids and bases? An acid is a substance that produces a or volume can be used to express the concentration. When a solution contains only liquids or gases, concentration is the volunteroduces a hydroxide ion in water. Acids and bases are found in of solute in a given volume of solution. In this case, the units of, many everyday items, including the foods we eat. volumes must match and the concentration can be expressed as a percentage.

Solubility—How much can dissolve? Solubility is the maximum amount of solute that can dissolve in a given amount of solvent atydrochloric a given temperature and pressure. The higher the solubility, the more of the solute can dissolve. A saturated solution contains the maximum possible amount of solute that can be dissolved. An unsaturated solution is able to dissolve even more of a solute. : Changing temperature or pressure can affect the solubility of a: substance. Many solid solutes become more soluble when the: soluble at higher temperatures, but more soluble under pressure.pH above 7 on the pH scale (because they have a lower However, pressure does not affect the solubility of a solid solute itoncentration of hydronium ions). Solutions that are neutral a liquid solution.

How Fast a Solute Dissolves When the particles of a solvent and a solute come into contact with each other more frequently, the How is pH measured? Test kits used to measure pH include solute dissolves faster. There are different ways to increase the speed of dissolving, including stirring the solution, crushing the the only way to change the solubility of a solute is to change the temperature or pressure. Stirring or crushing has no effect on solubility.

Lesson 3

Acid and Base Solutions

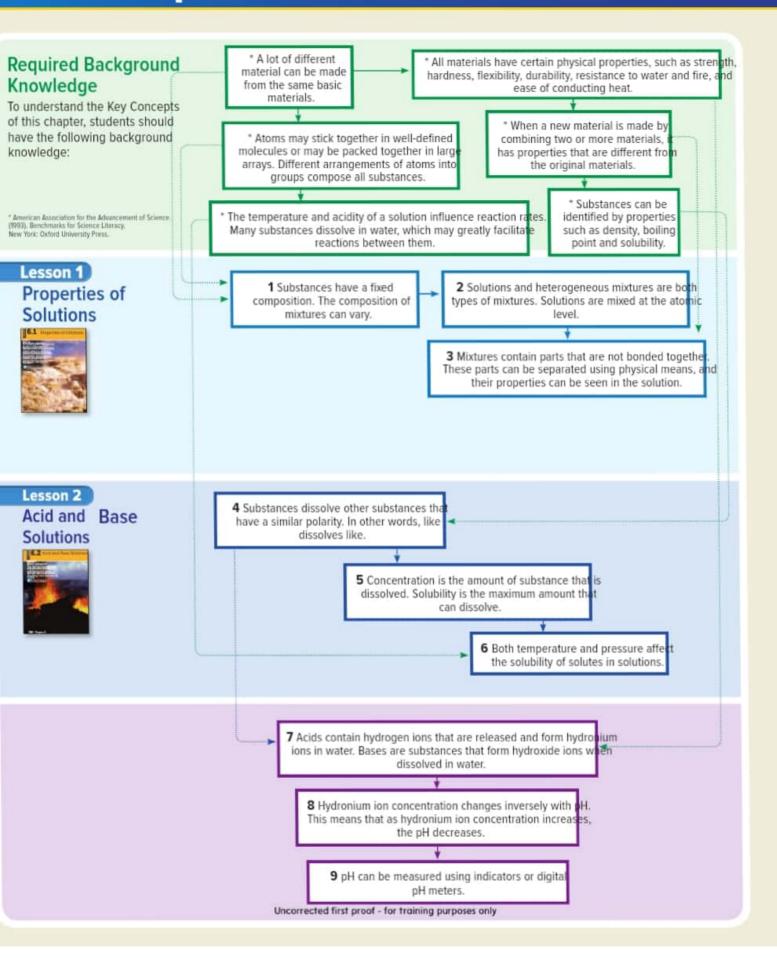
hydronium ion when it dissolves in water. A base is a substance that

Chloride Hydronium acid (H,0) ion ion (H3O+) (CI-) (HCI)

What is pH? pH is an inverse measurement of hydronium ions in a solution. As the concentration of hydronium ions increases, the pH decreases. Acids have a pH below 7 on the pH scale (because they temperature increases. Conversely, many gas solutes become lessave a higher concentration of hydronium ions) and bases have a measure exactly 7 on the pH scale. When the pH decreases by 1, for example, the acidity increases 10 times.

chemicals called indicators that cause a change in color when an acid or a base is added. To perform the test, place a drop or two of solute, and increasing the temperature of the solution. However, the indicator into the solution and watch it change color. Different indicators will change the solution into different colors, depending on the pH value of the solution tested. You can also perform a similar test using pH strips. Simply dip the testing strip into the solution and watch as the strip changes color. The pH testing strips will have a color correlation chart to give the approximate pH value. The most accurate way to measure pH is to use a pH meter, which is an electronic device that is sensitive to the hydronium ion concentration in a solution.

Strand Map



Identifying Misconception

Identifying Mixtures

Find Out What Students Think

Students may think that...

... the difference between a mixture and a substance is always visible under an ordinary microscope. They might mistake a solution for a substance because the mixture appears homogenous.

Discussion

Remind students that atoms make up all matter. This includes elements, compounds, solutions, and mixtures. The difference: between a mixture and a substance is seen at the atomic level. If Discussion only physically mixes, it is a solution or a mixture.

high-powered microscope. You cannot visually inspect matter: with an ordinary microscope and determine if it is a substance or of granite and the microscopic view of blood in Figure 4. In a a mixture. A sample of matter that appears to be a substance canhomogenous mixture, matter is mixed evenly throughout the be a mixture. The parts of a heterogeneous mixture are detectable with a microscope. The parts of a homogenous mixture cannot be seen with a microscope. Ask: What is the difference between a substance and a mixture? The matter in a substance is chemically bonded; in a mixture, it is physically: combined. Ask: Why might a homogenous mixture look like a substance? When matter is evenly blended at the atomic level, microscope. you cannot see the different parts. Ask: Why can't an ordinary microscope be used to determine if a sample of matter is a solution or a substance? An ordinary microscope cannot magnify at the atomic level.

Promote Un derstanding

Activity Use this demonstration to engage students about how the magnification of an item does not necessarily reveal its composition. Mix two colors of sand in a second beaker. Stir both beakers for a minute. The first solution away it appears one color. In a second beaker layer the two colors of sand so they are distinguishable from a distance. Fill a third beaker with just one sand color.

- 1. Have students stand far from the beakers. Explain that their position is like viewing matter without a microscope.
- 2. Display the first two beakers. Ask: Which beaker represents heterogeneous mixture. a mixture? Which beaker represents a substance?
- 3. Have students come close to the beakers. Explain that this: is like viewing matter with a microscope. Ask the questions again. Students should note that both are mixtures.
- Place the third beaker on the table. Ask the questions again. Students should note that it is impossible to say if it is a mixture or a substance. Explain to students that the same problem exists when trying to use an ordinary microscope to distinguish a solution from a substance. The magnification : level is too low to see if the matter is chemically bonded or just mixed.

Solutions

Find Out What Students Think

Students may think that...

... the atoms that make up homogenous mixtures are smaller than those that make up heterogeneous mixtures and that is why you can make out the parts of a heterogeneous mixture. Use this discussion and activity to clarify that all atoms are far too small to be seen with a microscope. Homogenous and heterogeneous mixtures are distinguished not by their atomic size but rather by the uniformity of mixing.

matter is chemically bonded together, it is a substance. If matter Remind students that while some atoms are bigger than others, all atoms are too small to be seen under an ordinary microscope. Explain to students that atoms are too small to be seen without a Usually the different parts in a heterogeneous mixture are visible because they do not mix evenly. This can be seen in the picture mixture. A good example of this is salt or sugar dissolving in water. Ask: Do the size of atoms help distinguish a heterogeneous mixture from a homogenous one? no What does? how the different types of matter are distributed in the mixture and if they dissolve Ask: Can you distinguish a heterogeneous sample just with your eyes? Not always; sometimes you need a

Promote Un derstanding

Remind students that the difference between homogeneous and heterogeneous mixtures is the uniformity of mixing and not the size of the atoms. Then show them this demonstration. Place two empty 250-mL beakers on a table. Add 100 mL of room-temperature water to each. Next, add 50 g of table salt to the first beaker. Add 10 g of table salt to the beaker. It should be blended well enough that from a few meters should have undissolved salt at the bottom. In the second beaker all the salt should dissolve. Since the same solute, salt, was used in both solutions, students can be assured that the size of the atoms is irrelevant to the type of mixture formed. Ask: Which solution is the homogeneous mixture and which is the heterogeneous mixture? The second solution is the homogeneous mixture, and the first solution is the



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Chapter 6 Mixtures, Solubility, and Acid/Base Solutions 186

6.1 Properties of Solutions Stairs? These stair-like formations, called tetraces, are located in Mammon Hot.



Explore Activity

How are they different?

If you have ever looked at a bottle of Italian salad dressing, you know that some substances do not easily form solutions. The oil and vinegar do not mix, and the spices sink to the bottom. How ever, the salt in salad dressing does mix evenly with the other substances and forms a solution. How can we describe the difference quantitatively?

m 2 m 3.

- 1. Read and complete a lab safety form
- 2. Label one beaker A and another beaker B.
- 3. Measure 100 mL of water and pour it into beaker A.
- 4. Measure 100 mL of water and pour it into beaker B.
- Add 10 g of baking soda to beaker A, and stir with a plastic spoon for 2 min or until all the baking soda dissolves, whiches happens first.
- Add 25 g of sugar to beaker B and stir with a plastic spoon 2 min or until all of the dissolves, whichever happens first.
- Observe the mixtures in each beaker. Record your observation in your Science Journal.

Think About This

- 1. What substance dissolved better in water? How do you know?
- Predict what would happen if you were to use 200 mL of water instead of 100 mL.
- Do you think more baking soda might dissolve if you stirred the solution longer?
- 4. Key Concept Why do you think one substance dissolved more easily in water than the other substance? What factors do you think contribute to this difference?

Essential Questions

- How do concentration and solubility differ?
- solubility differ?

 How can the solubility of a solubility be changed?

Vocabulary

solvent solute polar molecule concentration solubility saturated solution

10

INQUIRY

About the Photo Stairs? Limestone is made up mostly of the mineral calcite, or calcium carbonate. At Mammoth Hot Springs, calcium carbonate from limestone deep underground that formed millions of years ago is dissolved in hot water. When the water comes to the surface, the calcium carbonate comes out of the solution, and forms new limestone.

Guiding Questions

What substance forms the terraces in limestone the photo?

What is one way to make a mixture?

Answers may vary. Students may respond that you can stir or blend two liquids together, smash two solids together, and so on.

Why is the hot spring water in this photo an example of a mixture?

The water has carbon dioxide and calcium carbonate dissolved in it.

Essential Questions

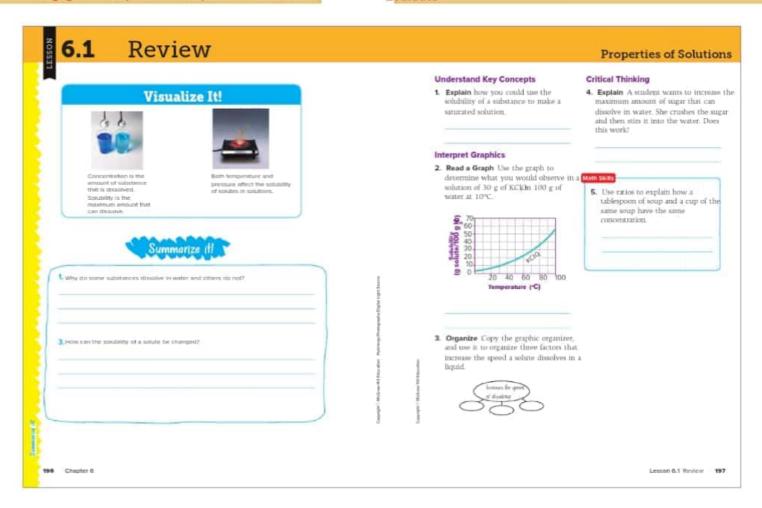
After this lesson, students should understand the Key Concepts and be able to answer these questions. Have students write each question in their Science Journals. Revisit each question as you cover its relevant content.

$a_{b_{\ell}}$

Vocabulary

Create Classroom Flash Cards

- Have students work in pairs to create one flash card for each vocabulary term in this lesson.
- At the beginning of the lesson, have them locate the vocabulary terms on the lesson opener page. Then ask them to write each term on the front of an index card.
- As they complete the lesson, student partners should work together to write a definition for each vocabulary term in their own words on the back of their index cards.
- At the end of the lesson, collect flash cards and organize them by vocabulary word.
- Pin the index cards on a bulletin board. Create a column for each vocabulary word.
- Have students select the best definition for each term. Ask them to explain their choices.



Use Vocabulary

1. A polar molecule has a slightly positive end and a slightly negative end. Polar molecules have an uneven distribution, or separation, of charge. DOK 1

Understand Key Concepts

- 2. The solubility of a substance is the maximum amount of solute Math Skills that will dissolve in a given volume of solvent. If this amount or more is placed in the given volume, the solution will be saturated. DOK 2
- 3. Because ions are charged particles, they will behave like polar substances, and will not dissolve in a nonpolar solvent. DOK 2

Interpret Graphics

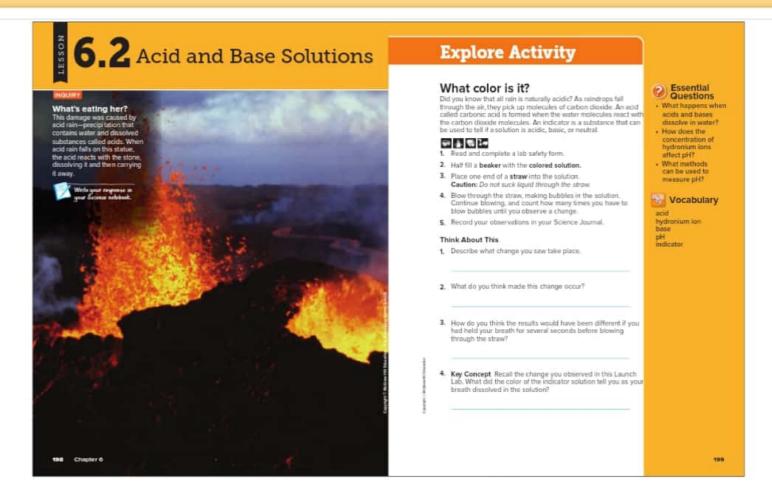
- The solubility of KCIO₃ at 10°C is about 5 g per 100 g of water. Therefore, you will observe most of the solute (25 g) on the bottom of the container. DOK 2
- 5. increasing the temperature, crushing the solute, stirring the solution (in any order) DOK 2

Critical Thinking

6. Breaking the solute into smaller pieces and stirring will make it dissolve faster, but it won't make more of it dissolve. Increasing temperature of a solution will make more solute dissolve. DOK 3

7. Concentration is m/V. A tablespoon has less mass and less volume. A cup has more mass and more volume. However, the ratio of mass to volume is the same for both, therefore, they have the same concentration. DOK 3





INQUIRY

About the Photo This statue is made out of a type of rock, such as marble, that reacts easily with acids. Make sure students recall scientific words.

understand that the statue is very old and that the damage shown 1. Write the word base on chart paper or on the board. Have

Vocabulary

everyday context.

Guiding Questions

How old do you think the statue is?

occurred over many years.

Students might suggest that the statue is hundreds of years old or more.

Do you think the statue is most likely in a city or in the country? Students might suggest that it is most likely in a city, since there is more pollution in cities than in the country.

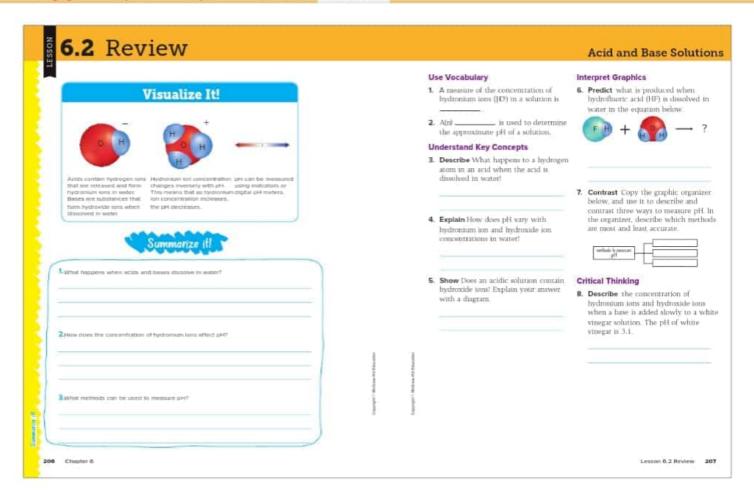
What do you think might happen to the statue if it continues to be affected by acid rain? Students might suggest that the marks on the statue would become bigger or that the statue might crumble apart.

Write the word base on chart paper or on the board. Have students look up the different meanings of the word in the dictionary. Discuss how they might use the word in an

- Have students work together as a class to create a dictionary entry for the term, writing two or three of the definitions they found in their own words.
- 3. Have students record the dictionary entry in their Science Journal. After they have completed the lesson, have them compare their definitions to the scientific definition of the term base. Ask students to consider how the scientific definition is different from the everyday definitions.

Essential Questions

After this lesson, students should understand the Key Concepts and be able to answer these questions. Have students write each question in their Science Journals. Revisit each question as you cover its relevant content.



Visual Summary

Concepts and terms are easier to remember when they are associated with an image. Ask: Which Key Concept does each image relate to?

Use Vocabulary

- 1. pH DOK 1
- 2. indicator DOK 1

Understand Key Concepts

- The hydrogen atoms separates from the acid molecules and reacts with water molecules forming hydronium ions. DOK 2
- 4. As the concentration of hydroxide ions increases, relative concentration of hydronium ions decreases, and the pH increases. As the concentration of hydroxide ions decreases, the relative concentration of hydronium ions increases, and the pH decreases. DOK 2
- Yes; but it contains more hydronium ions than hydroxide ions. Accept student diagrams that show hydroxide ions and hydronium ions. DOK 2

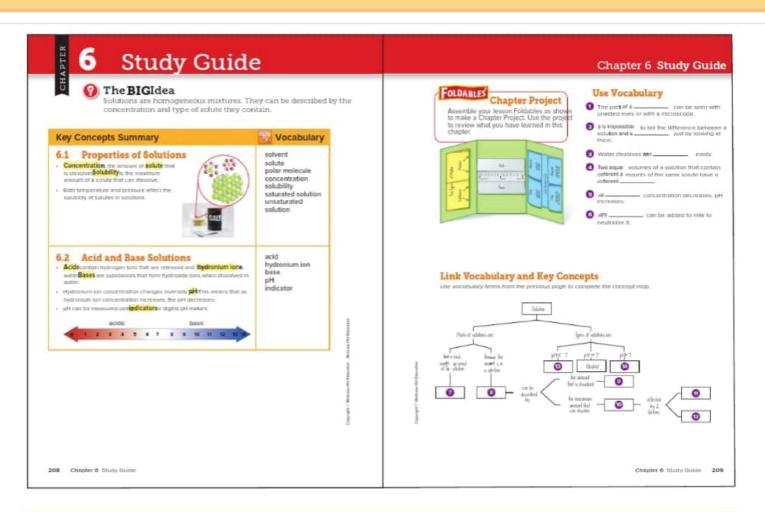
Interpret Graphics

- 6. H₃O+ and F- DOK 2
- 7. (in any order) pH meter, pH testing strips, pH indicators DOK 3

Critical Thinking

8. As a base is added, the hydronium ion concentration decreases and relative to the hydroxide ion concentration. The pH of the vinegar increases until the concentrations of hydronium and hydroxide ions are equal, the pH equals 7. DOK 3





Key Concepts Summary

Study Strategy: Write a Quiz

from the key concepts they have explored, it takes some of the mysterunderstanding more effectively than pure memorization. out of the assessment and allows them to focus on studying the condents Have students create a two-column table like the one below in their they have learned.

- 1. Organize students into groups of four.
- 2. Have each student develop a ten-question guiz from information in the key concepts summary. Encourage students to include a variety 3. Ask students to describe what they know about the chapter's of question types including true-false, matching, fill in the blank, multiple choice, and short answer.
- 3. Have each student exchange papers with another member of the group, who will complete the quiz.
- 4. Instruct each student to exchange papers with another member of the group, who will grade the quiz and give it back to the person wh
- 5. Encourage groups to discuss how writing questions helped them complete a quiz.

