Learn at Home

Grade 6 - Science

Unit Overview

This packet of resources is designed for students and their parents who wish to support in-school learning with activities that can be done independently and/or with a partner at home. This packet includes three activities that support major scientific content for the grade, focused on science literacy appropriate for the grade. These activities should take 40-60 minutes and may be completed in any order.

How to use this guide

For each activity, you will find:

- List of vocabulary words and its meanings for a better understanding of the reading passages
- Reading passages on a topic of interest and related to the science content
- Multiple choice questions
- Short writing assignments
- A short description and link for an informal science institution that supports the understanding of the content of this assignment.

Students and their families are invited to further explore these topics by conducting the activities found at the end of each assignment and/or by visiting the recommended informal science institutions.

Day 1 Science

The Cells That Make Us

Vocabulary

Learn the new vocabulary words below. You will use these vocabulary words in today's activity.

- ☐ **Cells** (noun) – the basic unit of structure and function of all livings things
- ☐ **Bacteria** (noun) – group of very small living things that may cause disease or play a role as decomposers
- ☐ **Microorganisms** (noun) – an extremely small living thing that can only be seen with a microscope
- ☐ **Nucleus** (noun) – the central part of most cells that contains genetic material and is enclosed in a membrane
- ☐ **Nuclear membrane** (noun) – a double membrane enclosing a cell nucleus and having an outer part continuous with the endoplasmic reticulum
- ☐ **Cell membrane** (noun) – (plasma membrane) a semipermeable membrane surrounding the cell
- ☐ **Cytoplasm** (noun) – the organized complex of inorganic and organic substances external to the nuclear membrane of a cell and including the cytosol and membrane bound organelles.
- ☐ **Vacuoles** (noun) – a small cavity or vesicle in the cytoplasm of a cell usually containing fluid.
- ☐ **Energy** (noun) – the ability to do work
- ☐ **Mitochondrion** (noun) –cell organelles that are found in the cytoplasm and which produce energy for the cell
- ☐ **Tissues** (noun)– a group of similar cells that together form a specific function
- ☐ **Unicellular** (noun) – having or consisting of a single cell

Directions

- Read the story and answer the questions that follow.

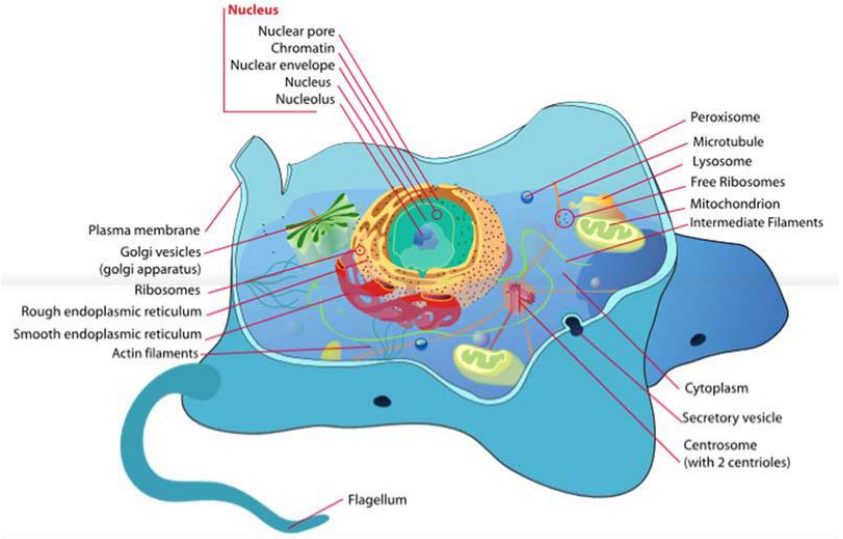
The Cells That Make Us

By ReadWorks

"Mom, I'm hurt," said Mike.

"What happened?" asked Mike's mom.

"I stumbled and fell while playing football at the playground today. I scraped my knee," said Mike. "You poor dear. Here, let's put a Band-Aid on your knee," said his mom. Mike's mom gingerly wiped his bleeding knee with a wet cloth and pasted a Band-Aid on it. Mike wondered aloud, "Our bodies are made of arms and legs. The arms and legs are made of blood and bones. But what are these blood and bones made of?"



Mike's mom replied, "Everything in our body is made of small units called cells. Think of it this way. Just like hundreds of thousands of bricks form a house, millions of cells form our blood, muscles, bones, skin, and hair—eventually coming together to form the human body."

As Mike looked at his bandaged knee, he wondered, "Wow, can I see these cells?"

"You cannot see your cells directly," said his mom. "A cell is tiny and is as small as the bacteria and other microorganisms that we cannot see with our naked eye. A cell is the smallest unit that can be said to be alive. You can see a cell if you have a powerful enough microscope, just like you'd see bacteria or microbes under a microscope."

"So, every part of my body consists of cells?" Mike said.

"Yeah. Not just your body, mine too," said Mike's mom. "Your pet dog, Tommy? He's made of cells. Your friend Jim's cat? She's made of cells, too. The lions we saw on safari last year, the spiders in our storeroom. Every creature on earth is made of tiny cells, just like you and me."

"Wow, so an ant or an amoeba is built up of cells, like so many Lego blocks?"

"Yes, just like Lego blocks. Only some creatures have just a single cell, like an amoeba. They are called unicellular organisms. Others, like us human beings, are collections of cells. These are called multicellular organisms. Multicellular organisms can range in size from brown algae to large animals like elephants, whales, and giraffes, which have trillions of cells."

"But what does a cell look like?"

"A cell is tiny, of course. But if you did manage to peer into a cell with a microscope that was powerful enough, you could see that a cell consists of different parts, too."

"So what parts are these?"

"Just like parts of our body are responsible for different activities (legs for movement, stomach for digestion, eyes for seeing, etc.), different parts within cells are responsible for different functions. These different parts perform the activities that keep the cell alive."

"Wow, so how does this teeny weeny cell stay alive?"

"The different parts of the cell work together to keep the cell alive. The nucleus is the 'brain' of the cell. It controls and coordinates all activities of the cell. The nucleus is surrounded by the nuclear membrane, which is like a blanket that protects the nucleus. The cell membrane is the outer covering of the cell, much like the nuclear membrane is the covering of the nucleus. The cell membrane is like a tap which controls what enters and leaves the cell. It can allow certain substances (food and water) to enter the cell, and block out other substances (waste or poisonous substances)."