4 Vocabulary

Study Strategy: In Your Own Words

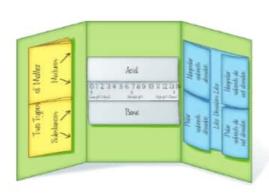
Students are often nervous about assessments because they are unsurask students to create vocabulary definitions using their own words. of what will be on the test. When students write possible test questions connecting vocabulary words to students' own language promotes

- Science Journal.
- 2. Have them write the vocabulary words in the Study Guide in the left column.
- vocabulary words using their own words (without referring to the textbook).

Example:

ho	Vocabulary Word	My Definition
110	substance	A substance is something that atways has the same kinds of atoms that are arranged in the same way. Substances can be elements or compounds.

FOLDABLES Chapter Project



Use the Foldables® Chapter Project as a way to connect Key Concepts.

- 1. Ask students to organize their Foldables® in a way that reflects how the concepts in each Foldable relate to each other.
- 2. Use glue or staples to hold the sheets together as needed.
- 3. When complete, ask students to place their Foldables® Chapter Project at the front of the room. Have the class critique and discuss the way in which students have organized their Foldables®.

Use Vocabulary

- 1. mixture
- 4. concentration
- 2. substance
- 5. hydronium ion
- 3. polar molecules
- 6. base

Link Vocabulary and Key Concepts

- 7. Solvent
- 11-12. Temperature, Pressure
- 8. Solute(s)
- 13. Acids
- 9. Concentration
- 14. Bases

10.Solubility

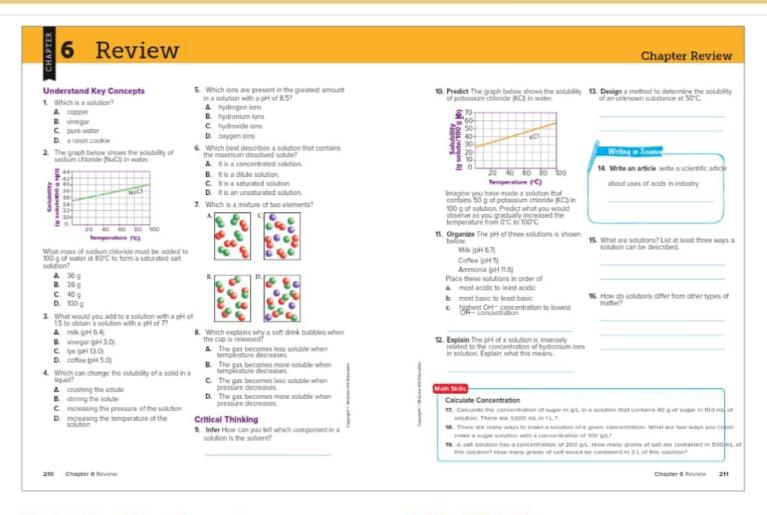




On Level Approaching Level

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Chapter 6 Study Guide



Understand Key Concepts

- 1 B. vinegar
- **2 B.** 40 g
- 3 C. lye (pH 13.0)
- 4 D. increasing temperature of the solution
- 5 C. hydroxide ions
- 6 C. It is a saturated solution.
- 7 A. mixture of two elements
- 8 C. The gas becomes less soluble when pressure decreases.

Critical Thinking

- 9 The component that exists in the greatest amount is the solvent. Also, the state of the solution is the same as the state of the solvent.
- 10 At 0°C, only about 28 g of KCI will dissolve. As the temperature increases, more solute dissolves. At about 80°C, the last of the KCI dissolves. Above 80°C, all of the solute remains in solution.
- 11 a. most acidic to least acidic: coffee, milk, ammonia b. most basic to least basic: ammonia, milk, coffee c. highest OH⁻ concentration to lowest OH⁻ concentration:
 - c. highest OH concentration to lowest OH concentration: ammonia, milk, coffee
- 12 This means that as the hydronium concentration increases, the pH of a solution decreases.
- 13 Possible method: Heat 100 g water to a temperature of 50°C. Measure the mass of a few grams of substance. Add small amounts of the substance until the point where a few crystals of substance do not dissolve. Measure the mass of the remaining substance and subtract from the mass of the starting amount. The difference is the mass of substance that dissolves in 100 g of solution—the unknown's solubility.

Engage

Explore

Elaborate

Writing in Science

14 Check that answers follow the definition of a haiku and accurately describe the formation of a hydronium ion.

The **BIG** Idea

- 15 Solutions are the same as homogeneous mixtures—two or more substances mixed together on the atomic level but not bonded together. A solution can be described as dilute or concentrated; by how much solute it contains; as saturated or unsaturated; as acidic, neutral, or basic; or by its pH.
- 16 Solutions are different from heterogeneous mixtures in that they are mixed on the atomic level. Solutions are different from substances in that they have a variable composition and substances have a fixed composition.

Math Skill

Calculate Concentration

- 17 40 g/100 mL × 1,000 mL/1 L = 400 g/L
- 18 Answers may vary but should result in a concentration of 100 g/L. Possible answers include: Add 100 g of sugar to a graduated cylinder or vessel and then add water to the 1,000 mL mark. Or add 10 g of sugar to a graduated cylinder or vessel and then add water to the 100 mL mark.
- 19 100 g; 400 g











Standardized Test Practice

Standardized Test Practice

Multiple Choice aligned with TIMMS 4 A beaker contains a moture of sand and small pebbles. What kind of mixture is this?

the the figures below to unswer question 1.





- 1 Which statement describes the two figures?
 - A Both 1 and 2 are mixtures.

 - 1 is a mixture and 2 is a substance.
- Which statement is an accurate companion of solutions and homogeneous mixtures.
 - A They are the same.
 - They are opposites
 - Solutions are more evenly mixed than homogeneous mixtures.
 - Homogeneous mixtures are more evenly mixed than solutions.
- 3 A worker uses a magnet to remove bits of iron from a providered sample. Which describes the sample before the worker used the magnet to remove the iron?
 - The sample is a compound because the iron was removed using a physical
 - The sample is a compound because the iron was removed using a chemical
 - C The sample is a mixture because the iron was removed using a chemical change.
 - The sample is a mixture because the iron was removed using a physical method.

- - A compound

 - homogeneous
 - D solution
- 5 Which type of substance would best dissolve in a solvent that was reade of nonpolar molecules?
 - A a water-based solvent
- C a solute made of polar molecules

Use the figure to answer question 6.



- The figure shows how water molecules surround an ion in a solution. What can you conclude about the ions?
 A is a negative because the negative ends of the water molecule are attracted to it.

 - B It is negative because the positive ends of the water molecule are attracted to it.
 - C It is positive because the negative ends of the water molecule are attracted to it.
 - b it is positive because the positive ends of the water molecule are affracted to it.

- 7 A get makes two glasses of lemonade using a powder mis. Site pours one cup of water into take glass. She acids one specified to powder to the first glass and two specified to powder to the first glass and two specifies of powder to the second glass. How do the solutions in the two glasses compare?

 Specified to the second glass is the solutions in the two glasses compare?
 - A The first glass has a greater concentration of powder mix
 - The first glass has a greater solutality.
 - C The second glass has a greater concentration of powder mix.
 - D The second class has a greater solubility.

The the table below to master mession 8.

Sample solution	Charge in blue litmus	Change in red (terms
1	furns rest	no charge
2.	no charge	burns brure
. 3	turns rest	to change
. 4	по спапре	he Cherge

- A scientist collects the data above using A scientist collects the data above using libraus paper. Silue libraus paper is a type of pH indicator that turns red when placed in an acidic solution. Red libraus paper is an indicator that turns blue when placed in an basic solution. Neutral solutions cause no change in either color of litmus paper, Which sample solution must be a base?
 - A solution 1
- B solution 2
- C solution 3

H G

- hydronium ions and the concentration of hydroxide ions change when a base is dissolved in water.
- 10 A researcher mixes a solution that is A researcher mixes a solution that is. 40 percent helium gas and 60 percent nitrogen gas. Which gas is the colute and which is the solvent? What would the mixture look like through a microscope? What would the mixture look fike at the atomic level?

Use the flaure to answer assestions 12 and 13.



- 12 The figure shows what happens when hydrogen iodide (HI) dissolves in water is hydrogen iodide an acid, a bese, or a neutral substance? Explain.
- 13 What can you conclude about the pH of the aqueous solution of hydrogen lockde?

Need Extra Help?			_			_	-	-	_	-	-	100	
f You Missed Question.	. 1	- 2	- 3	4	- 5	- 6	7	В	19	30	11	12	13
So to Lesson	1	1	-1	1	2	- 2	- 2	4	3	3	1	2	3

Multiple Choice

- 1 B—Correct. Both 1 and 2 are substances. 1 shows an element. 2 shows a compound. Both of these are substances. A, C, and D include mixtures in the descriptions.
- 2 A-Correct. They are the same. Solution is another word for homogeneous mixture. B does not accurately describe different types of mixtures, and C and D assume differences between solutions and homogeneous mixtures.
- 3 D-Correct. The sample is a mixture because the iron was removed using a physical method. The removal of iron using a magnet is a physical method. Only mixtures can be separated using physical methods. A and B state the sample is a compound, and C states the removal of the iron is a chemical
- 4 B—Correct. A, compounds are substances, not mixtures. C, the mixture contains visibly different components and is not uniform, or homogeneous. D, the mixture contains visibly different components and is not uniform.

- 5 D—Correct. Like dissolves like. Nonpolar dissolves nonpolar. A and C are polar substances and would not dissolve a nonpolar molecule. B dissociates into positive and negative ions which are attracted to the negative and positive ends (respectively) of a water molecule.
- C-Correct. It is positive because the negative ends of the water molecules are attracted to it. The end of the water molecule with the oxygen atoms is negative and is interacting with the ion. The ion has an opposite charge—positive. A is a wrong characterization of the ion and how water molecules interact with negative ions. B is a wrong characterization of the ion but a correct characterization of how water molecules interact with negative ions. D is a correct characterization of the ion but a wrong characterization of how water molecules interact with positive ions.



- 7 C-Correct. The second glass has a greater concentration than the first glass. A gives the opposite relative concentrations, and B and D describe solubility, which is the same for both glasses. The solubility for the powder mix is dependent on the interaction with water and not on the quantities of either.
- 8 B-Correct. A and C are acids, and D is a neutral substance.

Constructed Response

- 9 The concentration of hydroxide ions increases relative to the concentration of hydronium ions
- 10 Nitrogen is the solvent because there is more of it. The mixture is a solution, so the particles of gas are mixed evenly throughout the solution at the atomic level.
- 11 Sample answer: Crush the rock salt into a finer powder, heat up the water, or stir the water vigorously.
- 12 Hydrogen iodide must be an acid, because it produces hydronium ions when dissolved in water.
- 13 Because hydrogen lodide is an acid, the aqueous solution must have a pH lower than 7.

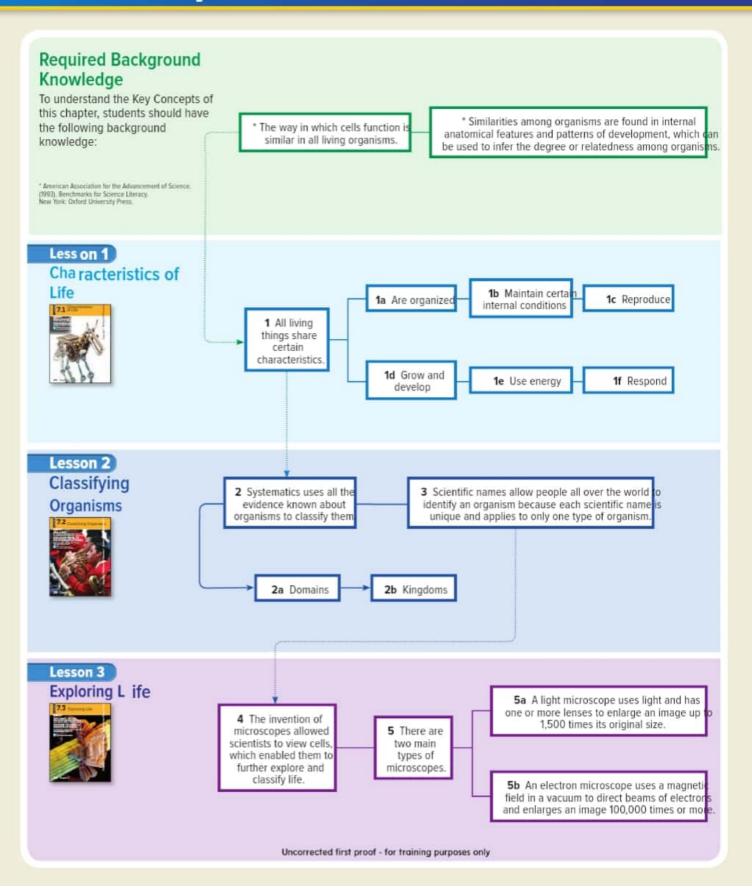
Answer Key

Question	Answer
1	В
2	A
3	D
4	В
5	D
6	C
7	C
8	В
9	See extended answer.
10	See extended answer.
11	See extended answer.
12	See extended answer.
13	See extended answer.





Strand Map



Identifying Misconception

Classification System

Find Out What Students Think

Students may think that...

... the classification system is difficult to remember and is used only by scientists.

Discussion

Review the classification system by first making a series of taxonomic group cards with the largest card labeled Domain and Discussion the smallest card labeled Species. Place the cards on chart paper. There should be a visual image of the cards becoming smaller as the taxonomic groups become more specific. Ask: Which taxonomic group holds the most species? Domain Which is specific to only one species? Species Take down the cards. Hold up a picture of an interesting animal. Ask: How can we label this animal so everyone knows which animal we are identifying? Repost each taxonomic group as students identify:it. Have them brainstorm which animals might be a part of each group. List them as they are identified. Talk about the traits that are common among the animals within the group. Discuss how the traits in each group become more specific as the classification system narrows. Ask: Where might the classification system be commonly used? at a zoo, arboretum,

Promote Understanding

Use the following activity to help students remember the sequence of taxonomic groups in the classification system of living things.

- 1. Divide the class into groups of three. Have each group write the names of the taxonomic groups found in the classification 1. Have each group identify ten things they would like to system.
- 2. Have students circle the first letter of the eight taxonomic groups: Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species (D, K, P, C, O, F, G, S).
- 3. Each group should use the letters to create a saying for the acronym, such as Ducks Keep People Coming On Flowing Grassy Streams. Encourage students to be creative.
- 4. Have groups share their sayings.

Cellular Respiration and Photosynthesis

Find Out What Students Think

Students may think that...

... if something is magnified enough, then its resolution will be clear. Some students may not understand that magnification and resolution are separate characteristics of a microscope.

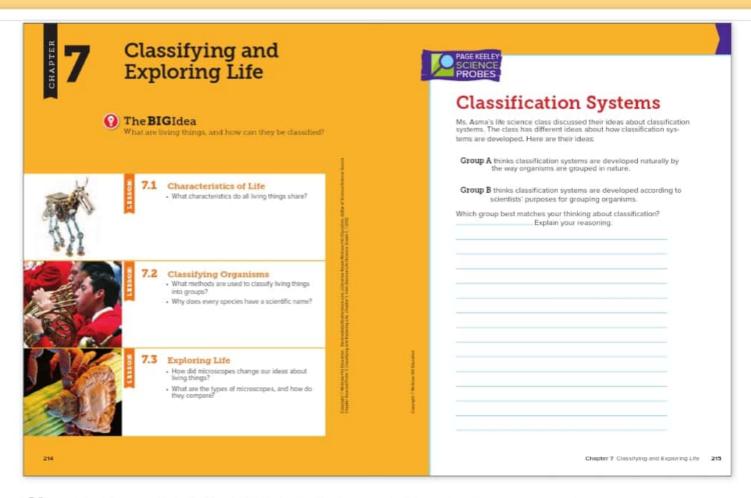
Create a Venn diagram on the board with two overlapping circles. In the left circle, write magnification. In the right circle, write resolution. In the center overlap, write microscopes. Ask: What does a microscope do? enlarges images of things, makes them clearer to see Explain that microscopes have two characteristics: they magnify, or make images of things larger, and they make things clearer to see. Both magnification and resolution are needed. Give each student a magnifying lens, or divide the class into small groups. Have students look at an object at different distances. Ask: What does the magnifying lens do? magnifies objects Ask: Did the magnifying lens make the object clearer at different distances? no What did you do to make the object look clear? adjusted where the magnifying lens was held Explain that a microscope not only magnifies, it also adjusts the resolution so that the object appears clear. It does more than a simple magnifying lens.

Promote Understanding

crivity Divide the class into student pairs. Give each student pair a photo of a living thing.

- observe more closely.
- 2. Have them list which of those ten things they could successfully learn more about by using the magnifying lens and which would be so small that a microscope would be needed to both enlarge and make it clearer to see.
- 3. To extend the activity, have students then identify three ways an electron microscope would be useful.
- Have students share their ideas.





Classifying and Exploring Life

🕡 The **BIG** Idea

There are no right or wrong answers to these questions. Write student-generated questions produced during the discussion on chart paper and return to them throughout the chapter:

Guiding Questions

What are living things?

This question helps students start to think about the characteristics that all living things have and that separate living things from nonliving things. Start by asking students what animals have in common. Then ask what animals and plants have in common. Then ask how animals and plants are different from nonliving things.

What are some different kinds of living things you know about?

This question initiates students' thinking about the variety of living things. If students don't mention any microscopic living things, ask them if there are living things that are too small to see.

How can living things be classified?

This question helps students start to think about how living things are classified by their differences. Start by asking how plants and animals are different.

Get Ready to Read

What do you think?

Use this anticipation guide to gauge students' background knowledge and preconceptions about oceans. At the end of the chapter, ask students to read and evaluate their earlier responses. Students should be encouraged to change any of their responses.

Anticipation Set for Lesson 1

1. All living things move.

Disagree. Movement is not a characteristic of all living things.

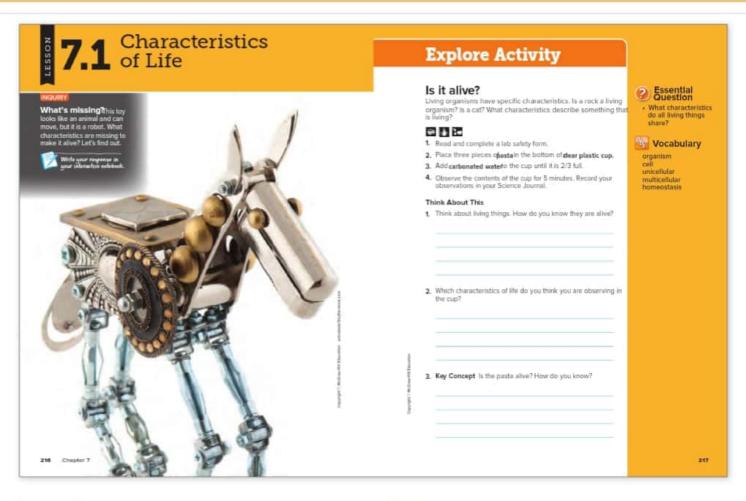
The Sun provides energy for almost all organisms on Earth.

Agree. Most organisms use energy from the Sun for all the processes they perform.

Anticipation Set for Lesson 2

A dichotomous key can be used to identify an unknown organism.

Agree. The series of questions in a dichotomous key leads to an organism's identity.



INQUIRY

About the Photo What's missing? Although the robotic animal resembles a real animal, it is obviously just a mechanical toy. But what if it looked and moved exactly like a real animal and even had an artificial heartbeat? How would we tell that it isn't really alive? Start the lesson with questions about the characteristics of life.

Guiding Questions

Ol How could we determine whether an advanced, lifelike robot was alive? What's missing to make it alive? What's missing to make it alive?

If a robot were made of biological materials and performed biological functions, would it be alive? Yes, we would have to consider it to be a living organism. And robots of this type are a staple of science fiction. They are called androids (though that term is flexible and also includes humanlike robots made of synthetic materials).

🚱 Essential Questions

After this lesson, students should understand the Essential Questions and be able to answer them. Have students write each question in their interactive notebooks. Revisit each question as you cover its relevant content.