"So the cell membrane is like a sieve that lets in some things and blocks other things?"

"Yeah. Or like an electric switch, if you think of it that way. Then there is the cytoplasm, which is a jellylike fluid that fills the cell, much like blood fills our body."

"Or like air fills the atmosphere around us?"

"Exactly! Only, all of this is within the tiny cell you can only see with the help of a microscope." "Wow. This is

like a tiny machine!"

"Yeah. But that's not all. All plant, fungal and some animal cells also have vacuoles, which is a cavity that works like a storage container."

"And what goes inside it?"

"It depends. Mostly, vacuoles are used to isolate harmful and waste material from the rest of the cell and help get rid of it."

"And what else?"

"Water; in plants, vacuoles help maintain the right water pressure. Animal cell vacuoles also help to store fats, starches, and glycogen which are all energy products."

"Is energy produced inside the vacuoles too?"

"No. Energy production happens in a part of the cell called the mitochondrion. These mitochondria are shaped like kidney beans. They convert food into chemical energy for the cells."

"And all the millions of cells keep me alive."

"Absolutely. With the accumulated energy in every one of the millions of cells, you and I get the strength to move our arms and legs, to think, move about, and to live."

"Wow. But each cell is tiny, so each cell would produce only a tiny amount of energy."

"Yeah. So these cells have to work together. A group of cells band together and form a tissue. There are many types of tissues. For example, connective tissues include blood or bones. These form connections between parts of the body. Muscle tissues form muscles, which help us move. Nervous tissues help parts of our body transmit messages—or 'think' and react to things that happen around us. Epithelial tissues are outer tissues that form protective layers."

“Like, skin?”

“Exactly! These tissues are specialized for different functions, so they work together in unison. For instance, all the cells in the muscle tissue in your calf muscles work together so that you can walk or run.”

“…and the tissues in my biceps help me wave my hand,” said Mike, waving his hand from side to side.

“That’s not all,” said Mike’s mom. “Often, tissues cannot function or operate by themselves. So, these tissues team up to form organs.”

“Just like me and my friends together form a football team,” said Mike, reminded of his scraped knee.

“Yeah, just like you can’t play football by yourself, a tissue cannot do anything by itself. It teams up with other tissues, and together, they perform the body’s activities. So, a group of tissues team up to form your nose and help you smell. Other tissues in your pancreas help you digest food. So, each organ performs its specific function because of the tissues that constitute it.”

“And the tissues, of course, are formed by the teeny weeny cells. Wow, so even if a cell by itself cannot smell anything, or a tissue by itself cannot smell anything, a collection of tissues can actually smell? That is so cool!”

“Unless you’re a unicellular organism, one cell can’t do much on its own. But in unity, there is strength. When millions of cells work together, magic happens. When cells combine to become tissues and tissues combine to become organs, the organs can perform the everyday activities like digestion, breathing, smell, taste—and just about everything else you do.”

“Wow, all because of a teeny weeny cell! That is truly magical.”

<u>Question 1</u>: According to Mike's mom, what is a cell?

1. Another name for an amoeba
2. The smallest unit of life
3. A group of tissues
4. A jellylike fluid

<u>Question 2</u>: How does Mike's mom compare the nuclear membrane and the cell membrane?

1. Both the cell membrane and nuclear membrane are protective coverings.
2. The cell membrane is like a blanket, while the nuclear membrane is like a sieve.
3. The nuclear membrane is like an electric switch, while the cell membrane is like a sieve.
4. Both the cell membrane and the nuclear membrane allow substances to enter the cell.

<u>Question 3</u>: Read the following sentences from the passage: "Only some creatures have just a single cell, like an amoeba. They are called unicellular organisms. Others, like us human beings, are collections of cells. These are called multicellular organisms. Multicellular organisms can range in size from brown algae to large animals like elephants, whales, and giraffes, which have trillions of cells."

What can be concluded about cells based on this information?

1. Unicellular organisms were once part of collections of cells.
2. Cells in multicellular organisms are stronger than unicellular organisms.
3. Cells can only support life if they are part of a multicellular organism.
4. Some cells can support life independently. Other cells support life collectively.

<u>Question 4</u>: Read the following sentences: "A group of cells band together and form a tissue. There are many types of tissues. For example, connective tissues include blood or bones. These form connections between parts of the body. Muscle tissues form muscles, which help us move. Nervous tissues help parts of our body transmit messages—or 'think' and react to things that happen around us."

Based on this information, what can you conclude about tissues?

1. All tissues in the body have similar functions.
2. All tissues band together to form organs.
3. Each kind of tissue has a different function.
4. There are only four kinds of tissues in the human body.

Question 5: What is this passage mostly about?

1. How the parts of the cell, tissues, and organs work together
2. The importance of mitochondria in the life of a cell
3. How tissues are made from groups of cells to serve different functions
4. The differences between unicellular and multicellular organisms

Question 6: Read the following sentences: "Just like you can't play football by yourself, a tissue cannot do anything by itself. It teams up with other tissues, and together, they perform the body's activities. So, a group of tissues team up to form your nose and help you smell. Other tissues in your pancreas help you digest food. So, each organ performs its specific function because of the tissues that constitute it."

As used in this sentence, what does the word "constitute" most nearly mean?

1. Take away from something
2. Give something energy
3. Make up the parts of something
4. Change in shape or size

Question 7: Choose the answer that best completes the sentence below.

_____a tissue by itself cannot digest food, a collection of tissues can work together as an organ to digest food.

1. Thus
2. Although
3. Above all
4. For instance

Day 2 Science

The Cells That Make Us

Based on your reading about cells, please answer the following questions, and complete **at least one of the Family Engagement Activities.**

Question 8: Why do tissues "team up" to form organs?

_____

_____

_____

Question 9: Why are all the different parts of the cell necessary?

_____

_____

_____

_____

Question 10: "When different parts of an organism work together in unison, things can be accomplished that could not happen otherwise." Explain this statement, using the interactions between different parts of the cell, tissues, and organs to support your answer.

_____

_____

Family Engagement Activities

Activity #1:

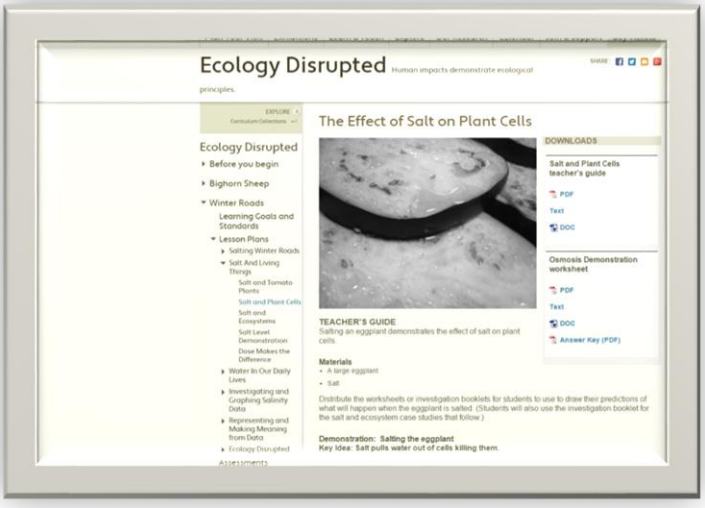
The Symbolic Cell Project

You are required to create a poster of a plant OR animal cell.

1. The organelles must be represented by a symbol which describes its function.
   - For example, a post office for the golgi body since it packages things within the cell and sends it to other parts of the cell.
2. Each cell model must include all of the following organelles:
   - Cell wall (if plant cell)
   - Chloroplasts (if plant cell)
   - Lysosomes (if animal cell)
   - Ribosomes
   - Cell membrane
   - Mitochondria
   - Nucleus
   - Vacuoles
   - Cytoplasm
   - Endoplasmic reticulum
   - Golgi bodies

3. The cell/function chart must be completed along with the post.

Activity #2:
Students and families can conduct this experiment that leads you to explore the effect of salt on plant cells, found on http://www.amnh.org/explore/curriculum-collections/ecology-disrupted/winter-roads/lesson-plans/salt-and-living-things/salt-and-plant-cells



Day 3 Science

Activity: The Ecosystem of the Forest

Vocabulary

Learn the new vocabulary words below. You will use these vocabulary words in today's activity.

- ☐ **Producer** (noun) – something that makes its own food
- ☐ **Decomposer** (noun) – any of the various organisms that return constituents of organic substances back to ecological cycles by feeding on and breaking down dead organisms
- ☐ **Consumer** (noun) – an organism requiring complex organic compounds for food which it obtains by preying on other organisms or by eating particles of organic matter
- ☐ **Ecosystem** (noun) – the complex community of organisms and its environment functioning as an ecological unit
- ☐ **Energy** (noun) – the ability to do work
- ☐ **Photosynthesis** (noun) – the process by which a green plant turns water and carbon dioxide into food when the plant is exposed to light.

Directions

- Read the passage below and answer the questions that follow.

The Ecosystem of the Forest

Even if it doesn't look like it, all living things constantly interact with their environment. For instance, every time you take a breath, you get oxygen from the air, and every time you breathe back out, you release carbon dioxide into the world around you. Both oxygen and carbon dioxide are vital gases that different organisms can use. You, a human, need the oxygen for energy and need to get rid of the carbon dioxide, because it's a waste matter.

Just like us, all other organisms take something from their environment while putting waste back into it. When several kinds of organisms interact with each other in one particular area, it's called an ecosystem. In the forest, living beings (plants, animals, insects, fungi and bacteria) all interact with each other and with the soil and water to form the forest's specific kind of ecosystem.

So, how does it work? Every organism in the forest can be put in one of three categories. Depending on which category they're in, they'll interact with each other and the forest's resources in a different way. The categories are producer, decomposer and consumer. Let's look at each one.

Producers are living things that can make their own energy out of non-living resources all around them like, oxygen and water. They're also known as autotrophs. Autotrophs do not need to kill anything in order to eat.

Plants and algae, for example, are producers. In the forest's ecosystem, the trees, shrubs and moss are all producers. They turn water and sunlight into the energy they need to live and grow, through a process called photosynthesis. And remember that carbon dioxide you expelled as waste matter? Well, for plants, carbon dioxide is a vital gas. It is used to help aid with the process of photosynthesis.

Like producers, decomposers don't need to kill another living being to obtain food. However, they differ from producers because they still need to get their nutrients from other organisms or from waste matter expelled by other organisms. Usually they eat dead animals and plants. Bacteria and certain kinds of fungi are examples of decomposers. They're very important because by helping break down dead organisms, they actually provide energy to living ones.

Consumers are the living beings that need to eat other organisms to survive. You may have heard about this group as being "at the top of the food chain." They're also known as heterotrophs. Humans are heterotrophs who eat both plants and animals to live. In the forest, a deer eating plants, a wolf hunting deer, a hawk eating rodents, and rodents eating both bugs and plants, are all examples of the ecosystem's consumers. As you can see, carnivores, omnivores and herbivores are all different kinds of heterotrophs. It doesn't matter which kind of organism they eat; as long as they eat other organisms to survive, they're consumers/heterotrophs.

So, now that you know each type of player, how does the ecosystem's cycle work? Well, when an organism dies and its body decomposes, bacteria go to work. Let's imagine the dead organism is a deer. Bacteria obtain energy from the deer's body, while helping it decompose efficiently. When the deer's body breaks down, because of the work done by the bacteria, it returns to the soil. This is important for the earth, because the carcass actually gives vital energy back to the environment. It makes the soil rich in nutrients for plants to grow there. Grasses, flowers and trees then grow in that soil and get the energy they need, along with energy from the sun and water. The water also filters through the soil, which is necessary for the forest's flowers and trees to be able to take it up through their roots. Heterotrophs, like deer, eat those plants to get their energy, and other heterotrophs, like wolves, eat the deer for their energy.

As you can see, in a forest ecosystem or any kind of ecosystem, every being interacts with other beings. What's important to remember is that each part of the ecosystem is as important as another. Without soil, there'd be no plants. With no plants, there'd be no deer, rodents or certain kinds of insects. And without tiny microbes (remember, the decomposers), animals and plants would die without their bodies being returned to the earth. Because forests cover about a quarter of the total land surface of the world, keeping their ecology balanced is important for the entire earth.

<u>Question 1</u>: What is an ecosystem?

1. A living being, such as a human, that eats other living beings in order to survive.
2. The process by which the body of a living thing is broken down by decomposers.
3. One particular area where several kinds of organisms interact with each other.
4. An organism that breathes in oxygen and then breathes out carbon dioxide.

<u>Question 2</u>: What is this passage mainly about?

1. The differences between oxygen and carbon dioxide.
2. Different kinds of consumers and the reasons they are "at the top of the food chain."
3. Different organisms in a forest ecosystem and how they interact.
4. What happens when the ecology of a forest is thrown off-balance.