Vocabulary

Thinking About Umbrella Words

- Write the word organism on chart paper or the board and review the definition of organisms given in the lesson: things that have all the characteristics of life...
- 2. Explain that an organism can be an animal, a plant, a fungus, or even something microscopic, such as an amoeba. If we want to discuss living things as a group, we can simply say "biological organisms" rather than "animals, plants, fungi, and microorganisms." The word organism can thus be considered an umbrella word, a term that encompasses two or more groups.
- With students, think of some other umbrella words. For example, siblings means "brothers and sisters" and aircraft includes all kinds of flying machines.

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216 Chapter 7

ExploreActivity

Is it alive?

Prep: 5 min Class: 15 min

Purpose

Students will observe and identify characteristics that can be attributed to both living and nonliving things, recognizing that only those things that possess all the characteristics of life are considered living.

Materials

Teacher: small pasta (elbow macaroni, bowtie), carbonated water (club soda), clear plastic cups, paper towels

Before You Begin

Remind students to bring Science Journals. Test the pasta in advance to guarantee that it is light enough to be lifted by the bubbles that form on its surface.

Guide the Investigation

- · Have students individually answer the introductory questions at the beginning of the lab, then share answers and brainstorm a list of characteristics of living things.
- A Have students wear goggles and aprons.
- · Troubleshooting Be sure to use unopened bottles in subsequent classes to ensure that no carbonation is lost from the club soda.

Think About This

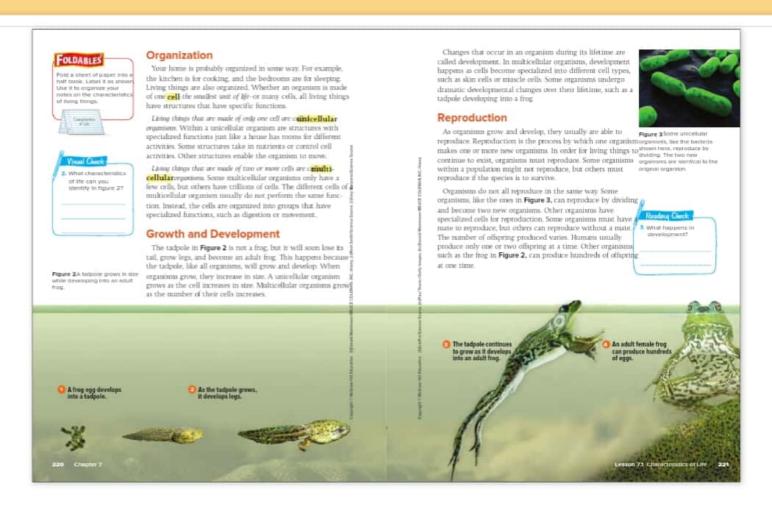
- 1. Living things are organized, grow and develop, reproduce, respond, maintain certain internal conditions, and use energy. Students may also include or substitute characteristics such as the ability to move, require food, and other simpler terms.
- 2. When the bubbles form on the pasta, the pasta rises through the liquid. The bubbles burst and the pasta sinks. This appears as movement, so students may suggest that the pasta is using energy to move or that the pasta is responding to its environment.
- 3. No, the object is not alive. I know this because the pasta shows only some, not all, of the characteristics that living things

Have students identify other nonliving things and the characteristics of life which they possess. Use something lifelike as an example, such as a doll that moves or talks.





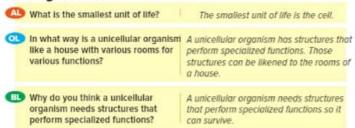




Organization

make note of that fact as they create a Foldable on the characteristics of life. Use the questions below to assess students'multicellular organism, growth is caused by an increase in the understanding of the text.

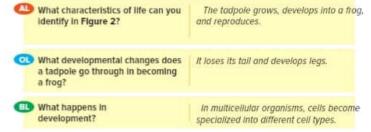
Guiding Questions

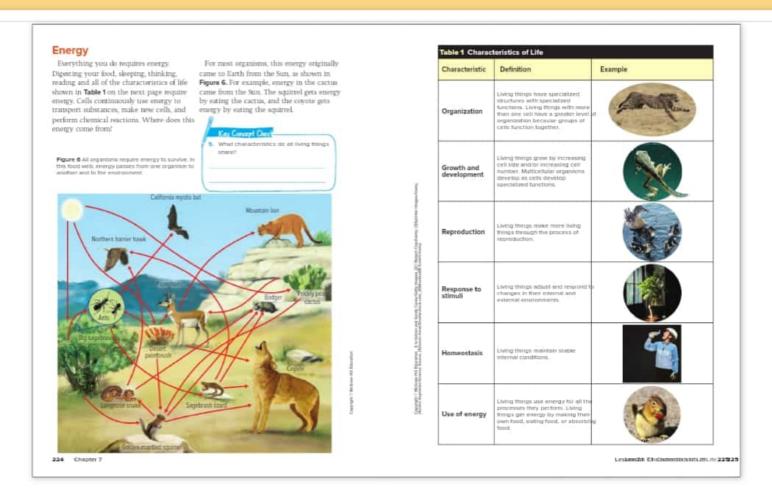


Growth and Development

Organisms can be either unicellular or multicellular. Have students Explain to students that growth can occur in one of two ways. A unicellular organism grows as the cell increases in size. In a number of cells. Explain that when an organism grows, it experiences changes called development. Ask students to think about the following questions.

Guiding Questions





Energy

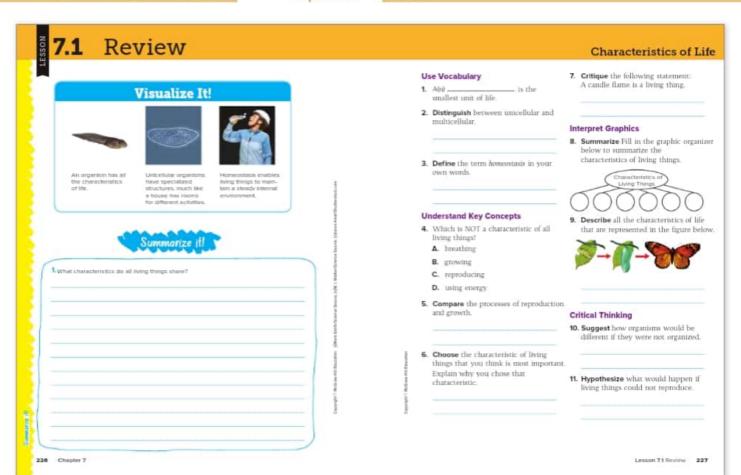
Visual Literacy: Characteristics of Life

Everything that a person—or any organism—does requires energy. Discuss the six characteristics of life presented in the lesson and The Sun is the source of energy for almost all life on Earth. Use the ummarized in **Table 1** and below. Use the Guiding Questions on questions below to check students' understanding.

Guiding Questions

AL	What do cells use energy for?	They use energy to transport substances, make new cells, and perform chemical reactions.
0	Which organisms get their energy directly from the Sun? Which organisms get the Sun's energy indirectly, and how do they get it?	Plants get their energy directly from the Sun. Animals get the Sun's energy indirectly by either eating plants or eating other animals.
0	What characteristics do all living things share?	All living things are organized, grow and develop, reproduce, respond to stimuli, maintain homeostasis, and use energy.
0	From which food sources does the badger in Figure 6 get energy?	The badger gets energy from the snake, lizard, and squirrel.

Characteristic	Definition
Definition	Living things have specialized structures with specialized functions. Living things with more than one cell have a greater level of organization because groups of cells function together.
Growth and development	Living things grow by increasing cell size and/or increasing cell number. Living things develop as cells develop specialized functions.
Reproduction	Living things make more living things through the process reproduction.
Response to stimuli	Living things adjust and respond to changes in their internal and external environments.
Homeostasis	Living things maintain stable internal conditions.
Use of energy	Living things use energy for all the processes they perform Living things get energy by making their own food, eating food, or absorbing food.





The information needed to complete this graphic organizer can be . Reproduction is the production of a new cell or cells and results

· Characteristics of Life

Use Vocabulary

- 1. cell DOK 1
- Unicellular organisms are made of only one cell. Multicellular organisms are made of more than one cell. DOK 2
- 3. Sample answer: Homeostasis is keeping an organism's internal conditions stable when external conditions change. DOK 1

Understand Key Concepts

- 4. A. breathing DOK 1
- in a new organism. Growth usually involves the production of more cells but does not produce a new organism. DOK 2
- 6. Student answers will vary. Sample answer: Energy is the most important characteristic of living things. Without energy, organisms would not be able to perform any other process necessary to live. DOK 3
- 7. A candle flame is not a living thing. A candle flame can respond to wind and can use energy, but it is not organized and cannot reproduce, grow and develop, or maintain homeostasis. DOK 3

Explain Engage Explore Elaborate

Interpret Graphics

8. Characteristics of Living Things growth and organization homeoslasis reproductor brente of a Elgenieri evergy

DOK 2

Evaluate

9. growth because the caterpillar increases in size; development because the caterpillar develops into a butterfly; and energy use because the caterpillar is eating food and all these processes require energy DOK 2

Critical Thinking

- 10. Sample answer: Organisms, even unicellular organisms, probably would not be as a complex if organisms did not have specialized structures for carrying out specialized functions. DOK 3
- 11. If living things could not reproduce, then eventually there would not be any living things. DOK 3











7.2 Classifying Organisms **Explore Activity** Essential Questions How do you identify similar items? Do you separate your candies by color before you eat them? When your family does laundry, do you sort the clothes by color first? Identifying characteristics of items can enable you to place 1. Read and complete a lab safety form. scientific name? Examine twelve leaves. Choose a characteristic that yourse to separate the leaves into two groups. Record the characteristic in your Science Journal. binomial nomenciature species Place the leaves into two groups, A and θ , using the characteristic you chose in step 2. Choose another characteristic that you could use to further divide group A. Record the characteristic, and divide the leave 5. Repeat step 4 with group 8. Think About This What types of characteristics did other groups in class choose to separate the leaves? 2. Key Concept. Why would scientists need rules for separating

INQUIRY

About the Photo Alike or Not? Have students identify the instruments shown in the photo. Discuss which instruments are alike in some way, and which are different.

Start the lesson with students generating a list of musical genres, such as jazz, classical, country western, hip hop, and so on. Discuss how each type of music is different from the other, but that they share similar sounds, although the sounds are arranged differently.

Guiding Questions

In what way are the instruments in Students should recognize that the different?

the photo alike? In what way are they instruments require the player to blow into them in order to make a sound, but that they are shaped differently and make different sounds.

What characteristic would you use to group these instruments?

Students might suggest grouping the instruments by sound or composition.

B) Why are living things classified?

Students should recognize that different groups of organisms have unique characteristics.

Essential Questions

After this lesson, students should understand the Essential Questions and be able to answer them. Have students write each question in their interactive notebooks. Revisit each question as you cover its relevant content.

Vocabulary Be a Word Detective

- 1. Write the word nomenclature on the board or chart paper. Explain that nomenclature means "a system or set of names," and comes from the Latin meaning "calling by name." There are sets of nomenclature in art, science, math, and every other subject.
- Write three subjects as headings, such as Music, Computers, Fashion on the board or on chart paper. Have students suggest different nomenclature for each subject. Discuss how the words are specific to that subject. Divide students into small groups. Have each group choose a subject and develop a set of nomenclature for the subject. Encourage students to think creatively.

3. Have each group share its set of nomenclature with the class. Create a list of the words on the board or on chart paper as they are generated by each group. Point out that the words on the vocabulary list are science nomenclature.

ExploreActivity

How do you identify similar items?

Prep: 30 min Class: 15 min

Purpose

To introduce students to the concept of classification by comparing leaf samples.

Materials

Teacher: 12 leaves from different trees for each student or student

Optional/Alternate: Any grouping of items that have multiple characteristics can be used. If real leaves are not available, silk leaves from a craft store could be used. Images of leaves and animals are readily available online.

Before You Begin

Remind students to bring their Science Journals. Separate leaf samples into groups of 12 for each student group.

Guide the Investigation

- · When students choose the characteristic to use for separation, items in one of the groups should have the characteristic while the items in the other group should not have the characteristic (e.g., blue v. not blue).
- Make sure that you can identify poisonous leaves so that you do not select those. Have students wash hands thoroughly with soap and water when finished.

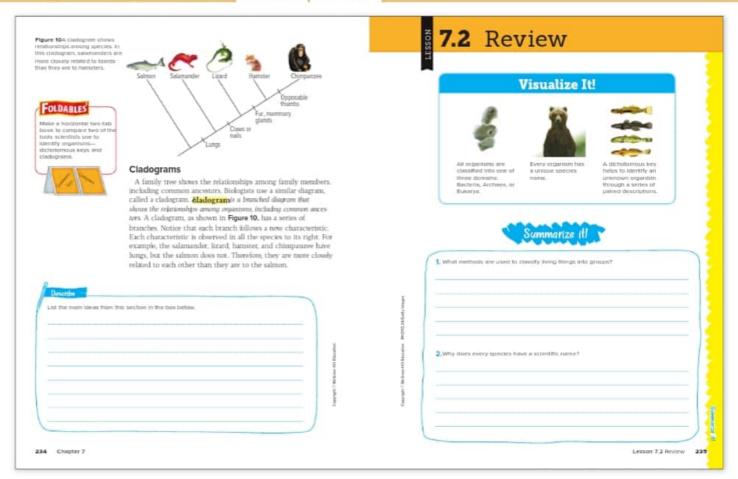
Think About This

- 1. Answers will vary but will likely include characteristics such as leaf margins (edges), branching or parallel veins, lobes (indents), and so on.
- 2. Scientists use rules for separating and identifying items so all scientists arrive at the same result if they were classifying the same organism.





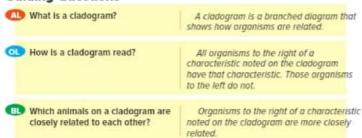




Cladograms

After students read the first paragraph, use the scaffolded questions below to connect the information in the paragraph to **Figure 10**.

Guiding Questions



Summarize it!

The information needed to complete this graphic organizer can be found in the following sections:

- · Determining Kingdoms and Determining Domains
- Scientific Names

Engage Explore Explain Elaborate Evaluate

Use Vocabulary	Interpret Graphics	
A naming system that gives every organism a two-word name is	 Organize Information Fill in the graphic organizer helow to show how organisms are classified. 	
2. Use the term dichotomous less in a swittence.	Domain	
Organisms of the same are able to produce fertile offspring.		
Understand Key Concepts		
 Describe how you write a scientific tame. 		
	Critical Thinking	
 Compare the data available today on how to classify things with the data available during Aristotle's time. 	Suggest a reason scientists might consider changing the current classification system.	
_		
6. Which is NOT used to classify organisms?	Evaluate the importance of scientific turnes.	en l'incenti
A. ancestry B. habitat		4
C. age of the organism	- Co	unio -
D. molecular evidence		

Use Vocabulary

- 1. binomial nomenclature DOK 1
- Sample answer: I used a dichotomous key to identify two different trees at my school. DOK 1
- 3. species DOK 1

Understand Key Concepts

- 4. The first word in a scientific name is the genus of the organism. The second word might describe the organism's appearance or its behavior. DOK 2
- Physical and molecular data are available today that were not available during Aristotle's time. DOK 3
- 6. C. age of the organism DOK 2

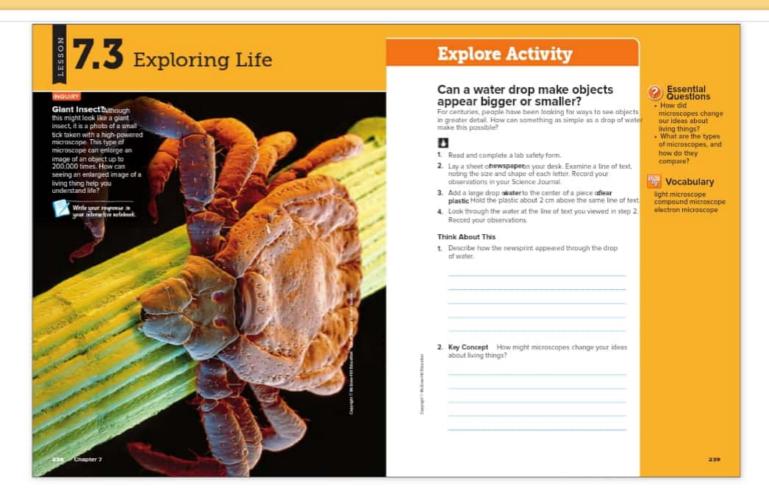
Interpret Graphics

From top to bottom: domain, kingdom, phylum, class, order, family, genus, species DOK 2

Critical Thinking

- 8. Answers will vary. Accept any reasonable response. DOK 3
- Scientific names are important because people worldwide use the same name for the same species. DOK 4





INQUIRY

About the Photo Giant Insect? Ticks are arthropods in the same class as spiders—the arachnids. They are animal parasites and feed on blood. Many of the detailed features of this arachnid would not be visible without a microscope.

Start the lesson with questions about the tick in the photo. Point out some of its external features. Have students count the legs. Tell students that most ticks are 2–6 mm long.

Guiding Questions

What features of the tick can be seen head, mouthparts, flat body, hairs, and eight legs

Do you think this image was seen through a magnifying lens or a microscope? Explain. The image was seen through a powerful microscope. A magnifying lens isn't powerful enough to show details such as hairs.

How can seeing an enlarged image of Answers will vary. Some will reply that it a living thing help you understand life?

Makes living things more interesting.

Essential Questions

After this lesson, students should understand the Essential Questions and be able to answer them. Have students write each question in their interactive notebooks. Revisit each question as you cover its relevant content.

Vocabulary

Exploring Life with a Magnifying Lens
Students should notice that the three yoca

- 1. Students should notice that the three vocabulary words all are kinds of microscopes. Explain that compound means "more than one" and that a compound microscope has more than one lens. A simple microscope, such as a magnifying lens, has only one lens.
- Pair students and give each pair a magnifying lens. Have them choose one living thing or part of a living thing, such as their skin, a strand of hair, or an insect. Have students examine their chosen item with the lens.
- Have students write in their Science Journals one detail about the item that they learned only by observing it under magnification.

Explore

Explain

Elaborate

Evaluate

ExploreActivity

Can a water drop make objects appear bigger or smaller?

Prep: 2 min Class: 15 min

Purpose

To compare an object viewed with the unaided eye and through a water drop.

Materials

newspaper, water, clear plastic wrap, dropper

Before You Begin

Gather printed items before the activity. Have paper towels available for spills.

Guide the Investigation

Students will need only a small drop of water. Using too much will cause the water to run off the plastic. A sheet of acetate works as well as plastic.

Think About This

Do not expect students to determine the correct answer. Students should be encouraged to speculate. Use the answer set to guide students' reasoning.

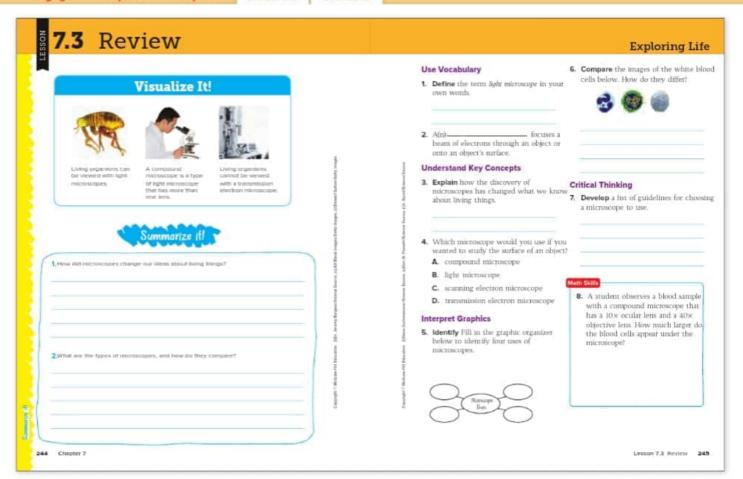
- The letters looked bigger.
- 2. Answers will vary, but might include that microscopes enable us to see more details about living things.











Visual Summary

Concepts and terms are easier to remember when they are associated with an image. Ask: Which key concept does each image relate to?