<u>Question 3</u>: What does this passage explain?

1. This passage explains what the difference between plants and fungi is.
2. This passage explains what an ecosystem is and how it works.
3. This passage explains how oxygen is used by the human body after it is breathed in.
4. This passage explains what happens when a decomposer dies in the forest.

<u>Question 4</u>: In an ecosystem, different organisms interact with each other. What evidence from the passage supports this statement?

1. Plants use sunlight, water, and carbon dioxide in a process called photosynthesis.
2. Forest ecosystems cover about a quarter, or one-fourth, of the total land surface in the world.
3. Producers are living things that can make their own energy out of non-living resources.
4. A deer decomposing in the soil provides food for bacteria and nutrients for plants to grow.

Question 4: Based on the information in the passage, what do all ecosystems have in common?

1. All ecosystems are home to a variety of living things.
2. All ecosystems are home to trees, deer, humans, rodents, wolves, hawks, and bacteria.
3. All ecosystems have an equal number of consumers, decomposers, and producers.
4. All ecosystems have a few consumers that do not interact with decomposers and producers.

Question 5: Read the following sentence: "Consumers are the living beings who need to eat other organisms to survive."

What does the word "organisms" mean?

1. Environments
2. Waste matter
3. Categories
4. Living things

Question 6: Choose the answer that best completes the sentence below.

Every organism in the forest can be put into one of three categories,_____producer, decomposer, or consumer.

1. Namely
2. Although
3. As a result
4. Earlier

Day 4 Science

Activity: The Ecosystem of the Forest

Based on your reading about ecosystems, please answer the following questions, and complete **at least one of the Family Engagement Activities.**

Question 7: What is a decomposer?

_____

_____

Question 8: How do decomposers interact with their ecosystem? Be sure to name one example of them taking from the ecosystem and one example of them giving to the ecosystem.

_____

_____

_____

Question 9: The author writes that each part of the ecosystem is as important as another. Based on the information in the passage, do you agree or disagree? Explain your reasons for agreeing or disagreeing using evidence from the passage.

_____

_____

_____

_____

Family Engagement Activity

Students and families may want to further explore ecosystems by performing these hands-on activities and/or by visiting these institutions. Please contact educators at the institution of your choice for guided field trips and workshops for students and families.

Activities to do at home:

Outdoor Bonanza – Design a garden or park which can attract native animals. Design the type of plants and trees that will be in the park/garden. Then show the native animals that will be attracted to this space because of the food sources you added to your design. Make a food web showing all of the organisms in your yard/park. Remember to draw or take photos of the space you have created.

How to Make Your Own Terrarium – This activity provides children with a long-term investigation of their own created ecosystem. http://fun.familyeducation.com/crafts/plants/47917.html

Grow Your Own Miniature Garden – Through this hands-on activity, children make a small garden that they will observe, learning about plants. They will also learn to appreciate plants and the environment when taking care and maintaining this garden. https://kids.nationalgeographic.com/explore/books/indoor-herb-garden/

Day 5 Science

Activity: Don’t Waste That

Vocabulary

Learn the new vocabulary words below. You will use these vocabulary words in today’s activity.

- ☐ **Batch** (noun): the amount of food cooked at one time
- ☐ **Chronic** (adjective): continuing for a very long time
- ☐ **Compensate** (verb): to make up for a disadvantage or disability
- ☐ **Compost** (noun): dead leaves, food, and other things that are added to soil to make it better
- ☐ **Institution** (noun): a place with a particular purpose; a school, hospital, etc.

Directions

- Read the article below and answer the questions that follow.

Don’t Waste That

PORTLAND, Oregon (Achieve3000, December 18, 2008).

Food waste has been a chronic problem for the food industry. Roughly 30 percent of food in the U.S. goes to waste. This costs about $48 billion annually. Unsold and past-due grocery store foods must be thrown out, while restaurants sometimes order more food than they end up needing. Diners don't always clean their plates, either. What's more, millions of tons of food are lost between the farm and the restaurant. This happens because crops are hauled hundreds of miles, stored for weeks in refrigerators, and then prepared at restaurants. Now, as food costs rise, many in the food industry want to stop wasting expensive food.

In 2008 alone, wholesale food costs rose more than 8 percent. This was the biggest jump in decades, according the National Restaurant Association. It came after a 7.6 percent increase in 2007. Experts say there's no easy answer for cutting back on waste because each kitchen is run so differently. This means that restaurants, colleges, and other institutions are now developing their own solutions to compensate for the rising costs of waste.

Some cafeterias are getting rid of trays. In 2008, Virginia Tech took that step. The school's dining halls hoped to cut down on the amount of food going into the trash after meals. The move cut food waste by 38 percent. Before, students often grabbed whatever food looked good. A large portion of their food ended up in the trash can.

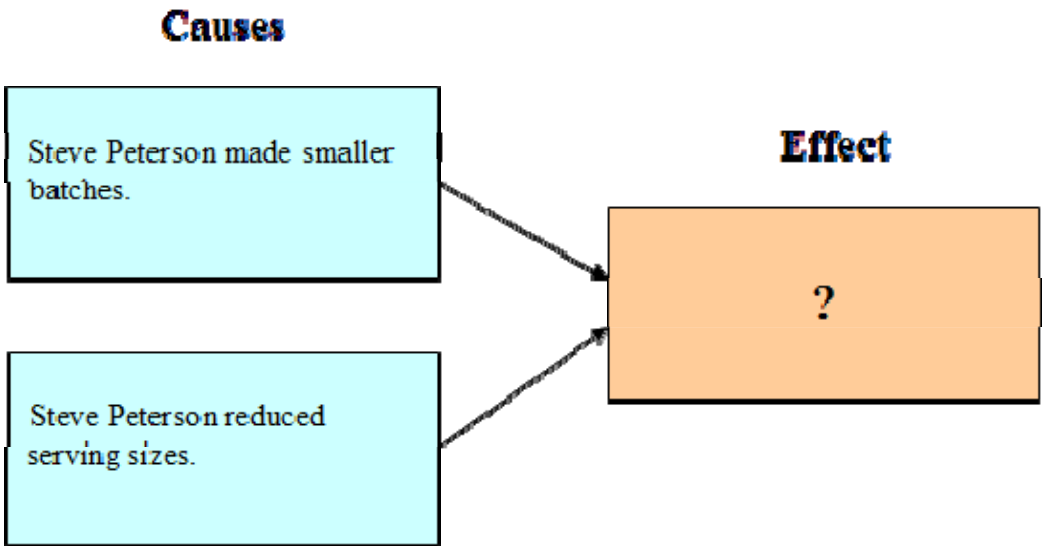
Oregon's Portland International Airport is dealing with food waste in a different way. The airport is installing food-only trash cans. The food waste is collected in special bags that will decay naturally. These bags of waste are given to the city to use as compost. Since food waste costs less to have hauled to the landfill than regular trash, the airport is saving money on hauling costs. It's also a more environmentally friendly approach. However, the special bags are expensive. It ends up costing the airport more to compost the food than to throw it away.