The information needed to complete this graphic organizer can be 5. Center oval: Microscope Uses; Branches: Student answers may found in the following sections:

- · The Development of Microscopes
- · Types of Microscopes

Use Vocabulary

- 1. Sample answer: A light microscope uses light and lenses to enlarge an image of an object. DOK 1
- 2. electron microscope DOK 1

Understand Key Concepts

- 3. The invention of microscopes led to the discovery that all living things are made of cells. Microscopes also allow us to study objects and living things in great detail. DOK 2
- 4. C. scanning electron microscope DOK 2

Interpret Graphics

- vary and may include surgery, forensic science, study fossils, steel analysis, jewel analysis. DOK 1
- 6. The left image is from a light microscope and shows a stained image of a white blood cell. The center image is from a TEM and shows more detail than the light microscope image. The right image is from an SEM and shows the surface of a white blood cell. DOK 2



Explore Explain Engage Elaborate Evaluate

Critical Thinking

7. Sample answers might include the type of object, whether the object is living or dead, whether the inside or the surface of the object is to be studied, or the level of magnification needed. DOK 3

Math Skill

Use Multiplication

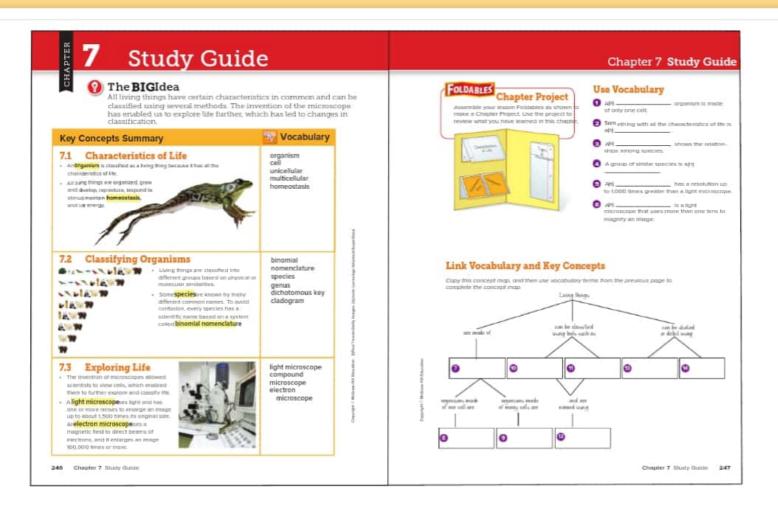
8. 10 × 40 = 400, so the image is 400 times larger DOK 1











Key Concepts Summary

Study Strategy: Self-Assessment

Students often complete a reading without thinking about their metacognition, increasing their awareness of their understanding.

- Ask students to draw in their Science Journals a table like the one below, listing the Key Concept questions found on the first page of each lesson.
- 2. Prompt students to read the Key Concept Summary for each Key Concept question.
- 3. For each Key Concept question, have them self-assess their understanding and make an x in the appropriate column in the table.
- Ask students to review any concepts they did not mark I understand xample:

Example:

Key	understand	l somewhat	dont
Concept		understand	understand
What characteristics	X		
do all living things			
share?			

b Vocabulary

Study Strategy: In Your Own Words

Ask students to write sentences that use the vocabulary words in understanding of the concepts. Self-assessment helps students practicecontext. Using words in sentences requires students to understand the meaning of the words and be able to use them correctly.

- Have students create a two-column table like the one below in their Science Journals.
- 2. Have them write the vocabulary words in the Study Guide in the left column.
- 3. Ask students to describe what they know about the chapter's vocabulary words using their own words (without referring to the

Vocabulary	My Sentence
Word	
organism	An organism I didn't recognize jumped into the tall grass

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Use the Foldables® Chapter Project as a way to connect Key Concepts.

- 1. Ask students to organize their Foldables® in a way that reflects how the concepts in each Foldable relate to each other.
- 2. Use glue or staples to hold the sheets together as needed.
- 3. When complete, ask students to place their Foldables Chapter Project at the front of the room. Have the class critique and discuss the way in which students have organized their Foldables®.

Use Vocabulary

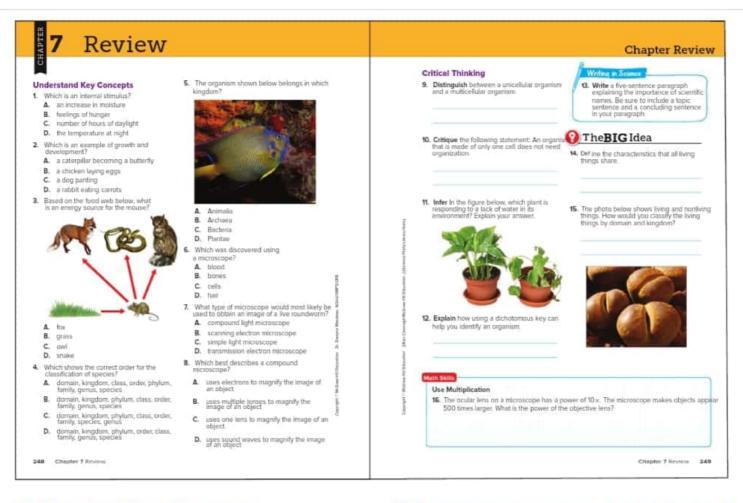
- 1. unicellular
- 2. organism
- 3. cladogram
- 4. genus
- 5. electron microscope
- 6. compound microscope

Link Vocabulary and Key Concepts

- 7. cells
- 8. unicellular
- 9. multicellular
- 10. 11. dichotomous keys; cladograms
- 12. binomial nomenclature
- 13. 14. light microscopes; electron microscopes







Understand Key Concepts

- 1 B. feelings of hunger
- 2 A. a caterpillar becoming a butterfly
- 3 B. grass
- 4 B. domain, kingdom, phylum, class, order, family, genus, species
- 5 A. Animalia
- 6 C. cells
- C. simple light microscope
- 8 B. uses multiple lenses to magnify the image of an object

Critical Thinking

- 9 Unicellular organisms have only one cell. Multicellular organisms contain multiple cells. The cell in a unicellular organism contains structures that perform specialized functions, whereas the cells in a multicellular organism perform specialized functions.
- 10 A unicellular organism must be organized because the organism has to perform all the functions needed to survive. These functions must be performed by different structures that are specialized for each function.

- 11 The plant on the right is responding to a lack of water in its environment as evidenced by the wilting leaves.
- 12 Student answers will vary. Answers should reflect students' understanding of what a dichotomous key is and how to use one to identify an object/organism.



Writing in Science

13 Answers will vary. Sample answer: Scientific names allow persons across the world to communicate about an organism. The scientific name of an organism is specific to that organism. A common name may be used to refer to many similar organisms, or an organism may have more than one common name. The scientific name avoids any confusion that may come from using the common name.



The **BIG** Idea

- 14 All living things share the characteristics of organization, growth and development, reproduction, response to stimuli, homeostasis, and energy use. Organization refers to cells or structures within a cell that are specialized to perform specific functions. Growth refers to the organism increasing in size as the number of cells increases. Development is the series of changes that occurs in an organism during its lifetime. Reproduction is the formation of a new organism. All living things respond to internal or external stimuli. Maintaining homeostasis means that the organism's internal conditions change in response to changes in external conditions. And all living things use energy to perform tasks.
- 15 Domain Eukarya, kingdom Plantae



Math Skill

Use Multiplication

16 10 × 500 = 5,000, so it looks 5,000 times larger

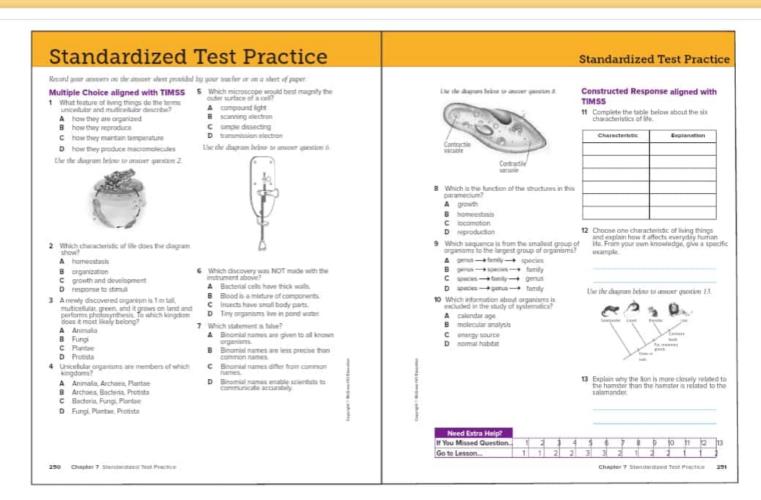












Multiple Choice

- 1 A—Correct. B, C, D—The cell is the smallest unit of life. Living things are organized according to their cellular structures. Unicellular organisms consist of just one cell, while multicellular organisms contain from a few to trillions of cells. DOK 2
- 2 C—Correct. A, B, D—The diagram shows the growth and development of a frog. A frog begins as an egg and grows into a tadpole with a tail and gills. The tadpole develops into a frog, it loses its tail and gills and grows legs and lungs. The adult frog then reproduces by laying eggs, and the cycle begins again. DOK 2
- 3 C—Correct. A, B, D—Of the kingdoms listed, only organisms in the Kingdom Plantae are multicellular and are able to produce their own food. The organism's size and ability to grow on land are also consistent with this kingdom. DOK 2
- 4 B—Correct. A, C, D—Kingdoms Bacteria, Archaea, and Protista contain only unicellular organisms. Kingdom Fungi contains both unicellular and multicellular organisms. Kingdoms Plantae and Animalia contain only multicellular organisms. DOK 2
- 5 B—Correct. A, C, D—A scanning electron microscope (SEM) produces a highly detailed, three-dimensional image of an object by bouncing electrons off the object's surface. While

light microscopes can also reveal a cell's outer surface, the images are far less detailed than those provided by SEMs. **DOK 2**

- 6 A—Correct. B, C, D—The diagram is of one of the first microscopes, a single-lens device capable of magnifying objects to about 270 times their original size. Although its magnification would have allowed scientists to observe organisms in pond water, blood cells, and tiny insects, it would not have been capable of revealing the nature of cell walls. DOK 1
- 7 B—Correct. A, C, D—Linnaeus' system of binomial nomenciature gives each organism a specific name. A binomial (two-word) name precisely denotes an organism's species. The first word names the organism's genus, and the second might describe the organism's appearance or behavior. DOK 2
- 8 B—Correct. A, C, D—Because the paramecium lives in a freshwater environment, water continually enters the cell. The contractile vacuoles collect and pump excess water out of the paramecium, which helps to maintain homeostasis. DOK 2
- 9 D—Correct. A, B, C—In the scientific naming system, species is the smallest group of organisms, followed by genus, and then family. A genus contains similar species, and a family contains similar genera. DOK 2

10 A-Correct. B, C, D-Using systematics, scientists classify organisms by considering several pieces of evidence, including an organism's habitat, the way it obtains food and energy, and its molecular analysis. Calendar age is not a criterion for classification within systematics. DOK 2

Constructed Response

11 Answers may vary. Sample answers:

Characteristic	Explanation
Organization	Organisms have specialized structures with specialized functions.
Growth and development	Living things grow by increasing cell size cell number and develop as cells develop specialized functions.
Reproduction	Living things make more living things through reproduction.
Response to stimuli	Living things adjust and respond to changes in their internal/ external environments.
Homeostasis	Living things maintain stable internal environments.
Use of energy	Living things use energy for everything they do. They get energy by eating, absorbing, or making their own food.

DOK 3

- 12 Answer may vary. Possible answer: Organization: The human body has many parts organized into several systems with different functions. Some parts are external and some are internal. Example: The digestive system digests the food that people eat and gets rid of waste. DOK 3
- 13 Answers may vary. Possible answer: The lion and the hamster differ by one trait on the cladogram, carnivore teeth. The hamster and the salamander differ by two traits. Although there are many other differences between the animals, the two points of difference are enough to separate them by a greater distance. DOK 3

Answer Key

Question	Answer
1	A
2	C
3	C
4	В
5	В
6	A
7	В
8	В
9	D
10	A
11	See extended answer.
12	See extended answer.
13	See extended answer.







Science Content Background

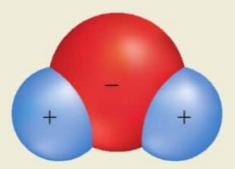
Lesson 1

Cells and Life

The Discovery of Cells The study of cells got its start more than 300 years ago with an English scientist, Robert Hooke, who that perform various functions necessary for the life of the cell. in the cork reminded Hooke of monks' monastery cells, so he : called them cells.

The Cell Theory Three German scientists later followed up on: Hooke's work and developed the cell theory. This theory states that all living things are made of one or more cells and that all tettells, which, with few exceptions, have genetic material come from preexisting cells.

Basic Cell Substances Cells contain a number of components, including water and various large molecules called macromolecules. There are four kinds of macromolecules in cells: nucleic acids, proteins, lipids, and carbohydrates.



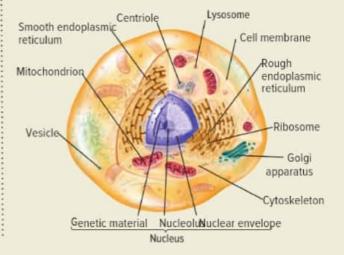
Lesson 2

The Cell

Cell Shape and Movement A cell is made of different structures looked at cork under a microscope. The honeycomblike openingsThese structures include the cell membrane, the cell wall (in plant cells and bacteria), and cell organelles.

> Cell Types There are two kinds of cells—prokaryotic cells and eukaryotic cells. Most prokaryotic cells are unicellular organisms, such as bacteria. Plants and animals are all made of eukaryotic surrounded by a membrane.

Cell Organelles Eukaryotic cells contain organelles—structures with specific purposes. A cell's organelles include the nucleus, which contains the cell's genetic material; ribosomes, centers of protein production; and mitochondria, where energy is generated.



Science Content Backgroun

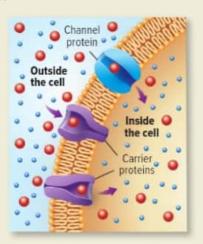
Lesson 3

Moving Cellular Material

Passive Transport This is the movement of substances through a cell membrane without using the cell's energy. Passive transport depends on the amount of a substance, such as oxygen, on each side of a membrane.

Diffusion Diffusion is a type of passive transport involving the : movement of substances from an area of higher concentration tois used, fermentation makes less ATP than cellular respiration an area of lower concentration. One type of diffusion is osmosis, does. the diffusion of water molecules across a semipermeable cell membrane.

Active Transport This is the transport of a substance through a cell membrane in a way that uses the cell's energy. In contrast as a by-product of these reactions. with passive transport, active transport involves the movement of substances from areas of lower concentration to areas of higher concentration.



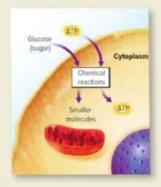
Lesson 4

Cells and Energy

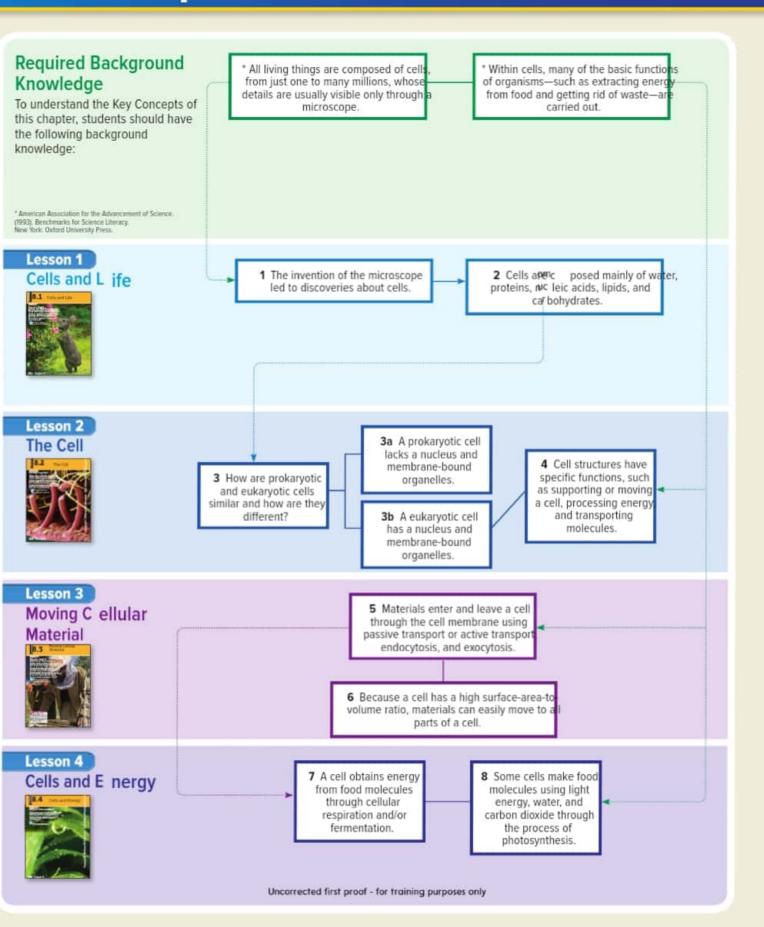
Cellular Respiration This is a series of chemical reactions in which the energy in food molecules is converted into a molecule called ATP, which provides energy to the cell.

Fermentation Fermentation is a process that cells use to obtain energy from food when oxygen levels are low. Because no oxygen

Photosynthesis Plants use the energy of sunlight to produce the sugar glucose from water and carbon dioxide in a series of chemical reactions called photosynthesis. Oxygen is produced



Strand Map



Identifying Misconception

Prokaryotic and Eukaryotic Cells Cellular Respiration and Find Out What Students Think **Photosynthesis**

Students may think that...

... prokaryotic cells are plant cells and eukaryotic cells are animal cells.

Discussion

Review the difference between prokaryotic cells and eukaryotic Discussion cells by helping students build a model cell. Using three sheets of chart paper, draw a large oval on each sheet of paper. Label one shape prokaryotic and the other two shapes eukaryotic. Prepare shapes from construction paper to represent the following organelles: nucleus, mitochondrion, endoplasmic reticulum, chloroplast, and Golgi apparatus. Have pieces of yarn cut to represent the DNA found in prokaryotic cells. Finally, have colored markers for adding the cell wall to the prokaryotic and plant cells and the cytoplasm to all three cells. Ask: What is found in a prokaryotic cell? Add items to the cell drawn on the: chart paper as students respond. Ask: What is found in a eukaryotic plant cell? Add the term plant to the chart paper and build the cell as students respond. Ask: What is found in a eukaryotic cell that is not a plant cell? Build the eukaryotic cell as carbon dioxide. Using the carbon dioxide removed from the students respond. Remind students that most prokaryotic cells are unicellular organisms, and that plants, fungi, animals, and protists are made from eukaryotic cells.

Promote Understanding

Activity Help students understand the similarities and differences between prokaryotic cells and eukaryotic cells.

- 1. Divide the class into groups of three. Give each group a set markers, card stock, various colors of construction paper, scissors, and glue.
- 2. Explain that each group is to design two puzzles—one for a prokaryotic cell and one for a eukaryotic cell. Students should create each cell, laminate their cells if possible, and then cut them into puzzle shapes of their choosing.
- Student groups should exchange puzzles for reconstruction.
- 4. As a group, discuss the differences between prokaryotic and 3. Write photosynthesis on the board or chart paper. Repeat the eukaryotic cells.

Find Out What Students Think

Students may think that...

... cellular respiration and photosynthesis occur in both plant and animal cells.

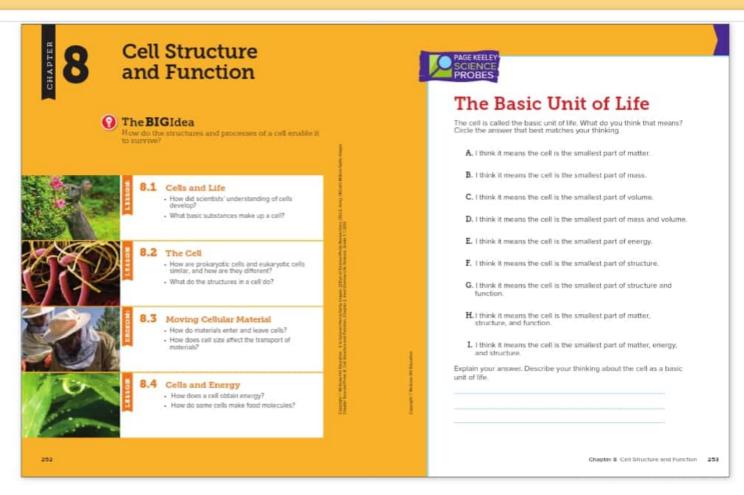
Have on hand two containers with lids-one container marked mitochondrion and the second container marked chloroplast, and different-colored objects (such as interlocking blocks) to represent glucose, ATP, oxygen, carbon dioxide, sunlight, and water. Place objects representing ATP, water, and carbon dioxide in the container marked mitochondrion. Ask: What is needed for cellular respiration to occur? As students respond, place objects representing glucose molecules and oxygen in the mitochondrion container. Ask: What is formed as a result of cellular respiration? As students respond, take out the objects representing ATP, water, and carbon dioxide. Ask: What happened to the glucose molecules and oxygen? They were used to form ATP, water, and mitochondrion, repeat the exercise for photosynthesis using the chloroplast container. Then take the oxygen produced by photosynthesis and place it in the mitochondrion container and repeat both examples. Discuss the production of energy in animal and plant cells, and the interchange of oxygen and carbon dioxide.

Promote Understanding

Vity Hand out one of the following to each student: a large C, H, O, +.

- 1. Write cellular respiration on the board or chart paper. Ask the class what is needed for cellular respiration (one glucose molecule and six O₂). Have students come to the front of the room to create a molecule of glucose and six O2.
- 2. Have students regroup to form the products of cellular respiration—carbon dioxide, water, and energy.
- activity beginning with oxygen and water.
- 4. Discuss the similarities and differences between the two processes.





Cell Structure and Function

The **BIG** Idea

There are no right or wrong answers to these questions. Write student-generated questions produced during the discussion on chart paper and return to them throughout the chapter.

Guiding Questions

Mhat processes are necessary for a plant or animal to stay alive?

This question gets students thinking about the processes of consuming food, converting food to energy, respiration, and removing wastes as necessary for survival

processes of a cell enable it to

How do you think the structures and This question initiates students' thinking about the many functions a cell must perform in order to survive and relates the importance of individual cell functions to the survival of the plant or

Why is it Important for some molecules This guestion helps students understand to move in and out of a cell?

that a cell is not a closed environment, but that it must interact with its outer environment in order to survive.

Get Ready to Read

What do you think?

Use this anticipation guide to gauge students' background knowledge and preconceptions about cell structure and function. At the end of each lesson, ask students to read and evaluate their earlier responses. Students should be encouraged to change any of their responses.

Anticipation Set for Lesson 1

1. Nonliving things have cells.

Disagree. Cells are found only in living things.

2. Cells are made mostly of water.

Agree. Water makes up more than 75 percent of a cell's volume.

Anticipation Set for Lesson 2

3. Different organisms have cells with different structures.

Agree. Two cells with two different functions will also have different structures.

4. All cells store genetic information in their nuclei.

Disagree, Prokaryotic cells do not have nuclei, DNA is located in the cytoplasm.

8.1 Cells and Life **Explore Activity** What's in a cell? Essential Questions Most plants grow from seeds. A seed began as one cell, but a mature plant can be made up of millions of cells. How does a seed change and grow into a mature plant? 9461 t. Read and complete a lab safety form. Use atoothpicks gently remove the thin outer covering of a bean seedhat has soaked overnight. Wocabulary Open the seed with plastic knife and observe its inside with amagnifyinglens Draw the inside of the seed in your Science Journal. nucleic acid protein Gently remove the small, plantlike embryo, and weigh it on a balance Record its mass in your Science Journal. carbonydrate Gently pull ibean seedlingrom the soil. Rinse the soil from the roots. Weigh the seedling, and record the mass. Think About This 1. How did the mass of the embryo and the bean seedling differ? Key Concept If a plant begins as one cell, where do all the cell come from?

INQUIRY

About the Photo Two of a Kind? Although the rabbit is an animal and the azalea is a plant, both are biological organisms composed of cells. Start the lesson with questions about the nature of cells.

Guiding Questions

different?

In what ways are plants and animals Students should be able to name some obvious differences between the two, Including mobility, or the lack of it, and the fact that many animals eat plants.

In what fundamental way are plants and animals the same?

Explain that both plants and animals are made up of cells that have many similarities, Including the same kinds of genetic material-DNA and RNA.

Do the similarities between plants and animals outweigh the differences, or vice versa?

Explain that the answer depends on what level of organization you are considering. At the level of the entire organism, differences predominate. At the microscopic level, plants and animals are more similar than different.

Essential Questions

After this lesson, students should understand the Essential Questions and be able to answer them. Have students write each guestion in their interactive notebooks. Revisit each question as you cover its relevant content.

Vocabulary **Build a Class Definition**

- 1. Write the word cell on chart paper or the board.
- 2. Ask: What are some common nonbiological uses of this word? cell phone, prison cell, storm cell, spy cell. Explain to students that a cell is an individual unit within a large collection of identical, or similar, units.
- 3. Ask students how this general definition of a cell relates to the cells of organisms. Develop a class definition for cell. Students should record the agreed-on definition in their Science Journals.

Engage Explore

Explain

Elaborate

Evaluate

ExploreActivity

What's in a cell?

Prep: 5 min Class: 10 min

Purpose

To compare one cell of a plant (a seed) to many cells of a plant (a seedling).

Materials

bean seed, bean seedling, toothpick, plastic knife, magnifying lens, sheet of paper, balance, self-sealing plastic bag

Before You Begin

- . Lima beans work well for this activity. If using dry beans, soak in water overnight. Use toothpicks and plastic knives to gently remove the coat and open up the seed.
- · Bean seedlings can be grown in small pots or cups. Seedlings can also be grown in a clear self-sealing plastic bag. Moisten a paper towel and place in bag. Place bean seed on moist paper towel inside bag. Seal bag and place in sunny area. Make sure to add water to the paper towel if it dries out.

Guide the Investigation

- Ask students to define the word embryo and discuss examples of embryos in the animal world. Talk about whether or not students had been aware that plant seeds contain embryos.
- · Troubleshooting Emphasize the need to gently and carefully pull apart the seed so the interior of the seed is not destroyed.

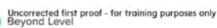
Think About This

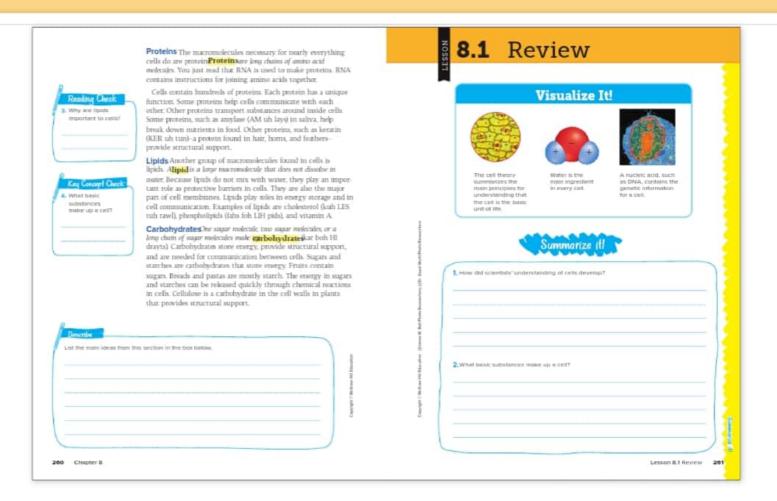
Do not expect students to determine the correct answer. Students should be encouraged to speculate. Use the answer set to guide students' reasoning.

- 1. Student answers will vary. The mass of the bean seedling will be much greater than the mass of the bean embryo.
- 2. Student answers will vary. Possible answer: All the cells in the plant came from the original cell in the seed.









Proteins, Lipids, and Carbohydrates

Visual Summary

These are the main constituents of cells, along with nucleic acids. Concepts and terms are easier to remember when they are associ-Students should learn that each substance has important functions ted with an image. Ask: To which Key Concept does each image relate?

Guiding Questions A. How are proteins manufactured in a cell? A. What basic substances make up a cell? O. Why are lipids important to cells? Because lipids don't mix with water, they also make up cholesterols and hormones

that play important roles in our bodies.



The information needed to complete this graphic organizer can be found in the following sections:

- · Understanding Cells
- · Basic Cell Substances

Elaborate

Cells and Life Use Vocabulary Interpret Graphics 7. Summarize Fill in the graphic organizer the cell is the basic unit of all living below to summarize the main principles of the cell theory. 2. Distinguish between a carbohydrate and 3. Use the term suckic acid in a sentence. 8. Analyze How does the structure of the own below enable to interact with other water molecules' **Understand Key Concepts** 4. Which macromolecule is made from amino acids) C. carbohydrate A. lipid 8. protein D. nucleic acid 5. Describe how the invention of the microscope helped scientists understand Critical Thinking 9. Summarize the functions of lipids in cells 6. Compare the functions of DNA and proteins in a cell. 10. Hypothesize why carbohydrates are

Use Vocabulary

- 1. cell theory DOK 1
- 2. Carbohydrates are sugars that store energy, provide structural support, and are needed for communication between cells. Lipids are fats which are not soluble in water and act as protective barriers in cells. DOK 2
- 3. Sample answers might include: DNA and RNA are nucleic acids. Nucleic acids are made up of nucleotides. Nucleic acids contain genetic information. DOK 1

Understand Key Concepts

- 4. B. protein DOK 1
- 5. The invention of the microscope enabled scientists to see the structure and function of cells. DOK 1
- 6. DNA stores genetic information, whereas proteins are used for Critical Thinking many functions, such as communication between cells, transport of materials, structural support, and the breaking down nutrients. DOK 3

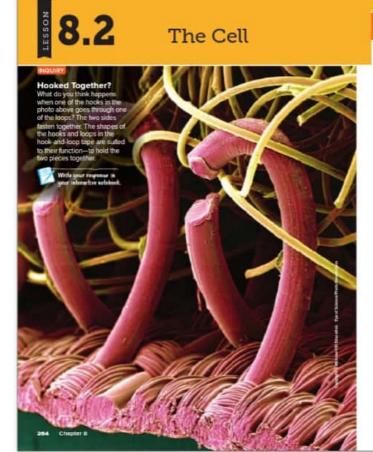
Interpret Graphics

7. DOK 2



8. Each water molecule has an area that is more negative and an area that is more positive. The negative oxygen areas can attract positive hydrogens on other nearby water molecules. The hydrogens in the positive area of the water molecule can attract oxygens in negative areas of other water molecules. DOK 4

- Lipids provide protective barriers around cells and play roles in energy storage and cell communication. DOK 2
- 10. Carbohydrates are found in plant-cell walls because they provide structural support. DOK 3



Explore Activity

Why do eggs have shells?

Bird eggs h ave different structures, such as a shell, a membran and a yok. Each structure has a different function that helps keep the e gg safe and assists in development of the baby bird inside of it.

a 1 9 1-

ead and complete a lab safety form

- 2. Place anuncooked eggn a bowl.
- 3. Feel the shell, and record your observations in your Science
- 4. Crack open the egg. Pour the contents into the bowl.
- Observe the inside of the shell and the contents of the bo Record your observations in your Science Journal.

Think About This

1. What do you think is the role of the eggshell?

- Are there any structures in the bowl that have the same function as the eggshell? Explain.
- 3. Key Concept What does the structure of the eggshell tell you

- Essential Questions
 - How are prokary cells and eukary cells similar, and
- structures in a cell do?

Vocabulary

cell membrane cell wall chloroplast

INQUIRY

About the Photo Hooked Together? If possible, show a piece of hook-and-loop tape. Point out that hook-and-loop tape is designed to hold things together, such as pockets, the tops of shoes, and the openings of bags. Emphasize that each of the two question as you cover its relevant content. parts that make up hook-and-loop tape have a different function. yet the parts of the tape must work together in order for the tape to work.

Start the lesson with questions about the shapes and connections shown in the photo.

Guiding Questions

Mow is the hook-and-loop tape able The hooks on the tape hold the loops in to hold together?

a random order, holding the two sections of the tape together.

Why must the hooks in a hookandloop tape be rigid?

The hooks must be rigid to add strength to the tape.

What is another example of an object Students may suggest something as

that has two differently structured parts that together perform a task?

simple as a button and buttonhole to a bike chain and wheel or a nut and bolt.

Essential Questions

After this lesson, students should understand the Essential Questions and be able to answer them. Have students write each question in their interactive notebooks. Revisit each

Vocabulary Be a Word Detective

- 1. Write the word organelle on chart paper or the board. Explain that the word organelle refers to a specialized cell part.
- 2. Ask: What word can you find in the word organelle? organ What word part comes after organ? -elle Explain that the suffix -elle means "very small" or "tiny." Write the following words on the board: gazelle, mademoiselle, novella, and roselle. Have students guess the meaning of each word. gazelle—small antelope, mademoiselle—a young woman (French language), novella—a short story, roselle—a type of short, bushy plant Explain that just as a body's organs perform special functions and are vital for survival, a cell's organelles also perform specialized functions and are vital to the survival of a cell.

3. Have students add the lesson's vocabulary words to their Science Journals. Remind them to write the definition after each word as they read the lesson.

ExploreActivity

Why do eggs have shells?

Prep: 15 min Class: 10 min

Purpose

To demonstrate that an eggshell acts as a protective barrier for an egg.

Materials

uncooked egg, bowl

Before You Begin

- · Purchase eggs a day or two before the activity.
- · Make sure you have enough gloves for every student who will be touching the egg or the egg contents.
- · If you do not have a sink in your classroom, have hand-sanitizing gel available.
- To clean up spills, it would be advantageous to have a bottle of bleach cleaner or bleach solution. Remind students that bleach can ruin clothing.

Guide the Investigation

- · Make sure students handle the eggs carefully.
- · As soon as the activity is complete, have students wash their hands thoroughly.

Think About This

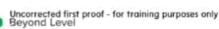
Do not expect students to determine the correct answer. Students should be encouraged to speculate. Use the answer set to guide students' reasoning.

- 1. The eggshell works as a barrier between the inside of the egg and the environment.
- 2. No. No other part of the egg is solid or able to provide structure or protection to the egg.
- 3. The eggshell is hard and surrounds the rest of the egg. This structure functions to protect the rest of the egg from the environment.











Engage

Explore



Plant cells and some protists, such as algae, also contain organ elles called chloroplasta, shown in FigureChloroplastere membrane-board organities that use light energy and make food-a sugar called glacuse-from water and carbon dioxide in a process lmouse as phousipathesis. The sugar contains stored chemical energy that can be released when a cell needs it. You will read more about photosynthesis in Lesson 4

Processing, Transporting, and Storing Molecules

Explain

Elaborate

Near the ER is an organelle that looks like a stack of pancakes. This is the Golgi apparatus, shown in Figure 11. It prepares proteins for their specific jobs or functions. Then it packages the proteins into tiny, membrane-bound, ball-like structures called vesicles. Vesicles are organelles that transport substances from one area of a cell to another area of a cell. So vesicles in an animal cell are called hysosomes. Lysosomes contain substances that help break down and recycle cellular components.

Some cells also have sactike structures called vacuoles. Vacuoles are organelles that store food, water, and waste material. A typical plant cell usually has one large vacuole that stores water and other substances. Some animal cells have many small vacuoles.





1.	How are	prokeryotic	cets and	esikaryotic	cens simmer,	and how are	they different?

Lesson B.2 Review

Processing Energy

Students may find reading the chemical terms challenging. Write the terms on the board and read them for students. Have students read the three paragraphs. Write ATP on the board. Have students who have difficulty remembering the chemical terms think of three words beginning with A, T, and P that will help them remember the function of ATP in a cell.

Guiding Questions

In what way are vesicles like trucks on Both trucks and vesicles transport a highway? "cargo" from one area to another.

What is the function of the Golgi apparatus?

It prepares proteins for their specific functions and packages them into vesicles for transport.

BL Why is removing wastes an important Students may suggest that the cell cell function?

environment would become toxic if wastes were not removed, resulting in cell death.

Guiding Questions

What do all living things need to All living things need energy. survive? Which types of cells contain Plant cells and some protists, such as algae, contain chloroplasts. chloroplasts? How do plant cells make food? Plant cells make food through a process called photosynthesis in which chloroplasts use light energy to convert water and carbon dioxide into glucose.

Visual Literacy: Figure 11

To help students understand energy production in eukaryotic cells, have them refer to Figure 11. Have students draw a chloroplast, a vesicle, a vacuole, and the Golgi apparatus in their Science Journals and add a notation under each drawing that explains the function of the organelle.

Processing, Transporting, and Storing Molecules Sk: What are chloroplasts? Chloroplasts are energy-producing organelles found in Have students read the section and look at Figure 11. Write Golgi plant cells and in some protists.

apparatus, vesicles, vacuoles, and lysosomes on the board or charles. What is the Golgi apparatus? The Golgi apparatus is an organelle that is paper. Have students provide facts to write under each heading. shaped somewhat like a stack of pancakes. It prepares proteins in the cell for their Then have students identify as many cell functions as they can recall. Write these on the board as they generate them. Review the cell structures that perform the functions.

specific functions.

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272 Chapter 8

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Use Vocabulary

- The cell wall is a rigid structure that provides support and protection in plants and some bacteria, whereas the cell membrane is a flexible covering that is found around all cells. DOK 2
- Possible answer: Mitochondria and chloroplasts are used to process energy. DOK 1
- An organelle is a structure in a cell that is surrounded by a membrane and used for a specialized task. DOK 1

Understand Key Concepts

- 4. D. vacuole DOK 1
- 5. The cytoskeleton provides structural support to the cell. DOK 2
- Cell drawing should lack organelles and show DNA without a membrane around it. DOK 1
- The endoplasmic reticulum makes proteins and lipids, whereas the Golgi apparatus prepares proteins for their specific functions and packages them into vesicles for transport. DOK 3

Interpret Graphics

- These tubelike cells are hollow and transport materials in plants. DOK 2
- 9. Structure Plant Cell Animal Ce Cell membrane yes yes Cell wall yes no Mitochondrion yes yes Chloroplast no yes Nucleus yes yes Vacuole yes no Lysosome no yes

DOK 3

Critical Thinking

- to perform functions without interference from other organelles DOK 4
- A prokaryotic cell lacks a nucleus and most other organelles, while a eukaryotic cell has a nucleus and many other organelles. DOK 3

Moving Cellular Material



Explore Activity

What does the cell membrane do?

membrane separates the inside of a cell from the environment outside a cell. What else might a cell membrane do?

- t. Read and complete a lab safety form.
- 2. Place a square owire meshon top of beaker.
- Pour a small amount dirdseeds top of the wire mesh. Record your observations in your Science Journal.

Think About This

1. What part of a cell does the wire mesh represent?

2. What happened when you poured birdseed on the wire mesh?

Key Concept How do you think the cell membrane affects materials that enter and leave a cell?

- Essential Questions How do materi enter and leave cells?

Wocabulary

passive transport diffusion osmosis facilitated diffusion

INQUIRY

About the Photo Why the Veil? Although students might not be familiar with beekeepers, they can relate to being surrounded by bees that might sting and the importance of a veil that keeps the bees away from the beekeeper's face while letting air and light in.

Start the lesson with questions about materials entering and leaving a cell.

Guiding Questions

What does the veil of mesh keep in and keep out? How?

The veil of mesh keeps the bees out. It lets light and air in. Openings in the mesh are small enough to keep bees out but large enough to let air in.

How do you think materials move in and out of a cell?

Students might propose that cells have tiny openings that let materials in and out.

BL What cell structures might let some | Students might propose that cell walls might do this?

materials into the cell but keep other and cell membranes have tiny openings materials out? How do you think they that allow some materials to enter the cell but keep other materials out.

Essential Questions

After this lesson, students should understand the Essential Questions and be able to answer them. Have students write each question in their interactive notebooks. Revisit each question as you cover its relevant content.

Vocabulary

Build Class Definitions

- 1. Write the words active transport and passive transport on chart paper or the board.
- 2. Ask: What things do you transport or carry from home to school each day? When do you need to use more energy or be more active to transport these things? when walking to school or riding bike When do you need to use less energy or be more passive to transport these things? when riding on a bus or in a car Help students connect these words with the transport of materials into and out of a cell.
- 3. Build a class definition for active transport and passive transport in cells. Students should record the accepted definitions in their Science Journals.

ExploreActivity

What does the cell membrane do?

Prep: 5 min Class: 5 min

Purpose

To model a cell membrane using wire mesh and to observe the size of materials that can pass through the membrane.

Materials

piece of wire mesh, beaker, birdseed

Before You Begin

- · Make sure that the birdseed mix has a variety of sizes—some that are small enough to fit through a square of wire mesh and some that are too large to fit through the mesh.
- · Provide a bucket or other container for collecting the birdseed after the lab. A broom and dustpan might also be needed for cleanup.