Indeed, sometimes institutions have to spend a little to save a little. For $600 a month, Lean Path Inc. sells a software system to track food being tossed out. Restaurant employees put food waste on a scale. They use a touch-screen computer to record what type of food it is. The system determines the cost of the food. It also tracks what is being thrown out.

Steve Peterson is the head cook at a hotel. Peterson was surprised when the Lean Path system showed him the value of food being thrown out. To cut costs, Peterson decided to make smaller batches and reduce serving sizes. His customers didn't mind. Peterson found he was able to trim food waste by 15 to 20 percent over 18 months.

Andrew Shackman is the president of Lean Path. He says one of the biggest benefits of the program is simply showing restaurant owners and cooks how much food gets thrown away. They learn that when they're trying to save money, every little scrap counts.

The Associated Press contributed to this story.



Question 1: Based on the article, which best replaces the question mark in the diagram above?

1. Peterson was able to trim food waste in a hotel by 15 to 20 percent over 18 months.
2. Peterson stopped using the Lean Path software system to track food waste in a hotel.
3. Peterson started using special bags that decay naturally to collect food waste.
4. Peterson needed to increase the prices he charged his customers for food.

Question 2: Which of these is a statement of fact?

1. Lean Path's software that tracks food waste costs $600 per month.
2. Virginia Tech's cafeterias should use their food waste as compost.
3. Students who eat in school cafeterias need to try to eat less food.
4. All airports should use food that comes from farmers in their area.

Question 3: The article talks mainly about:

1. What institutions within the food industry are doing to reduce food waste.
2. How Steve Peterson was able to reduce food waste by reducing serving sizes.
3. Where Portland International Airport installed its food-only trash cans.
4. How Lean Path's software shows cooks how much food gets thrown away.

Question 4: In the fifth paragraph, the author gives information about Lean Path's software in order to:

1. Show one way that institutions are spending money to reduce food waste.
2. Convince the reader that all airports should use the waste-reducing software.
3. Describe how reducing serving sizes could control food waste at home.
4. Explain why Lean Path charges companies $600 per month for its software.

Question 5: The article states: Oregon's Portland International Airport is dealing with food waste in a different way. The airport is installing food-only trash cans.

Which would be the closest antonym for the word install?

1. Remove
2. Muffle
3. Soothe
4. Pounce

Question 6: Which question is not answered by the article?

1. How much food waste does Portland's airport have each year?
2. How much does Lean Path's software cost each month?
3. How much has Steve Peterson reduced food waste at his hotel?
4. How much did Virginia Tech reduce food waste by getting rid of trays?

Question 7: Which is the closest synonym for the word batch?

1. Quantity
2. Resource
3. Decision
4. Miracle

Question 8: The reader can tell from the article that

1. Some restaurant employees probably need training to use Lean Path's software.

2. Most students at Virginia Tech would rather eat in a restaurant than the cafeteria.
3. All restaurant owners probably believe that Lean Path's software is too expensive.
4. Few farmers would be concerned about how food is transported to stores and restaurants.

Day 6 Science

Activity: Don't Waste That

Based on your reading about food waste, please think about solutions to the problems presented, and complete **at least one of the Family Engagement Activities.**

Writing Activity

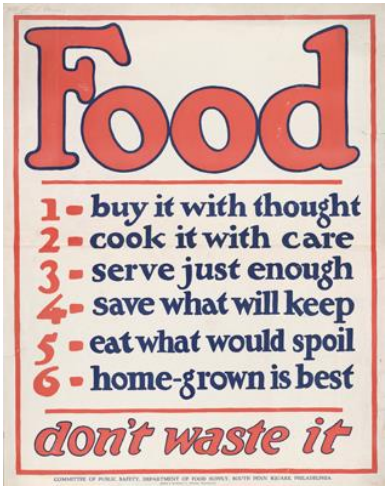
Describe the problem with food waste in the food industry using information from the article. What are some ways that the article mentions to solve this problem?

Write your answer below.

Family Engagement Activities

Students and families may want to further explore the topic of food waste by performing these activities:

What's for Dinner – Children and adults can discover the benefits of the types of food that they eat for dinner. Chart the food that you eat for dinner as a family for one week. Then find out where the type of food came from – for instance, if you have salmon for dinner one night, search the internet and see where salmon is produced and then shipped to NYC. Do the same for all of the food products that you eat for dinner and then create a chart of the cost of the food and the distance it travels. See if you can find any trends in the data that you have collected.



Learning about ways to reduce food waste at home, as well as storage and preservation of foods:
http://www.usda.gov/oce/foodwaste/resources/consumers.htm

Create/participate at in composting at a GreenMarket – store food scraps and drop it off at selected locations in which food is transformed into fertile soil for urban gardening and gardening projects. More information found here.
http://www.grownyc.org/compost

Day 7 Science

Activity How Are Rainbows Formed?

Vocabulary

Learn the new vocabulary words below. You will use these vocabulary words in today's activity.

- ☐ **Wavelengths** *(noun)*: the distance between successive crests of a wave, especially points in a sound wave or electromagnetic wave
- ☐ **Reflects** *(verb)*: (off a surface or body) throw back (heat, light, or sound) without absorbing it
- ☐ **Re-emerges** *(verb)*: comes into sight or prominence once more
- ☐ **Bends** *(verb)*: shape or force (something straight) into a curve or angle
- ☐ **Refracts** *(verb)*: (of water, air, or glass) make (a ray of light) change direction when it enters at an angle.
- ☐ **Parallel** *(adjective)*: (of lines, planes, surfaces, or objects) side by side and having the same distance continuously between them.
- ☐ **Arc** *(noun)*: a part of the circumference of a circle or other curve
- ☐ **Band** *(noun)*: a strip (as of living tissue or rock) or a stripe (as of an animal) differentiable (as by color, texture, or structure) from the adjacent material or area; a more or less well-defined range of wavelengths, frequencies, or energies

Directions

- Read the article below and answer the questions that follow.