Guide the Investigation

- · Encourage students to observe the properties of the birdseed that moves into the beaker and compare them to the properties of the birdseed that does not move into the beaker.
- · Troubleshooting Caution students to pour the birdseed carefully and to avoid spills. Have students clean up spilled birdseed immediately after the lab.

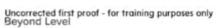
Think About This

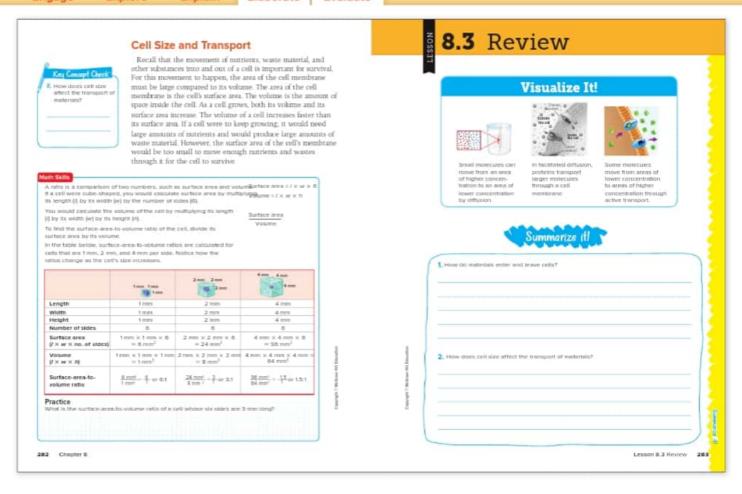
Do not expect students to determine the correct answer. Students should be encouraged to speculate. Use the answer set to guide students' reasoning.

- 1. the cell membrane
- 2. The smaller pieces of birdseed went through the mesh, but the larger pieces stayed on top of the mesh and were not able to pass through.
- 3. The cell membrane allows some things into the cell and keeps other things out of the cell.









Cell Size and Transport

Before students read about cell size and transport, review the importance of transport for cell survival. Then help students make the connection between a cell's size and transport.

Guiding Questions

What is a cell's surface area, and what The area that the cell membrane covers is the cell's surface area. The amount of space inside the cell membrane is the cell's volume.

How does cell size affect the transport As a cell becomes larger, its volume increases faster than its surface area,

making the transport of enough materials to support the cell more difficult.

Why is transport more difficult as a cell's volume increases faster than its surface area?

Students might propose that the larger volume needs more nutrients and creates more wastes than the smaller surface area can move into and out of the cell.

Math Skills

Use Ratios

Explain to students that they will be calculating the surface-area-to-volume ratio of a cell.

Practice

Ask students to answer the practice question. The surface-area-to-volume ratio of a cell whose sides are 3 mm long is 2:1.

use the term ownosis in a sentence.	 What is limited by a cell's striace-area-to- volume ratio? C. cell surface area 	
	B. cell stare D. cell volume	
	Interpret Graphics	
Distinguish between active transport and passive transport.	identify the process shown below, and explain how it works.	
. The process by which vestcles move	○ €	
substances out of a cell is	9. Fill in the graphic organizer below to	
Inderstand Key Concepts Explain why energy is needed in active	describe ways that cells transport substances.	راهطن اح
transport.	Transport Across Moretirate	2019 ﴿ الله المامد
Summarize the function of endocytosis.		عام المساسم
	Critical Thinking	2018
	 Relate the surface area of a cell to the transport of materials. 	
Contrast esmosis and diffusion.	to the same of the	N. C.
	Marth Sailte	
	11. Calculate the surface area to volume ratio of a cube whose sides are 6 cm forig.	Maria Africano

Use Vocabulary

- Sample answers might include: Water moves across membranes by osmosis. DOK 1
- Active transport requires energy and moves substances from areas of lower concentration to areas of higher concentration, whereas passive transport does not require energy and moves substances from areas of higher concentration to areas of lower concentration. DOK 2
- 3. exocytosis DOK 1

Understand Key Concepts

- Active transport requires the use of a cell's energy because materials are being moved from areas of lower concentration to areas of higher concentration. DOK 2
- Endocytosis is used to move substances that are too large to pass through the cell membrane through diffusion or by using transport proteins into cells. DOK 2
- 6. Osmosis is the movement of water across a semipermeable membrane, whereas diffusion is the movement of small molecules from higher to lower concentrations and does not always involve a membrane. DOK 3
- 7. B. cell size DOK 1

Interpret Graphics

- Exocytosis is the process during which a cell's vesicles join with the cell membrane and release substances outside the cell. DOK 1
- 9. diffusion, facilitated diffusion, active transport DOK 1

Critical Thinking

 The larger the surface area, the more transport that can occur. DOK 2

Math Skills

11. 1:1 DOK 1



-	
	distribution in contrast
 0) 4 - 3	
300	 tivity

What do you exhale?

9 1 1

- Read and complete a lab safety form
- Unwrap astraw Use the straw to slowly blow into a snaip of bromthymol blueDo not splash the liquid out of the cup
- 3. In your Science Journal, record any changes in the solution

Think About This

1. What changes did you observe in the solution?

2. What do you think caused the changes in the solution?

3. Key Concept. Why do you think the air you inhale differs from

-			
_			

- Essential Questions

 How does a cell obtain energy?
 How do some cells

Vocabulary cellular respiration

INQUIRY

About the Photo Why are there bubbles? The leaves of terrestrial plants contain stomata, tiny openings through which oxygen and carbon dioxide are exchanged. In most of these plants, stomata are found on the lower surface of the leaves. The stomata of aquatic plants that float are often found on the upper surface of the leaves, which are exposed to the air. Aquatic plants that are completely submerged usually lack stomata. Start the lesson with questions about the production of gas bubbles by aquarium plants.

Guiding Questions

What process is taking place in the photo? How do you know?

Students should realize that photosynthesis is taking place because gas bubbles are forming. They may not recognize that plants undergo cellular respiration as well as photosynthesis.

Do you think the aquarium plants in the photo are being grown in light or In dark? How do you know?

Students should know that photosynthesis requires light. Explain that plants use the energy in sunlight to power photosynthesis. Without light, photosynthesis cannot occur.

B Why do plants need to photosynthesize?

Students may suggest that plants must make food because they have no way of capturing and eating it.

Essential Questions

After this lesson, students should understand the Essential Questions and be able to answer them. Have students write each question in their interactive notebooks. Revisit each question as you cover its relevant content.

Vocabulary

Build Class Definitions

- 1. Write the term cellular respiration on chart paper or the board. Explain that the word respiration commonly refers to
- 2. Ask: What happens during breathing? Air (containing oxygen) moves into the lungs, and air (containing carbon dioxide) moves out of the lungs. Do cells breathe? Cells do not have lungs and cannot breathe. However, oxygen and carbon dioxide move into and out of cells. Have students read the definition of cellular respiration on the next student page and try to connect the processes of cellular respiration and breathing.

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286 Chapter 8 3. Have students hold a piece of paper in front of their nostrils as they inhale and exhale deeply. Have them pay close attention to what happens as they breathe. Their chests expand and air moves into their noses with inhaling; their chests contract and air is expelled with exhaling.

ExploreActivity

What do you exhale?

Prep: 5 min Class: 5 min

Purpose

To observe that the air humans inhale differs from the air humans exhale.

Materials

wrapped straws, small transparent plastic cups, bromthymol blue solution

Before You Begin

Prepare the cups before class. Pour enough bromthymol blue solution in each cup to cover the bottom of the straw (approximately 1 cm of liquid). The bromthymol blue solution should be light blue in color. If the solution does not turn to green/yellow when blown into, try adding a little water to the solution.

Guide the Investigation

- Direct students to lightly blow into the liquid until it begins to change color. The liquid should change to a yellow/green color with a few breaths. Again, if the solution is not changing, add a little water to the cup.
- · Have students use only wrapped straws, and remind them not to share used straws or suck liquid through the straws.
- · Troubleshooting Bromthymol blue can stain clothing. Tell students to be careful with the liquid, and remind them not to force the liquid out of the cup.

Think About This

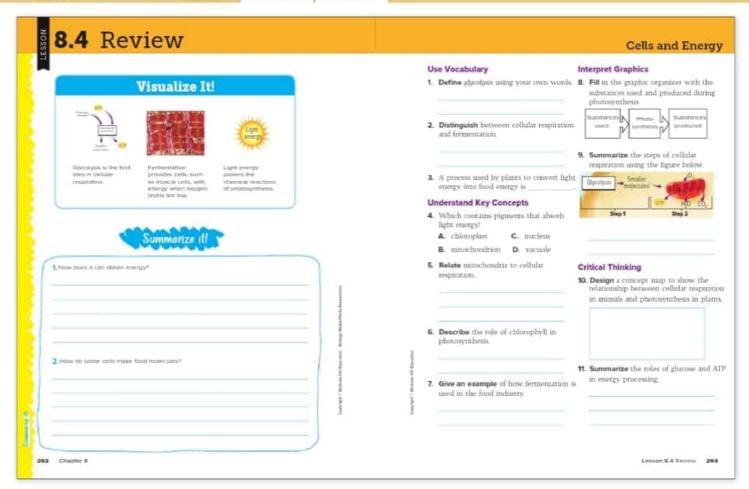
Do not expect students to determine the correct answer. Students should be encouraged to speculate. Use the answer set to guide students' reasoning.

- 1. The color changed from blue to yellow.
- 2. The color of the solution changed when carbon dioxide was added.
- 3. Oxygen is used to release energy for cell processes.









Visual Summary

Concepts and terms are easier to remember when they are associ₁. Sample answers might include: Glycolysis is a stage of cellular ated with an image. Ask: Which Key Concept does each image relate to?



The information needed to complete this graphic organizer can be found in the following sections:

- Cellular Respiration
- Photosynthesis



Use Vocabulary

- respiration where glucose is broken down into smaller parts and some ATP is generated. DOK 1
- 2. Cellular respiration and fermentation are used to release energy (ATP) from food; however, cellular respiration requires oxygen and fermentation does not. Fermentation takes place in cytoplasm and respiration takes place in mitochondria. DOK 2
- 3. photosynthesis DOK 1

Understand Key Concepts

- 4. A. chloroplast DOK 1
- The second stage of cellular respiration occurs in mitochondria, where the products of glycolysis are converted into ATP, water, and carbon dioxide. DOK 2
- Chlorophyll absorbs light energy. DOK 1
- 7. Sample answers might include: Fermentation is used to make cheeses, yogurt, and breads. DOK 1

Interpret Graphics

- 8. Substances used: light energy, carbon dioxide (CO2), water (H2O); Photosynthesis; Substances produced: glucose (food energy), oxygen (O2). DOK 1
- 9. During step 1, the reactions of glycolysis occur in the cytoplasm and break down glucose into smaller molecules and some ATP. During step 2, the reactions in the mitochondria use oxygen and convert the smaller molecules made during glycolysis into carbon dioxide (CO2), water, and large amounts of ATP. DOK 2

Critical Thinking

- 10. Students' concept maps will vary. Concept maps should show that animals require oxygen and glucose for cellular respiration, whereas plants use the carbon dioxide produced by animals for photosynthesis. DOK 4
- 11. Animal cells convert the energy in glucose to ATP, whereas plant cells store energy in the form of glucose. DOK 2





Careers In Science

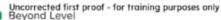
Baker Some people might not think bakers need to understand science to do their job, but they do! Bakers use yeast to make bread, rolls, and some pastries. They must understand the process of alcohol fermentation and know how yeast cells grow and perform life processes. Do you know the best temperature to grow yeast cells? With on-the-job training, you can become a master baker.

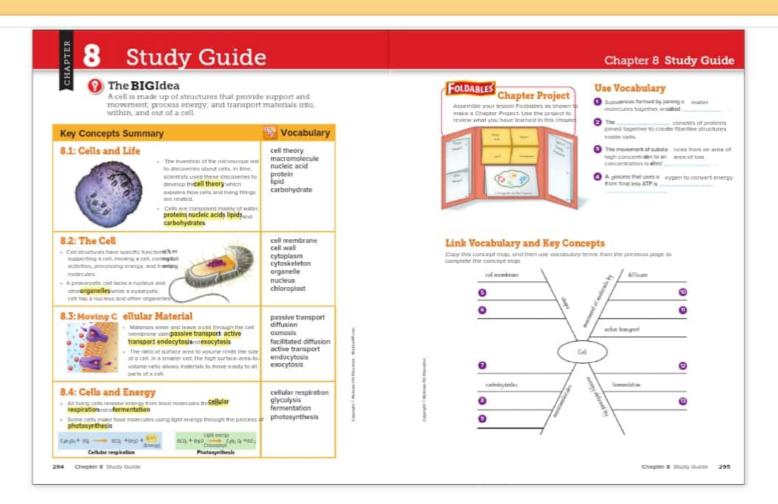
Van Helmont Got It Wrong Jan Baptista van Helmont, a Belgian scientist (1577–1644), performed the first scientific experiment on plant life processes. He planted a willow sapling weighing 5 lb in a pot containing 200 lb of soil and covered the soil to keep out dust and dirt. For 5 years, he added only water to the tree. Then, van Helmont re-weighed the tree and soil. He found that the tree had gained 164 lb, but the soil had lost only 2 oz. He concluded wrongly, that plants use only water to grow. Now we know that the tree grew because it made food by photosynthesis using carbon dioxide in the air.











Key Concepts Summary

Study Strategy: Self-Assessment

Students often complete a reading without realizing they failed to understand it. Self-assessment helps students practice metacognition, increasing their awareness of their understanding.

- below, listing each Key Concept in the left column.
- 2. Prompt students to read the Key Concepts Summary.
- For each Key Concept, have them self-assess their understanding of the Key Concept and record it in their table.
- 4. Ask students to review any concepts they did not mark I understand.

Example:

Key Concept	Lundersland	l somewhal	1 don't
Concept		understand	understand
A prokaryolic cell lacks	X		
a nucleus			

b Vocabulary

Study Strategy: In Your Own Words

Ask students to create vocabulary definitions using their own words. Connecting vocabulary words to students' own language promotes understanding more effectively than pure memorization.

- Ask students to draw in their Science Journals a table like the one.
 Have students create a two-column table like the one below in their Science Journals.
 - Have them write the vocabulary words in the Study Guide in the left
 - Ask students to describe what they know about the chapter's vocabulary words using their own words (without referring to the textbook).

Example:

Vocabulary Word	My Definition	
macromolecule	It's what forms when smaller molecules combine.	
lipid	This is a macromolecule that does not dissolve in water and is important in cell communication, energy storage, and cell membrane structure.	





Use the Foldables® Chapter Project as a way to connect Key Concepts.

- 1. Ask students to organize their Foldables® in a way that reflects how the concepts in each Foldable relate to each
- 2. Use glue or staples to hold the sheets together as needed.
- 3. When complete, ask students to place their Foldables® Chapter Project at the front of the room. Have the class critique and discuss the way in which students have organized their Foldables®.

Use Vocabulary

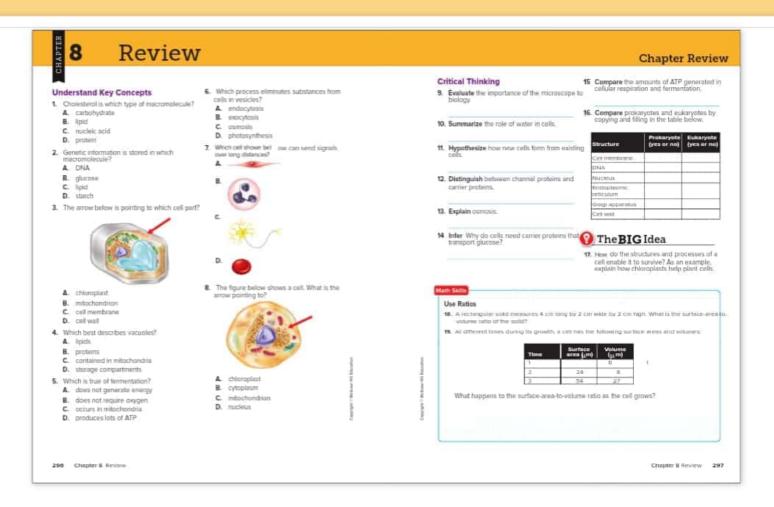
- 1. macromolecules
- 2. cytoskeleton
- 3. diffusion
- 4. cellular respiration

Link Vocabulary and Key Concepts

- 5. cell wall
- 6. cytoskeleton
- 7. nucleic acids
- 8. proteins
- 9. lipids
- 10. osmosis
- 11. facilitated diffusion
- 12. cellular respiration
- 13. photosynthesis







Understand Key Concepts

- 1 A. lipid.
- 2 A. DNA
- 3 D. cell wall
- 4 D. storage compartments
- 5 B. does not require oxygen
- 6 B. exocytosis
- 7 C.



8 B. cytoplasm

Critical Thinking

- 9 The microscope was important to biology because it enabled scientists to discover and study the structure of the cell, which is the foundation of all living things.
- 10 Water is the most abundant component of a cell, making up 75 percent of a cell's volume. Water provides a stable environment inside and outside a cell. Many substances can be dissolved in water.
- 11 Existing cells produce new cells by dividing.
- 12 Channel proteins form pores in the cell membrane to allow smaller molecules to pass through the membrane. Carrier proteins carry larger molecules through the cell membrane.
- 13 Osmosis is the movement of water molecules across a membrane from an area where there is a lot of water to an area where there is less water.
- 14 Cells need carrier proteins that carry glucose because the glucose molecule is too large to pass through the cell membrane by diffusion, but the cell needs glucose as fuel for cellular respiration.
- 15 Both cellular respiration and fermentation generate ATP; however, since cellular respiration uses oxygen, it generates more ATP than fermentation.

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296 Chapter 8

Engage Explore Explain

Elaborate

16

Structure	Prokaryote (yes or no)	Eukaryote (yes or no)
Cell membrane	yes	yes
DNA	yes	yes
Nucleus	no	yes
Endoplasmic reticulum	no	yes
Golgi apparatus	no	yes
Cell wall	yes (some bacteri	a) yes (plants)



The **BIG** Idea

17 Structures and processes enable a cell to survive by providing support and fuel for the cell. Chloroplasts help a plant cell survive by absorbing light energy, then using that energy to turn water and carbon dioxide into food energy and releasing oxygen through photosynthesis. The food energy made through photosynthesis provides fuel for the cell and for other organelles to function.

Math Skills

Use Ratios

- 18. 2.5:1
- 19. As the cell grows, the surface-area-tovolume ratio decreases.











Standardized Test Practice

- Which process do plant sells use to capture and store energy from sunlight?
 - endocytosis
- B. fermentation
- glycolysis





- The diagram shows salt dissolved in water. What does it show about water molecules and chloride ions?
- Chloride sizes.

 A waster molecule consists of daygen and \$ Which structure does the arrow point to in the eukaryotic cell?
- A water molecule is surrounded by several chloride ions.
- A water molecule moves away from a chloride ion.
- A water molecule points its positive end foward a chloride ion.
- 3 Which transport process requires the use of a
 - asmosis
 - active transport

 - facilitated diffusion

- Multiple Choice aligned with TIMSS 4 Diffusion differs from active cell transport processes because it.
 - A forces large molecules from a cell.
 - keeps a cell's boundary intact C moves substances into a cell
 - D needs none of a cell's energy

Use the diagram below to assurer questions



- A cytoplasm
- D tibesome
- Which feature does a typical proke have that is missing from some eu cells, like the one above?

 - C cell membrane

area to volume affects the cell size? Cells with TIMSS

a high surface-to-volume ratio 7 Which explains why the ratio of cell surface

- A consume energy efficiently.
- B produce waste products slowly
- C suffer from diseases frequently D transport substances effectively.

Use the diagram below to answer question B.



- - A Carrier proteins change shape as they function but channel proteins do not.
 - B Carrier proteins and channel proteins extend through the cell membrane.
 - Channel proteins move items inside a cell but camer proteins do not.
 - Channel proteins and carrier proteins perform facilitated diffusion.

Standardized Test Practice

Cell Structure	Function
	Maintains the shape of an entrail self.
	Controls the activities of a cast
	Trapis energy from the. Sun
	Controls the materies going in and out of a ce
	House the structures of cell in a watery into
	Maintains the shape of some plant cells

 Name the kinds of organisms that have c with cell walls. Name the kinds of organis that have cells without cell walls. Briefly describe the benefits of cell walls for

Draw simple diagrants of an animal cell and a plant cell. Label the nucleus, the cytoplasm, the mitochondria, the cell membrane, the chloroplasts, the cell wall, and the central vacuels in the appropriate cells. Briefly describe the main differences between the



ed Extra Help? 3 Go to Lesson

Chapter # Standardized Test Practice

Multiple Choice

- 1 D-Correct. A, B, C-Endocytosis is the process by which a substance is taken into the cell by surrounding it with the cell membrane. Fermentation is the proceess that cells can use to obtain energy from food when little oxygen is available. Glycolysis is the process by which sugar molecules are broken down into smaller molecules. DOK 1
- 2 D-Correct. A, B, C-A water molecule consists of oxygen and hydrogen atoms. Several water molecules surround each chloride ion. The positive end of water molecules are attracted to sodium chloride's negative end. DOK 2
- 3 C-Correct. A, B, D-Diffusion, osmosis, and facilitated diffusion are all forms of passive transport and do not use cellular energy to move substances through a cell membrane. DOK 1
- 4 D-Correct. A. B. C-During diffusion, only small molecules are transported. Small openings in the cell's boundary allow for materials to move into or out of the cell. Both diffusion and active cell transport enable substances to move into a cell. DOK 2

- 5 A-Correct. B. C. D-DNA is located in the nucleus of the cell. The cell membrane and cell wall are both boundaries that cover the outside of the cell. DOK 1
- 6 D—Correct. A. B. C—Both eukaryotic cells and prokaryotic cells have cytoplasm, DNA, and a cell membrane. DOK 2
- 7 D-Correct. A, B, C-The size of a cell is not related to a cell's efficiency when using energy, production of waste products, or frequency of contracting diseases. DOK 2
- 8 C—Correct. A, B, D—Both carrier proteins and channel proteins change shape and move substances from outside a cell to inside a cell. DOK 2



Constructed Response

9	Cell Structure	Function
	Cytoskeleton	maintains the shape of an animal cell
	Nucleus	controls the cell's activities
	Chloroplast	traps energy from the Sun
	Cell membrane	controls the materials going into and out of a cel
	Cytoplasm	holds the structures of a cell in a watery mix
	Cell wall	maintains the shape of some plant cells

DOK 2

- 10 Plants, fungi, bacteria, and some protists have cells with cell walls. Animals and some protists do not have cells with cell walls. Cell walls provide support for the cells. Cell walls also provide some protection for the cells from viruses and other organisms that can cause diseases and injury. DOK 3
- 11 The diagram should show the correct locations and relative sizes of the nucleus, cytoplasm, mitochondria, cell membrane, chloroplasts, cell wall, and central vacuole. The main differences between the two cells are that the plant cell has a rigid cell wall that gives a fixed shape to the cell, chloroplasts that perform photosynthesis, and a central vacuole that holds water and other substances. DOK 3



Answer Key

Question	Answer
1	D
2	D
3	C
4	D
5	A
6	D
7	D
8	С
9	See extended answer.
10	See extended answer.
11	See extended answer.

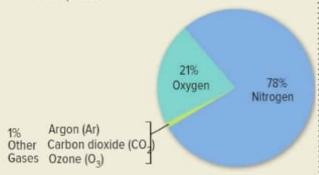


Science Content Background

Lesson 1

Earth Systems

The Atmosphere Earth's atmosphere is critical to life on Earth. It origin. contains the gases needed by many organisms to survive, including oxygen and carbon dioxide. A layer of ozone in the stratosphere protects the biosphere from harmful ultraviolet radiation from the Sun. Also, thermal energy trapped by the atmosphere helps regulate Earth's surface temperature, making based life on Earth possible.

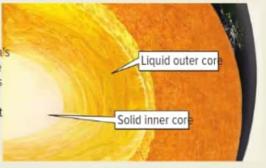


The Hydrosphere and the Cryosphere The hydrosphere consists of all of the water on Earth, which is found at Earth's surface in oceans, lakes, and rivers, as well as underground and in the atmosphere. Water exists as a solid, a liquid, and a gas on Earth. Water is solid in glaciers and polar ice caps, and it is gas (water vapor) in the atmosphere. Liquid water exists on and below Earth's surface. About 97 percent of water on Earth is salt water, and the remaining 3 percent is freshwater. Only 1 percent of freshwater is at Earth's surface in lakes, rivers, and streams. The majority of freshwater—79 percent—is stored in glaciers and ice caps. About 20 percent is groundwater.

Materials in the Geosphere The geosphere consists of minerals, rocks, soil, and metals. Minerals are naturally occurring inorganic solids that have crystal structures and definite chemical compositions. "Inorganic" means that minerals are not biologic in origin.

Rocks Rocks are made of minerals and other materials, including organic matter. Rocks are classified into three main categories—igneous, metamorphic, and sedimentary. These categories are based on how the rocks form. Igneous rock forms when magma or lava cools. Metamorphic rock forms when high temperatures and pressure change existing rock into new rock. Metamorphic rock can form from igneous rock, sedimentary rock, or other metamorphic rock. Sedimentary rock forms when layers of sediment are compressed and cemented together.

Structure Earth's structure consists of three main layers—the crust, the mantle, and the core. Compared to the other layers, the crust is thin. Oceanic crust is usually 5–10 km thick. Continental crust is 35–70 km thick. The mantle extends from the bottom of the crust and is about 2,900 km thick. The outer and inner core together are about 3,500 km thick. The layers of Earth are often compared to the layers of a hard-boiled egg or a peach. Each has a thin outer layer, comparable to Earth's crust; a middle layer, like the smantle; and an inner layer, similar to the core.



Science Content Background

Lesson 2

Interactions of Earth's Systems

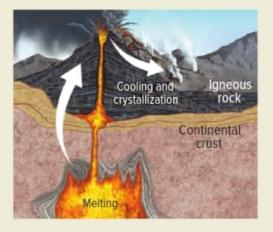
one location to another. But globally, the amount of water days for a water molecule that has been evaporated to fall back to Earth's surface.

Evaporation and Transpiration Factors that affect rates of evaporation include temperature and wind. The higher the temperature of water, the faster the evaporation rate. Increased: wind speed also leads to an increase in evaporation rates. temperature, wind, relative humidity, and the type of plant. Increased temperature and wind lead to increased transpiration: rates. Different types of plants transpire at different rates. For: example, desert plants, such as cacti, transpire less than other, each can change into a new metamorphic rock. types of plants in order to help conserve water in dry conditions.

Precipitation Water vapor condenses

Changes in the Atmosphere One example of an interaction between the geosphere and the atmosphere is the rain-shadow effect. Orographic lifting is the term used to describe the rising of air due to contact with an elevated barrier, such as a mountain. The Water Cycle Rates of evaporation and precipitation vary from The windward sides of mountains usually have high levels of precipitation. The leeward sides of mountains, under the influence evaporated from Earth's surface is about equal to the amount of of a rain-shadow, are usually deserts. The Great Basin Desert in water that falls back to Earth as precipitation. It takes about 10: the western United States was created by the rain-shadow effect.

The Rock Cycle The rock cycle connects processes at Earth's surface with those in Earth's interior. Weathering and erosion break rocks at Earth's surface into sediment. When layers of sediment are deposited on top of each other, enough pressure is eventually applied to the bottom layers that the sediment changes to Transpiration rates are also affected by several factors including afedimentary rock. If sedimentary rock is exposed to the extreme temperatures and pressure in Earth's interior, it will eventually become metamorphic rock. The term metamorphosis means "to rates. Increased relative humidity leads to decreased transpiration change physical form or structure." When igneous, metamorphic, or sedimentary rock are subjected to intense heat and pressure,



Strand Map

Required Background *Earth is mostly rock. Three-fourths of *The world contains a wide diversity of physic Earth's surface is covered by a relative conditions, which creates a wide variety of Knowledge thin layer of water (some of it frozen) environments: freshwater, marine, forest, dese To understand the Key Concepts of and the entire planet is surrounded by grassland, mountain, and others. In any particu this chapter, students should have relatively thin layer of air. environment, the growth and survival of organisms depends on the physical conditions the following background knowledge: *Rock is composed of different combinations of minerals. Smaller rock "When liquid water disappears, it turn into a gas (vapor) in the air. It can come from the breakage and weathering of bedrock and larger rocks. Soil is reappear as a liquid when cooled and made partly from weathered rock and then as a solid if cooled below the American Association for the Advancer 1993), Benchmarks for Science Literacy. New York: Oxford University Press. partly from plant remains, and it also freezing point of water. Clouds and for are made of tiny droplets or frozen contains many living organisms. crystals of water. Lesson 1 The atmosphere has a layered structure that Earth Systems includes the troposphere, the stratosphere the mesosphere, the thermosphere, and the exosphere. It is made of nitrogen, oxygen, and trace gases. 3 Earth is madeup of the biosp here, the atmosphere, the ltwosphere, the cryosphere 2 Water is found on Earth in oceans, lakes and the geosphere. rivers, and as ice and groundwater. Small amounts of water are also found within the atmosphere and the biosphere. 4 The geosphere is made of soil, metal, an rock. It has a layered structure that include the crust, the mantle, and the core. Lesson 2 5 The water cycle shows how water move 7 Rocks continually change form as they Interactions of between reservoirs of the hydrosphere, t move through the rock cycle. Processes sur Earth Systems atmosphere, the geosphere, and the as weathering and erosion are examples of interactions among the Earth systems. biosphere. 6 Weather and climate are influenced b transfers of water and energy among th atmosphere, the geosphere, and the hydrosphere.

Identifying Misconception

Earth's Ocean

Find Out What Students Think

Students may think that...

... because oceans have different names-Atlantic Ocean, Pacific ... Earth's atmosphere contains only gases. Students learn that a separate body of water that does not interact with other oceans.

Discussion

Although the word oceans, plural, is commonly used when large ocean. The water masses within each ocean basin have : and other water chemistry qualities. The water temperature varies as well. However, the basins are connected and water does move from one basin to another.

Promote Understanding

Activity Provide students with a map that shows the great ocean conveyor belt. Explain to students what the "conveyor belt" illustrates. The conveyor belt model shows how deep-water currents and surface currents move water (and thermal energy) around the globe.

- Have students place an x along the conveyor belt in the Nortifi. Have students spread a layer of the petroleum jelly in Atlantic Ocean at the point where the warm surface current changes to a cold deep-water current. Explain that as surface 2. Have students cover the dish and walk to an outdoor water in the North Atlantic cools, it increases in density and eventually sinks.
- 2. Have students track the deep-water current on the conveyor 3. Retrieve the dishes, covering them before moving back to the belt into the South Atlantic Ocean and the Southern Ocean: Explain that deep-water currents move the water that sank; in the North Atlantic to the south, eventually reaching the Southern Ocean.
- 3. Have students continue to follow the conveyor belt to the the North Atlantic when it reaches the North Pacific Ocean? It will resurface, and surface currents will carry it back toward Australia.
- 4. Have students track the water through the Indian Ocean and back to the North Atlantic where it began. Explain that it takes about 1000 years for water to circulate throughout all ocean basins.
- 5. Ask: How could surface water that sank near Antarctica in the Southern Ocean circulate through other ocean basins to reach its starting point? Possible answer: Students should track the water from the deep-water current in the Southern Ocean to the North Pacific, where it resurfaces. Surface currents will move the water through the Indian Ocean and back down into the Southern Ocean. The water could travel around Antarctica to reach its starting point.

Composition of the Atmosphere

Find Out What Students Think

Students may think that...

Ocean, Arctic Ocean, Indian Ocean, and Southern Ocean—each ishe atmosphere is made up of mostly nitrogen and oxygen, along with small amounts of other gases. Liquids and solids exist in the atmosphere as well.

Discussion

If asked what makes up the atmosphere, the reply of most discussing Earth's salt water, most of Earth is covered by a singlestudents will likely be nitrogen and oxygen. The atmosphere is composed mainly of gases; however, liquids and solids also exist slightly different characteristics in terms of salinity, oxygen levels suspended in the atmosphere. Ask: Give an example of a liquid in the atmosphere. Students should recognize that clouds consist of condensed water droplets; raindrops that fall from clouds as precipitation are liquid. In this activity students will collect samples of solids in the atmosphere.

Promote Understanding

Activity Provide students with Petri dishes (or lids from plastic containers) and petroleum jelly. Explain to students that they will be testing the air for solids in the atmosphere.

- location. Uncover the dish and leave it in the chosen location for 30 minutes.
- classroom. Then have students use a magnifying lens to examine the materials stuck in the petroleum jelly.
- 4. Ask: Describe the solid materials collected on your dish. Materials might include dust, pollen, soil, salt from the ocean, soot from a fire, or ash from a volcanic eruption.
- systems. Ask: How does the atmosphere interact with rocks and other parts of Earth's crust? Wind can carry sediment from one area to another. Ask: How does the atmosphere interact with living things? Wind carries pollen from flowers from one location to another.



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Chapter 9 Our Planet-Earth 300D



How can you describe Earth? The **BIG** Idea

There a re no right or wrong answers to these questions. Write studentgenerated questions produced during the discussion on chart paper and return to them throughout the chapter.

Guiding Questions

Mow is life on Earth linked to water at Use this question to get students thinking Earth's surface and oxygen in Earth's about Earth's different systems and how they are linked. Students should recall atmosphere? that all living organisms need water to survive. Many organisms, including animals, need oxygen to survive as well.

What are some features that make our solar system?

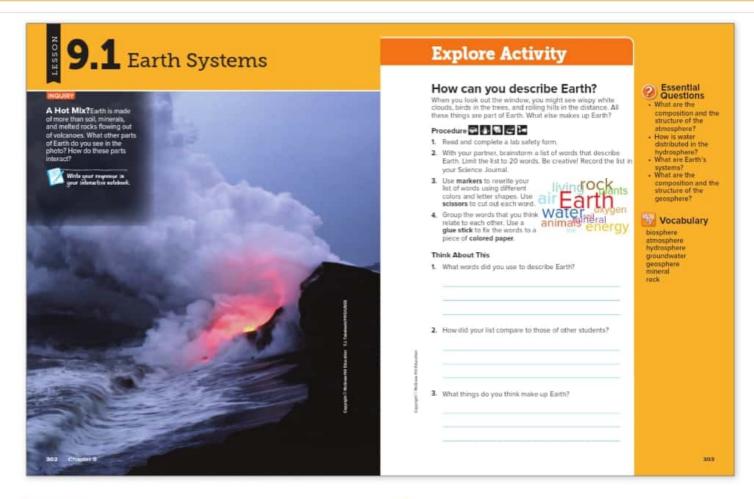
Use this question to get students thinking Earth different from other planets in about Earth's different systems and their characteristics. Possible answer: Earth is the only planet that has life as we know It. Earth's atmosphere contains oxygen. The temperatures on Earth are not as extreme as they are on other planets. Earth has liquid water. Earth has a solid surface.

Give one example of how water at Earth's surface is linked to the atmosphere.

Students should recall Interactions between the hydrosphere and the atmosphere as part of the water cycle. Possible answer: Water at Earth's surface evaporates into the atmosphere. It later condenses and forms clouds.

Earth, Our Planet

Answers to the Page Keeley Science Probe can be found in the Teacher's Edition of the Activity Lab Workbook.



INQUIRY

A Hot Mix? About the Photo The photo shows the interaction between the geosphere, the hydrosphere, and the atmosphere. Hot, Questions and be able to answer them. Have students write molten lava that has erupted from Earth's interior is oozing into the ocean, creating steam as the water heats up. The lava will eventually question as you cover its relevant content. harden and form igneous rock. Have students think about how a volcanic eruption might affect the biosphere and the atmosphere.

Guiding Questions

Describe Earth's water system.

Possible answers: Most of the water on Earth is salt water in the oceans. Freshwater is found in rivers and lakes and is stored in ice. including glaciers. Some water is in the atmosphere in a gaseous state.

Where did the lava in the photo of Earth differ from conditions at Earth's surface?

Possible answers: The lava came from come from? How might the interior Earth's interior. Temperatures in Earth's interior are hot enough to melt rock. But at Earth's surface, where temperatures are lower, rock is solid.

Give an example of an interaction

Answers will vary. Students might point out between any two of Earth's systems. The interaction between the hydrosphere and the atmosphere, which leads to weather; or the interaction between the biosphere and the atmosphere, in which organisms exchange gases, such as oxygen and carbon dioxide.

Essential Questions

After this lesson, students should understand the Essential each guestion in their interactive notebooks. Revisit each

Vocabulary Prefixes and Root Words

- 1. Have students look up meaning of the root sphere. Sphere means "globe" or "ball."
- 2. Have students look up the definition of each of the following prefixes: bio-, atmos-, hydro-, geo-. Bio- means life, atmosmeans "vapor," hydro- means "water," and geo- means "earth" or "ground."
- 3. Have students write their own definitions for the terms biosphere, atmosphere, hydrosphere, and geosphere in their Science Journals. Answers will vary but should be based on the meanings of the prefixes and word root. Have students compare their definitions to those provided in the text as they read Lesson 1.

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302 Chapter 9

Engage Explore

Explain

Elaborate

Evaluate

ExploreActivity

How can you describe Earth?

Prep: 15 min Class: 20 min

Purpose

To recognize that Earth is a complex system made of different subsystems.

Materials

colored markers, scissors, glue stick, colored cardboard or stiff paper, plain white paper, examples of word clouds

Before You Begin

- Provide each group of students with a piece of colored cardboard, a glue stick, and several sheets of plain white paper.
- Explain the concept of a Wordle[®]. A Wordle is a "word cloud" in which words from a given text are grouped together. Show students several examples. To create your own Wordle, go to http://www.wordle.net. Some words in a Wordle are written in different colors or sizes based on how frequently they appear in a given piece of writing. Students do not need to reflect the frequency of usage of each word in their word clouds.

Guide the Investigation

Stress that there is no right way or wrong way to assemble a word cloud. Encourage students to be creative and inventive with their word cloud designs.

Think About This

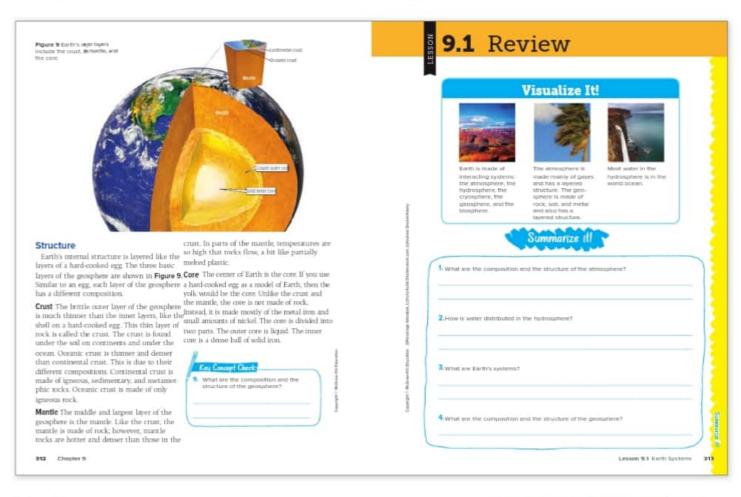
- 1. Sample answer: water, air, round, rocks, planet, people, trees, mountains
- 2. Answers will vary. Students might find that each group used similar words to describe Earth. Some words that were not used by all groups might provide opportunities for discussion.
- 3. Sample Answer: Earth is made of living things, air, water, soil, and rocks.