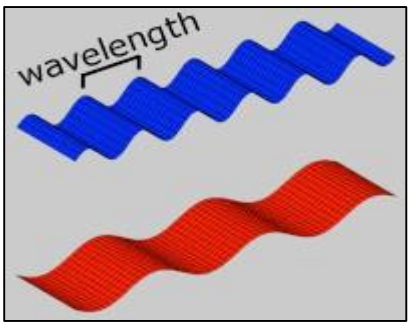
How Are Rainbows Formed?

By Dr. Hany Farid, Dartmouth College

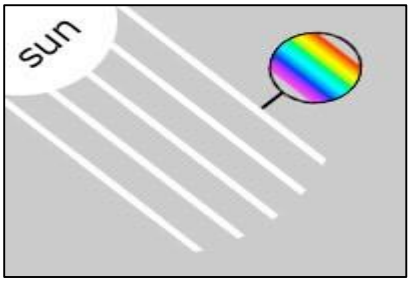
Sunlight is composed of light of varying wavelengths. Short wavelength light appears blue, violet and indigo, and long wavelength light appears red, orange and yellow. When sunlight enters a raindrop in the air, the light splits into a multitude of colors. This light then reflects off the back of the raindrop and re-emerges in the direction in which the light first entered. The light emerging from many raindrops creates a rainbow.

Read on for a more detailed explanation.

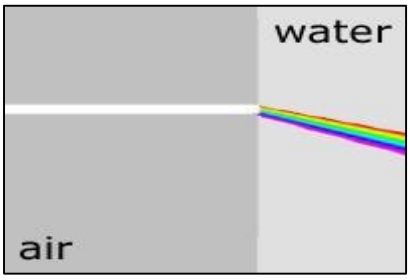
Fact 1. Light travels in waves. The light's wavelength determines its perceived color. Short wavelength light, for example, appears blue, and long wavelength light appears red.



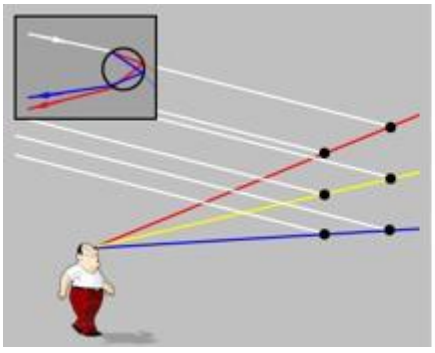
Fact 2. Sunlight is composed of light of many wavelengths. In the range that we can see, this includes the colors of the rainbow.

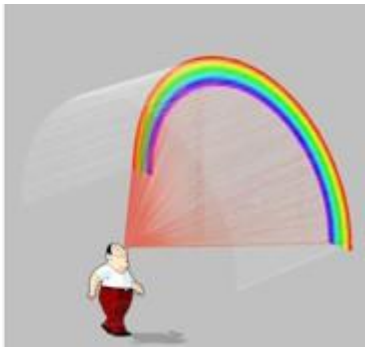


Fact 3. When light enters water, it bends (refracts). The amount of bending depends on the wavelength of light. As a result, the light splits into its component colors.



When a ray of sunlight enters a raindrop, it bends (refracts). The light then strikes the back of the raindrop, where some of the light passes through and some is reflected. As the light exits the raindrop, it is refracted again. The angle at which the light emerges depends on the wavelength of light. This path is illustrated in the small box below, where only the bending of two wavelengths (blue and red) are shown.





Consider now the diagram on the left. The sun is behind you (white rays) and there is rain in front of you (black dots). As the sunlight enters each raindrop, the light is refracted and reflected as described above. Because the sun is so far away, the rays of sunlight are nearly parallel to one another. As a result, the angle between the red line and each ray of sunlight striking a raindrop on that line will be the same. So, the light that reaches your eye along this ray will be of the same wavelength (color). The same is true for the yellow, blue, and intermediate lines corresponding to each color of the rainbow.

Consider now the diagram on the right which explains why the colors of a rainbow form an arc. The angle between the incoming rays of sunlight (white) and all of the red lines, forming a circular cone, have the same angle. As a

result, the light that reaches your eye along these lines have the same wavelength (color). The same is true for each band of the rainbow.

The reason that rainbows are somewhat rare is that you will only see them when there is rain in front of you and somewhat in the distance, and the sun is behind you and fairly low on the horizon.

Question 1: What is sunlight composed of?

1. Light of a single color.
2. Light traveling at different speeds.
3. Light of varying intensity.
4. Light of varying wavelengths.

Question 2: What does the author explain in the first paragraph of the text?

1. How light travels.
2. How a rainbow is formed.
3. Why rainbows are shaped like an arc.
4. Why rain causes light to split into separate colors.

Question 3: Read these sentences from the text.

"Sunlight is composed of light of varying wavelengths. […] When light enters water, it bends (refracts). The amount of bending depends on the wavelength of light. As a result, the light splits into its components colors.

What can you conclude based on this evidence?

1. Each wavelength of light bends the same amount when it enters water.
2. When light enters water, its wavelength is altered.
3. Each component color of light has a different wavelength.
4. The component colors of light all have the same wavelength.

Question 4: When would you be most likely to see a rainbow?

1. In the evening on a partly rainy, partly sunny day.
2. In the morning on a bright, sunny day.
3. In the evening on a cloudy, rainy day.
4. At noon on a partly cloudy day.

Question 5: What is the main idea of this text?

1. Sunlight is composed of light of varying wavelengths. Short wavelength light appears blue, and long wavelength light appears red.
2. Rainbows form when sunlight enters raindrops, splits into different color components, and re-emerges from the raindrops.
3. The colors of the rainbow from an arc because of the angles at which light of different wavelengths reaches your eye.
4. You will only see rainbows when there is rain in front of you and somewhat in the distance, and the sun is behind you and fairly low in the horizon.

Question 6: Why might the author have chosen to list Fact 1, 2, and 3 separately instead of describing them in one paragraph?

1. To emphasize the importance of these facts to the way rainbow form.
2. To show that these facts are not related to each other in any way.
3. To indicate that these facts do not affect the way rainbows form.
4. To make the explanation of how rainbows form seem more complicated.

Question 7: Choose the answer that best complete the sentence.

Light wavelength determines its perceived color; _____, short wavelength light appear blue.

1. initially
2. for instance
3. however
4. similarly

Day 8 Science

Activity: How Are Rainbows Formed?

Based on your reading about rainbows, please answer the following questions, and complete **at least one of the Family Engagement Activities.**

Question 8: When light enters water, it bends. What does the amount of bending depend on?

_____

_____

Question 9: For a rainbow to form, sunlight needs to enter and then re-emerge from raindrops. Describe what happens to the light when it first enters a raindrop and when it comes out of the raindrop. Support your answer with evidence from the text.

_____

_____

_____

_____

Question 10: Why might you only see a rainbow when rain is in front of you? Support your answer with evidence from the text and images.

_____

_____

_____

_____

Family Engagement Activities

Make a Rainbow In Your Kitchen!

Instructions

1. Fill the glass with water.
2. Put the mirror into the water inside the glass at an angle.
3. Position the glass so that sunlight shines directly at the mirror.
4. Look for a reflection on the wall.
5. Adjust the angle of the mirror until you see a **rainbow** on the wall.

How does this model help you explain how rainbows form?

_____

_____

_____

_____

Make a Rainbow

What You Need:

- A glass of water
- A sheet of white paper
- A sunny day or a flashlight

Instructions:

1. Fill the glass almost to the top with water.
2. If you are using sunlight, place the glass so that it is half on and half off the edge of a table, and so that the sun shines directly through the water, onto a sheet of white paper on the floor.
3. Adjust the paper and the glass until a rainbow forms on the paper.
4. If you are using a flashlight, place the glass of water on the white piece of paper, and move the flashlight around until you see a rainbow on the piece of paper

How does this model help you explain how rainbows form?

_____
_____
_____
_____

Day 9 Science

Activity: A Drop's Journey

Vocabulary

Learn the new vocabulary words below. You will use these vocabulary words in today's activity.

- ☐ **Cycling** *(verb)*: move in or follow a regularly repeated sequence of events
- ☐ **States of matter** *(noun)*: one of the distinct forms that matter takes on and is observable in everyday life: solid, liquid, and gas
- ☐ **Journey** *(noun)*: an act of traveling from one place to another
- ☐ **Hydrogen** *(noun)*: a colorless, odorless, highly flammable gas, the chemical element with an atomic number of 1.
- ☐ **Oxygen** *(noun)*: a colorless, reactive gas, the chemical element with an atomic number of 8 and a life-supporting component of the air.
- ☐ **Molecule** *(noun)*: a group of atoms bonded together, representing the smallest fundamental unit of a chemical compound that can take part in a chemical reaction.
- ☐ **Rumbling** *(verb)*: a continuous deep, resonant sound.
- ☐ **Bleak** *(adjective)*: an area lacking vegetation and exposed to elements.
- ☐ **Dweller** *(noun/adjective)*: something or someone that lives or stays as a permanent resident
- ☐ **Sway** *(verb)*: move or cause to move slowly or rhythmically backward and forward or from slide to side.
- ☐ **Heat** *(noun)*: a form of energy that causes things to become warmer
- ☐ **Energy** *(noun)*: capacity to do work
- ☐ **Meander** *(verb)*: to walk slowly without a specific goal, purpose or direction
- ☐ **Crystallized** *(verb)*: to change into a solid form that is made up of crystals.
- ☐ **Thaws** *(verb)*: to return to a normal temperature after being very cold.

Directions

- Read the passage below and answer the questions that follow.

A Drop's Journey

What would people learn if they could follow a drop of water wherever it went? They would discover that the water exists permanently, cycling through different states of matter as it travels on its adventure through so many different aspects of the earth. Its journey might not be measured in years but could be measured in states of being—how many times the droplet finds itself to be part of a pool of water in a suburban back yard, locked up in a glacier, floating in a cloud, or part of a massive sea. Let's examine how a tiny drop of water could make its way through so many different circumstances.

Our drop of water is like any other drop of water—it is made of hydrogen and oxygen. In fact, each molecule of our water drop looks exactly the same: two hydrogen atoms linked up with one oxygen atom. This combination of hydrogen and oxygen is simply what makes water what it is.

When we first see our little drop of water, it is part of a huge ocean, the biggest of all the oceans. This little drop of water lives at the bottom of the Pacific Ocean. Being part of the rumbling ocean means it is liquid, of course. It's dark and cold at the bottom of the ocean, and relatively bleak. Every once in a while the water molecule is somehow consumed by a deep- sea dweller, and passes through its body until it eventually rejoins the ocean. As this happens, the little water drop may end up in a different part of the ocean where it is more shallow, and there is less pressure and more light, as some sunlight filters through.

The water droplet continues to sway and move, sometimes finding itself pushed back down into the darkness, but in general moving up, higher and higher, until eventually one cool night, it hits the surface. All of a sudden, instead of water on every edge, the water droplet makes contact with the air. It's resting right on top there, but of course, it stays closely connected to its other oceanic droplets. This tendency to stay connected to other liquid bits of water is what makes water pool together on a table, if you spill a glass. What could force it to abandon its rigid structure, though, is heat. As liquid water is heated, the individual droplets gain more and more energy. They gain so much energy that they start to bang around against each other with greater and greater force until all of a sudden—pow! The amount of energy the little drop contains is simply too much to be reined in. Instead, the droplet can no longer handle bouncing against its fellow water droplets, and it bursts right out of the body of water and goes straight up into the air. For our little droplet of water, this is exactly what happens the morning after it reaches the top of the ocean. The sun comes out early and throughout the day, and keeps on heating the little drop of water up, hotter and hotter until all of a sudden— pow! Our little droplet of water is lifted up and can no longer call the ocean home.

The water droplet has evaporated, meaning it's gained enough heat to transform from a liquid to a gas. In its new gas state, it is floating up above the ocean into the air. When this happens, all of the salt particles hanging on between water molecules fall, and are left behind. The salt is too heavy for the tiny water droplet to carry it into the sky, so down it stays, making sure the ocean remains salty, even as freshwater rivers run into it, thousands of miles away.

The water droplet continues to rise all the way up, until it's high enough that the air begins to cool down. It's high up in the cool air—the same cool air that makes mountaintops so cool and frigid. And as it gets colder, the droplet of water loses more and more of its energy. It stops bouncing until it slows down dramatically and collides with other drops of water. Rather than separating again, they start to stick. They stick together, with drops of water encasing dust and other small particles that have made it so high up. They stick and continue picking up more and more droplets until they've created the beginnings of a cloud. High up in the sky, the cloud is carried by the wind, across an ocean and finally over the beach. Then it starts to get lower and lower as it collects more and more water droplets.