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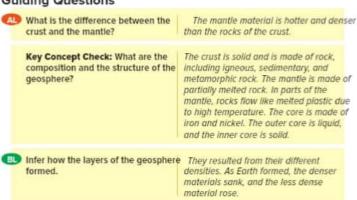


Structure

The three basic layers of the geosphere are the crust, the mantle, Figure 9 shows the layers of the geosphere. Relate material from and the core. While the crust and mantle are made of rock, the core is made of iron and nickel. The outer core is liquid and the inner core is solid iron and nickel. The text compares the layers of house, which layer of the geosphere are you standing on? the Earth's internal structure to the layers of a hard cooked egg. Com-crust What type of crust? continental crust

plete the Teacher Demo using a hard-cooked egg to help students visualize the layers. Ask: What other analogies can you make about layers in the geosphere? Possible answers: a peach, which has a thin outer skin, a fleshy layer, and a pit in the center

Guiding Questions



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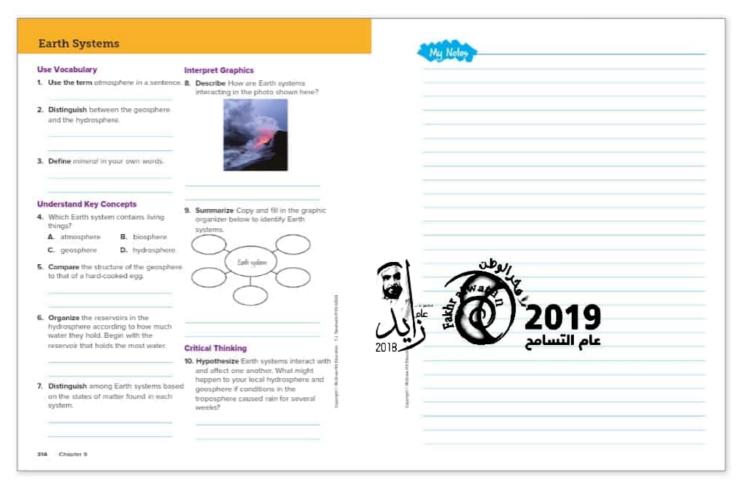
Visual Literacy: Structure of the Geosphere

the figure to student's lives.

Ask: When you are standing on the ground outside your



312 Chapter 9



Use Vocabulary

- 1 Sample answer: The hot air balloon floated up through the atmosphere. DOK 1
- 2 The geosphere is the solid Earth system made mostly of rock, and the hydrosphere is the system that contains Earth's water. DOK 1
- 3 Sample answer: A mineral is a solid that has a crystal structure, is inorganic, has a set composition, and forms naturally. DOK 1

Understand Key Concepts

- 4 B. biosphere DOK 1
- 5 Sample answer: The geosphere is layered like a hard-cooked egg. The crust of the geosphere is like the shell of the egg. The mantle is like the egg white. The core is like the yolk. DOK 2
- 6 The reservoirs listed from largest to smallest are: the ocean, ice, groundwater, lakes, and rivers. DOK 2
- 7 Sample answer: The atmosphere is composed mainly of gases, the hydrosphere is composed mainly of liquid, the geosphere is composed mainly of solids, and the biosphere is composed of solids and liquids. DOK 2

Interpret Graphics

- 8 Lava from the geosphere is flowing into the ocean, which is part of the hydrosphere. The hot lava causes steam to form when it comes into contact with the ocean water, and the steam (water vapor) is released into the atmosphere. The ocean waves crash against the rocks, causing weathering and erosion. DOK 3
- 9 geosphere, hydrosphere, atmosphere, biosphere DOK 3

Critical Thinking

10 Sample answer: Rivers and streams might overflow their banks and cause widespread flooding. The heavy rains could increase soil erosion and might lead to mudslides. DOK 4

Desalination This feature can be found in the *Activity Lab Workbook*.



Explore Activity

How do some Earth systems interact?

a constantly interact with each other. In this activity, you'll model some com

Procedure

- 1. Read and complete a lab safety to
- Place a plastic container on a sheet of newspaper. In one er of the container, mold about 5 cups of sell into a landform of your choice.
- Hold a hair dryer about 20 cm from the model landform. Usi the hair dryer set on low, blow air across the model landscap for 1 min. Be careful not to blow the soil out of the container. Record your observations in your Science Journal.
- 4. Using a spray bottle, spray water onto your landform. Record

Think About This

- How did you use the materials in this activity to model Earth's systems?
- How could you improve your model? What changes would you
- 3. Describe how Earth systems interacted in your model



- How does the water cycle show interactions of Earth
- cycle show interactions of Earth

W Vocabulary

water cycle evaporation transpiration

INQUIRY

About the Photo All Systems Go? The photo can be used to start a discussion on how Earth's systems interact. In the photo, the interaction between the systems includes the waves hitting the cliffs (hydrosphere and geosphere), the clouds, which were formed with water from the hydrosphere (atmosphere and hydrosphere), the rain from the storm will provide water for plants and other organisms (hydrosphere, atmosphere, biosphere) and cause some soil erosion (hydrosphere, atmosphere, geosphere), and the plants are growing in the soil on top of and along the cliff Students might be familiar with many of the vocabulary terms in (biosphere and geosphere).

Guiding Questions

Which two Earth systems interact and form the clouds in the sky?

The two systems are the hydrosphere and the atmosphere. Students might recall that clouds form when water from Earth's surface evaporates and then condenses in the atmosphere.

How do the waves from the hydrosphere interact with the cliffs from the geosphere?

Possible answers: The waves will cause the rocks that make up the cliff to erode.

biosphere?

How does the storm interact with the Possible answers: The rain will provide water for plants and other organisms. If the storm is severe, it might damage or destroy habitats.

Essential Questions

After this lesson, students should understand the Essential Questions and be able to answer them. Have students write each guestion in their interactive notebooks. Revisit each question as you cover its relevant content.

Vocabulary Prior Knowledge

this lesson.

- 1. Make several sets of index cards. For each term, write just the definition on an index card. Then make another index card with just the term written on the card.
- 2. Group students in small groups. Set up stations around the room for each group.
- 3. At each station, arrange the cards with the terms in rows so that there is enough room above each card for the definition card.
- 4. Have students match the definition cards with each term.
- 5. Review the answers with students.

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316 Chapter 9

Engage Explore

Explain

Elaborate

Evaluate

ExploreActivity

How do some Earth systems interact?

Prep: 10 min Class: 20 min

Purpose

To model erosion, an interaction between the hydrosphere, atmosphere, and geosphere.

Materials

plastic shoe box, newspaper, five cups of soil, 100 mL beaker, water, hairdryer, spray bottle

Before You Begin

- Place the materials in a central location. Open a bag of soil and place a cup nearby.
- Tell students to scoop around five cups of soil into their plastic containers.

Guide the Investigation

- · For best results, set the hairdryer on low. Suggest that students experiment with the height and distance at which to hold the dryer to obtain a steady breeze across the model landform.
- A Students should wear their safety goggles during this activity. Blowing soil might get into eyes. Take care not to trip over the cord for the dryer or any extension cords you might use. Taping the cord to the floor may help prevent tripping. Keep water away from the dryer.

Think About This

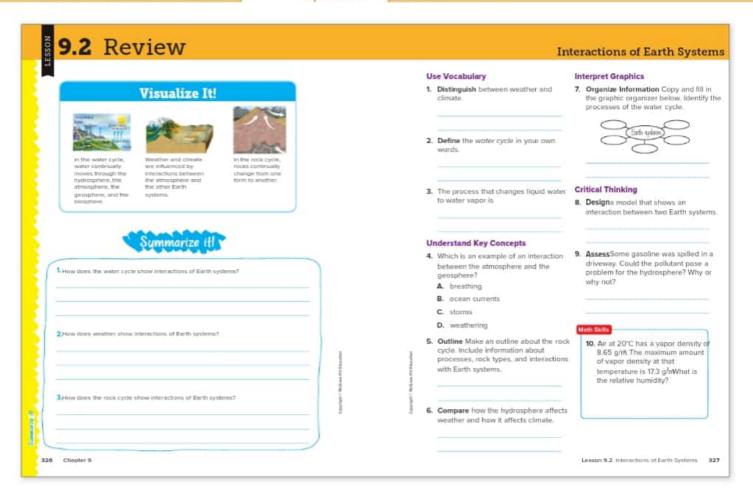
- The fan represented the atmosphere. The water in the spray bottle represented the hydrosphere. The soil represented the geosphere.
- 2. Sample answer: I could compact the soil or add vegetation to help prevent erosion. Or I could insert sticks to simulate trees or structures.
- 3. Key Concept The wind from the atmosphere blew the soil; the rain from the hydrosphere washed away some soil.











Visual Summary

Concepts and terms are easier to remember when they are associated with an image. Ask: Which Key Concept does each Image relate to?

Summarize it

The information needed to complete this graphic organizer can be found in the following sections:

- The Water Cycle
- · Changes in the Atmosphere
- · The Rock Cycle

Use Vocabulary

- Weather is the state of the atmosphere at a particular time and place, and climate is the average weather over several decades. DOK 1
- Sample answer: The water cycle shows how water moves through different Earth systems. DOK 1
- 3. evaporation DOK 1

Understand Key Concepts

- 4. D. weathering DOK 1
- 5. Outlines should include information about the processes of the

326 Chapter 9

rock cycle, the three main rock types, and interactions with Earth systems. Outline heads might be similar to those in the text. **DOK 2**

6. The hydrosphere provides the water for cloud formation and precipitation. The hydrosphere can also affect air masses. Surface currents in the ocean transfer thermal energy, modifying the climates of coastal regions. DOK 2

Interpret Graphics

 In any order, the processes of the water cycle are evaporation, condensation, precipitation, transpiration, and respiration. DOK 3

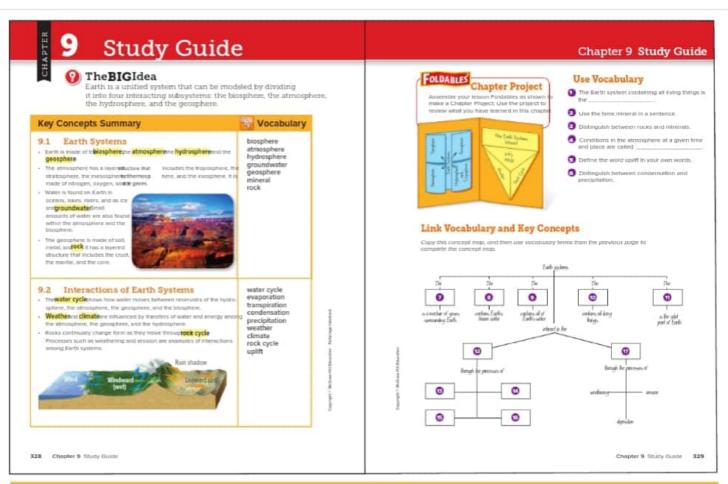
Critical Thinking

- A model might be a terrarium that includes plants, soil, air, and water. DOK 3
- Sample answer: Yes, it could pose a problem if rain washed the gasoline into a nearby lake or river, or if the gasoline soaked into the ground and polluted groundwater. DOK 4

Math Skills

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10. RH = 8.65/17.3 = 0.50 × 100 = 50% DOK 2



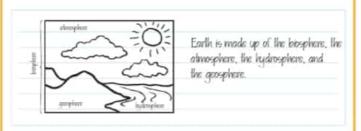
Key Concepts Summary

Study Strategy: Draw It

Students who are visual learners rather than verbal learners will benefit earning word roots will help students remember the meanings of from using drawings to represent the meaning of key concept

- 1. Assign each student one of the sentences from the Key Concepts Summary.
- 2. Instruct students to draw a picture that represents the meaning of tize. Instruct students to use a dictionary to find the roots (also called sentence. Underneath the drawing, students should write the
- 3. Have students share their drawings with the class. If possible, make3. If time allows, have students find other English words that share copies of all the student drawings and give them to students to use as a study guide.

Example:



Vocabulary

Study Strategy: Word Roots

difficult vocabulary terms. In addition, it will help students infer the statements. Give visual learners in your class the following instructions: meanings of other related terms. Give students the following instructions:

- 1. Have students create a chart like the one below in their Science Journals:
- etymology) of the chapter's vocabulary terms. Demonstrate to students where this information can be found in a dictionary entry.
 - common roots with the chapter's vocabulary terms.

Example:

Grock, bios meaning life
Greek, bios, meaning life Greek, sphaira, meaning ball





Use the Foldables® Chapter Project as a way to connect Key Concepts.

- 1. Ask students to organize their Foldables® in a way that reflects how the concepts in each Foldable relate to
- 2. Use glue or staples to hold the sheets together as needed.
- 3. When complete, ask students to place their Foldables Chapter Project at the front of the room. Have the class critique and discuss the way in which students have organized their Foldables®.

Use Vocabulary

- 1. biosphere
- 2. Sample answer: Rocks are made of minerals.
- 3. Rocks are naturally occurring solids composed of minerals, rock fragments, and organic matter or glass. Minerals are naturally occurring, inorganic solids that have crystal structures and definite chemical compositions.
- 5. Sample answer: Uplift is the process that moves Earth materials to higher elevations.
- 6. Condensation occurs when a gas changes into a liquid. Precipitation occurs when water falls from clouds to Earth's surface.

Link Vocabulary and Key Concepts

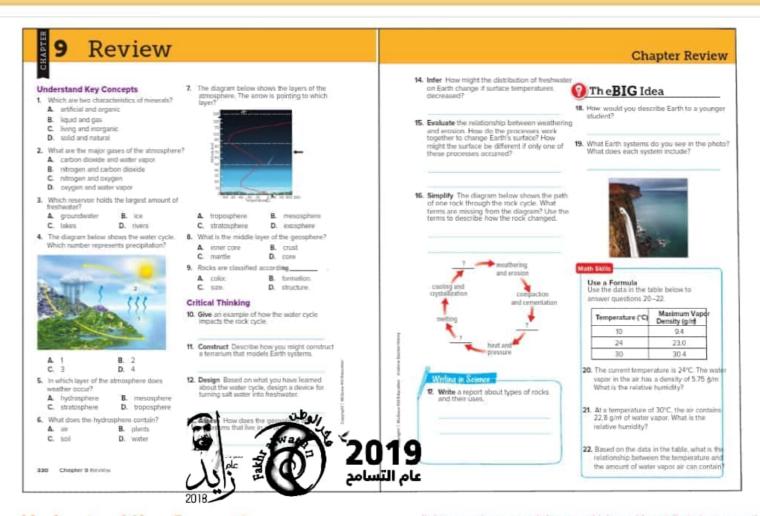
- 7. atmosphere
- 8. hydrosphere
- 9. biosphere
- 10. geosphere
- 11. water cycle
- 12 13 14 15 evaporation/transpiration/ condensation/precipitation
- 16. rock cycle







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Understand Key Concepts

- 1 D. solid and natural
- 2 C. nitrogen and oxygen
- 3 B. ice
- 4 C. 3
- 5 D. troposphere
- D. water
- 7 B. mesosphere
- 8 C. mantle
- B. formation

Critical Thinking

- 10 Sample answer: The water cycle impacts the rock cycle through precipitation, which contributes to weathering and erosion.
- 11 The terrarium should include materials that represent each Earth system, such as rocks, soil, plants, water, air, and a cover to allow water to evaporate and condense, remaining within the terrarium. The rocks and soil would represent the geosphere, the plants would represent the biosphere, the water would represent the hydrosphere, and the air would represent the atmosphere. Students might include adding a heat/

light source to represent the sun, which would contribute to evaporation of the water. They might include an animal to represent the biosphere and include respiration. Students might describe how the "systems" in their terrarium would interact. Interactions should be consistent with content presented in the chapter.

- 12 A device for turning salt water into freshwater could be based on evaporation and condensation. The set-up could include a pot of boiling salt water and a slanted lid with a trough on the low side for collecting the condensed freshwater.
- 13 Sample answer: Dissolved minerals from the geosphere make ocean water salty, which marine organisms need to survive.
- 14 Sample answer: Cooler temperature might increase the size of glaciers and ice caps, reducing the amount of freshwater in other reservoirs.
- 15 Sample answer: Weathering and erosion work together to break down rocks and carry sediment to new locations. Over time, they can carve canyons and valleys or wear away tall mountains. If only one of these processes occurred, rocks would not be broken down into smaller pieces or sediment would remain in one place if it was not eroded by wind, ice, or water.

Writing in Science

17 Haikus will vary, but should include the correct number of lines and syllables. They should also include information about interactions among Earth systems.



The **BIG** Idea

- 18 Sample answer: Earth is a large system divided into smaller, interacting systems that include air, water, living things, and rocks and soil.
- 19 The photograph shows Earth's atmosphere, hydrosphere and geosphere. Students might identify vegetation on the landmasses as part of the biosphere. The atmosphere includes air and water vapor that surround Earth. The hydrosphere includes all of Earth's water. The geosphere includes the solid part of Earth. And the biosphere includes all living things on Earth.

Math Skills

Use a Formula

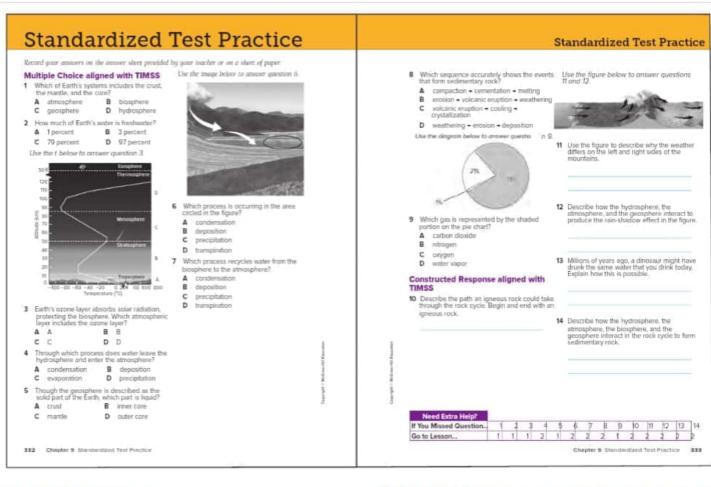
20.RH
$$=\frac{5.75}{23.0}$$
 = 0.25 × 100 = 25%

21. RH =
$$\frac{22.8}{30.4}$$
 = 0.75 × 100 = 75%

22. The higher the temperature, the more water vapor the air can contain.







Multiple Choice

- 1 C—Correct. A, B, and D are Earth's other systems and do not include the crust, mantle, and core. DOK 1
- 2 B—Correct. A is the amount of freshwater available on Earth's surface. C is the amount of freshwater in glaciers and ice caps. D is the amount of ocean salt water. DOK 1
- 3 B—Correct. A, C, and D are atmospheric layers that do not contain a layer of ozone. DOK 2
- 4 C—Correct. Water "leaves" the hydrosphere by evaporation, and the water vapor produced becaomse part of the atmosphere. A, B, and D are other processes that occur within the hydrosphere and atmosphere. DOK 2
- 5 D—Correct. A, B, and C are parts of the geosphere that are solid. The crust and inner core are solid. Rocks in the mantle flow because they are so hot, but they are considered a solid. DOK 2
- 6 B—Correct. A, C, and D are not processes of the rock cycle and are not shown in the diagram. DOK 1
- 7 D—Correct. A, B, and C are other processes in the water cycle and do not involve living things. DOK 2

- 8 D—Correct. A and B are sequences that do not occur in nature. C describes a sequence that forms ignous rock. DOK 1
- 9 B—Correct. A, C and D are gases that make up much less than 78 percent of Earth's atmosphere. DOK 1



Constructed Response

- 10 An igneous rock is uplifted to Earth's surface, where it weathers and produces sediment. The sediment is compacted and cemented together, forming sedimentary rock. The sedimentary rock is subducted. Deep below Earth's surface, the sedimentary rock is subjected to high temperatures and pressure and forms a metamorphic rock. The metamorphic rock is subjected to higher temperatures and melts, forming magma, If the magma cools below Earth's surface, it will crystallize and form an igneous rock. If the molten rock erupts as lava, the lava will cool and crystallize at Earth's surface and form an igneous rock. DOK 2
- 11 Moist air comes off the ocean and cools as it moves up over the coastal mountains. The cooled air drops precipitation on the left side of the mountains. The air, now dry, continues on to the right side of the mountains, causing a dry climate. DOK 1
- 12 Water evaporates from the surface of the hydrosphere, adding moisture to the atmosphere. The air cools as it travels over the mountains of the geosphere. The moisture condenses, forming precipitation on the windward side of the mountain (geosphere). The dry air creates the rainshadow effect as it moves down the leeward side of the mountain. DOK 2
- 13 The amount of water on Earth does not change but cycles continuously through the water cycle. Therefore, the water that was on Earth during times of the dinosaurs is the same water on Earth today. DOK 2
- 14 Water and ice (hydrosphere and cryosphere), wind (atmosphere), and plants and animals (biosphere), break down rocks (geosphere) into sediment through weathering. Erosion occurs when water and ice (hydrosphere) and/or wind (atmosphere) carry sediment to new locations. Deposition forms layers of sediment. The weight of sediment layers compacts them. Minerals from surrounding water crystallize in the sediment and cement the layers together, producing new sedimentary rocks. DOK 2

Answer Key

Question	Answer
1	C
2	В
3	В
4	C
5	D
6	В
7	D
8	D
9	В
10	See extended answer.
11	See extended answer.
12	See extended answer.
13	See extended answer.
14	See extended answer.