Soon, enough water is gathered so that the cloud is so heavy that it can start to release some of its water droplets down and back onto the land in big wet drops of rain. Our water droplet falls from the cloud right onto the center of the Rockies, a place that is called the Continental Divide.

The Continental Divide is so named because it represents a stark split across the entire North American continent. The Rocky Mountains are so high they act like a fold in a piece of paper propped up to be a nametag. On one side of the Rockies, all water landing there will trickle down and to the West, so that the droplets of water may eventually reach the Pacific Ocean. On the other side of the Rockies, all water landing there trickles down to the East, and it may eventually reach the Atlantic Ocean. Of course, most of the water will meander amongst the paths of rivers, lakes, bays and clouds on its journey.

Our water droplet falls on the east side of the Continental Divide. Unfortunately, it lands in a small puddle hidden under the shade of a bigger rock. That means it ends up staying there for quite some time, never getting hot enough to pop back into the sky. Months pass, and it grows cold. The next time water falls from the sky, it comes as snow. Cold droplets of water have frozen into tiny solid flakes falling from the sky. It chills our water droplet in the puddle and as the snow packs on, eventually the new drifts meet with a glacier that exists at the top of this mountain. For many months, our water droplet is quiet and still—void of energy and not willing to move. It has crystallized and is joined to its fellow water droplets in a large sheet of frozen ice.

The spring comes and the ice thaws. The water droplet heats up and melts, and as the rest of its snow chunk does, it finds itself propelled forward, trickling all the way down the mountain. This droplet still has so many possibilities—it may trickle all the way into the Atlantic Ocean. Perhaps it will stall and find itself flowing from a natural spring, where it could be collected and bottled, and sent to a grocery store to sit for months on a shelf until someone buys it. Or perhaps it will find its way to your closest lake, and as you dive in, you'll encounter a tiny droplet that has traveled thousands of miles and through several states of being, just to swim next to you.

<u>Question 1</u>: What is a water droplet made of?

1. Oxygen and calcium
2. Hydrogen and oxygen
3. Lithium and oxygen
4. Sodium and hydrogen

<u>Question 2</u>: Which of the following states of water are described in the passage?

1. Liquid and gas only
2. Ice, liquid, and gas
3. liquid and ice only
4. gas only

<u>Question 3</u>: The amount of heat energy in the water droplet determines whether the water droplet can transform from a liquid to a gas. Which evidence from the text supports this statement?

1. The water droplet loses its salt particles when it evaporates into the air.
2. The water droplet gains more and more energy as the liquid water is heated.
3. The water droplets bang against each other when they have a lot of heat energy.
4. The water droplet evaporates when it has gained enough heat to transform from a liquid to a gas.

<u>Question 4</u>: Where in the ocean does the water droplet need to be located in order to evaporate?

1. Inside a deep-sea dweller.
2. In the middle of the ocean.
3. On the surface of the ocean.
4. At the bottom of the ocean.

<u>Question 5</u>: What is this passage mainly about?

1. How water crystallizes.
2. The different states of water.
3. The way water evaporates.
4. How water moves down a mountain.

<u>Question 6</u>: Read the following sentences: "And as it gets colder, the droplet of water loses more and more of its energy. It stops bouncing until it slows down dramatically and collides with other drops of water."

What does the word *<u>"dramatically"</u>* tell us about the way the water droplet slows down?

1. It takes a long time for the water droplet to slow down.
2. The water droplet doesn't slow down at all.
3. The water droplet barely slows down.
4. The water droplet slows down a lot.

<u>Question 7</u>: Choose the answer that best completes the sentence below.

The crystallized water droplet must melt_____it can trickle down the mountain.

1. although
2. after
3. before
4. never

Day 10 Science

Activity: A Drop's Journey

Based on your reading about the cycle of water, please answer the following questions, and complete **at least one of the Family Engagement Activities.**

Question 8: How does the water droplet change throughout the passage?

_____

_____

Question 9: The author writes that the water droplet has evaporated. What does "evaporated" mean?

_____

_____

_____

_____

Question 10: How does heat affect a water droplet's state of matter? Support your answer with evidence from the passage.

_____

_____

Reading passages and exercises from http://www.readworks.org

Family Engagement Activity

Family Activity #1:

What Fraction of Earth's Water is Usable?
(Adapted from "Apple Ocean" by Jeff Cenoz and Lindy Millman)

This is an interesting way to see how much of the earth's land and water is usable by humans! All you need is an apple, a dull knife, an adult, and a knowledge of fractions!

1. Cut your apple into equal fourths. Set three of the four pieces aside. These three fourths represent the part of the earth covered by ocean. Mark them ocean by labeling a paper towel or plate. The other fourth represents the part of the earth that is land not covered by water.

2. Cut the earth quarter into equal halves. One piece represents all the land that is too dry, too wet, too cold, too hot, or otherwise uninhabitable by people. The other piece, which is one eighth of the entire earth, is the land that is habitable by people.

3. Cut this one-eighth into four pieces. Set aside three of these pieces. The remaining piece represents the portion of the habitable land in which we are able to grow food.

4. This piece is worth 1/32 of the whole. Cut off a thin slice. This tiny slice represents 3/100 of 1% of the earth's surface. All of our drinking water comes from this tiny area!

5. Now turn your attention to the ocean part of the earth; the three quarters you put aside at the beginning.

6. Take one of the quarters and cut it in half. This piece, worth 1/8 of the world's surface, represents the productive zones of the oceans, or parts of the ocean that support life.

7. Now take this 1/8 and cut it into four equal pieces. One of these represents the productive area of the oceans along the Pacific coast of North America, one of the riches regions of the oceans.

8. Now take one of these pieces, which are worth 1/32, and cut off a thin slice. This tiny slice represents the photic zone, the top 100 meters (300 feet) of the ocean through which light can penetrate and support photosynthesis. Since most marine life depends in some way on photosynthesizing plants, most all of the ocean's life is concentrated in this narrow surface region. Look at the reasons in #2 why some areas of earth may not be inhabitable by humans.

List at least three areas of the earth that may fit into these categories.

_____

_____

What do you notice about the fraction of usable land and water versus the fraction of land and water that is unusable? _____

_____

Family Activity #2:

Students and their families can continue exploring the topics of water by going to the Environmental Protection Agency for kids website at http://water.epa.gov/learn/kids/waterkids/kids.cfm