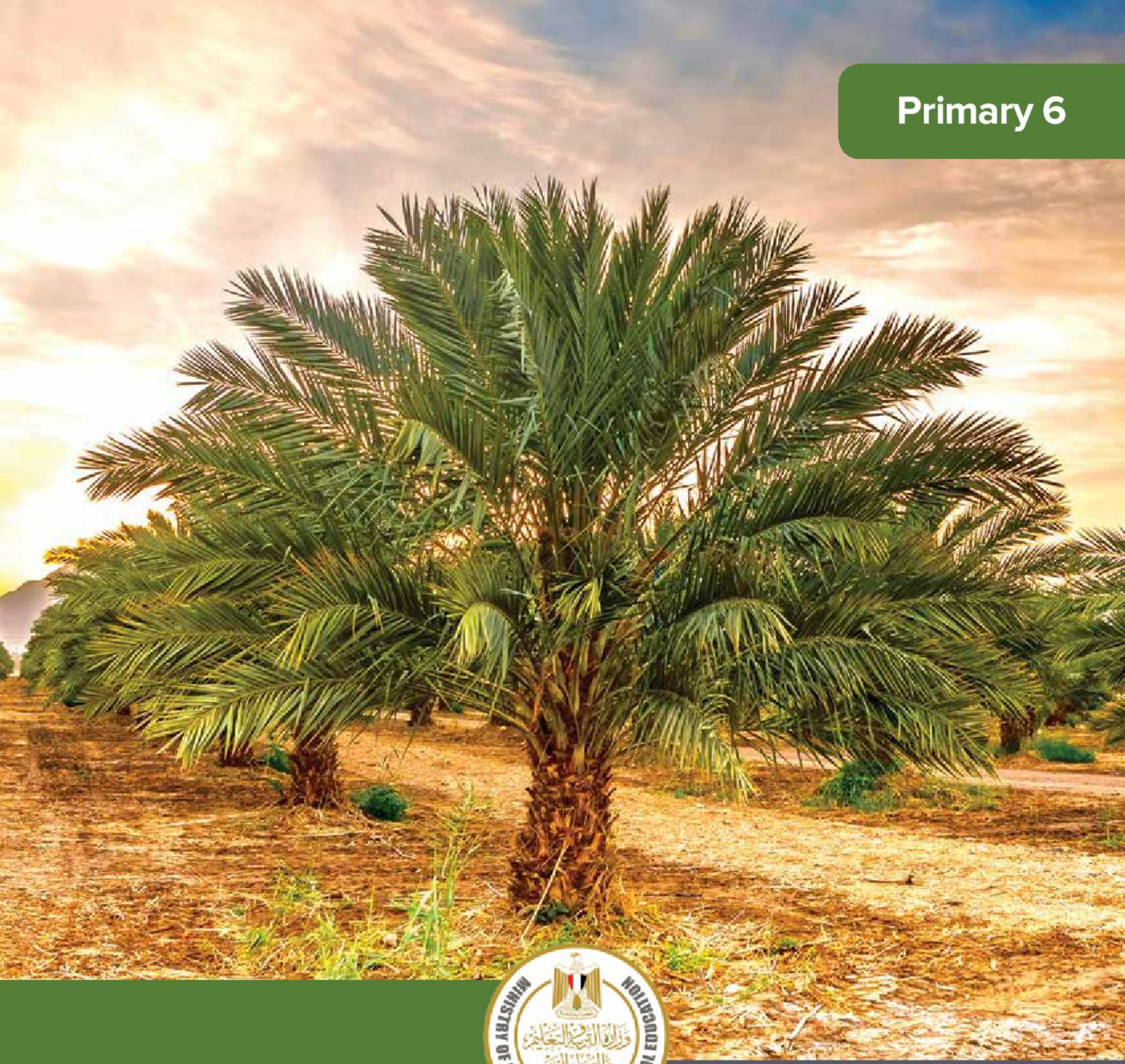
Primary 6



MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

# Science Term 2

## WORDS FROM THE MINISTER OF EDUCATION & TECHNICAL EDUCATION

It is my great pleasure to celebrate this extraordinary moment in the history of Egypt where we continue to launch a new education system designed to prepare a new Egyptian citizen proud of his Egyptian, Arab and African roots — a new citizen who is innovative, a critical thinker, able to understand and accept differences, competent in knowledge and life skills, able to learn for life and able to compete globally.

Egypt chose to invest in its new generations through building a transformative and modern education system consistent with international quality benchmarks. The new education system is designed to help our children and grandchildren enjoy a better future and to propel Egypt to the ranks of advanced countries in the near future.

The fulfillment of the Egyptian dream of transformation is indeed a joint responsibility among all of us; governmental institutions, parents, civil society, private sector and media. Here, I would like to acknowledge the critical role of our beloved teachers who are the role models for our children and who are the cornerstone of the intended transformation.

I ask everyone of us to join hands towards this noble goal of transforming Egypt through education in order to restore Egyptian excellence, leadership and great civilization.

My warmest regards to our children who will begin this journey and my deepest respect and gratitude to our great teachers.

**Dr. Reda Hegazy**

**Minister of Education & Technical Education**

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## Unit 4: Adapting to Change



### Concept 4.1 Adapting to Survive



### Concept 4.2 Soil and Environmental Change



### Unit Wrap-Up



### Interdisciplinary Project

## Dear Parent/Guardian,

This year, your student will be using Science Techbook™, a comprehensive science content developed to inspire students to act and think like scientists and engineers. Throughout the year, students will ask questions about the world around them and solve real-world problems through the application of critical thinking across the domains of science (life science, earth and space science, physical science, environmental science, and Technology).


Science Techbook is an innovative content that helps your student master key scientific concepts. Students engage with interactive science materials to analyze and interpret data, think critically, solve problems, and make connections across science disciplines. Science Techbook includes QR codes, dynamic content, videos, digital tools, hands-on investigations and labs, and game-like activities that inspire and motivate scientific learning and curiosity.

Science Techbook is divided into units, and each unit is divided into concepts. Each concept has three sections: Wonder, Learn, and Share.

**Units and Concepts** Students begin to consider the connections across fields of science to understand, analyze, and describe real-world phenomena.

**Wonder** Students activate their curiosity and prior knowledge of a concept's essential ideas and begin making connections to a real-world situation.

**Learn** Students dive deeper into core scientific concepts through critical reading of texts and analysis of multimedia resources. Students also build their learning through investigations and interactives focused on the learning goals.

**Share** Students share what they are learning with their teacher and classmates using evidence they have gathered and analyzed during Learn. Students connect their learning with entrepreneurship, careers, and problem-solving skills.

Within this Student Edition, you will find QR codes and quick codes that take you and your student to a corresponding section of Science Techbook online.

We encourage you to support your student in using QR code. Together, may you and your student enjoy a fantastic year of science and exploration.

**Sincerely,**

**The Science Team**

# Unit 3
# Water, Weather, and Climate

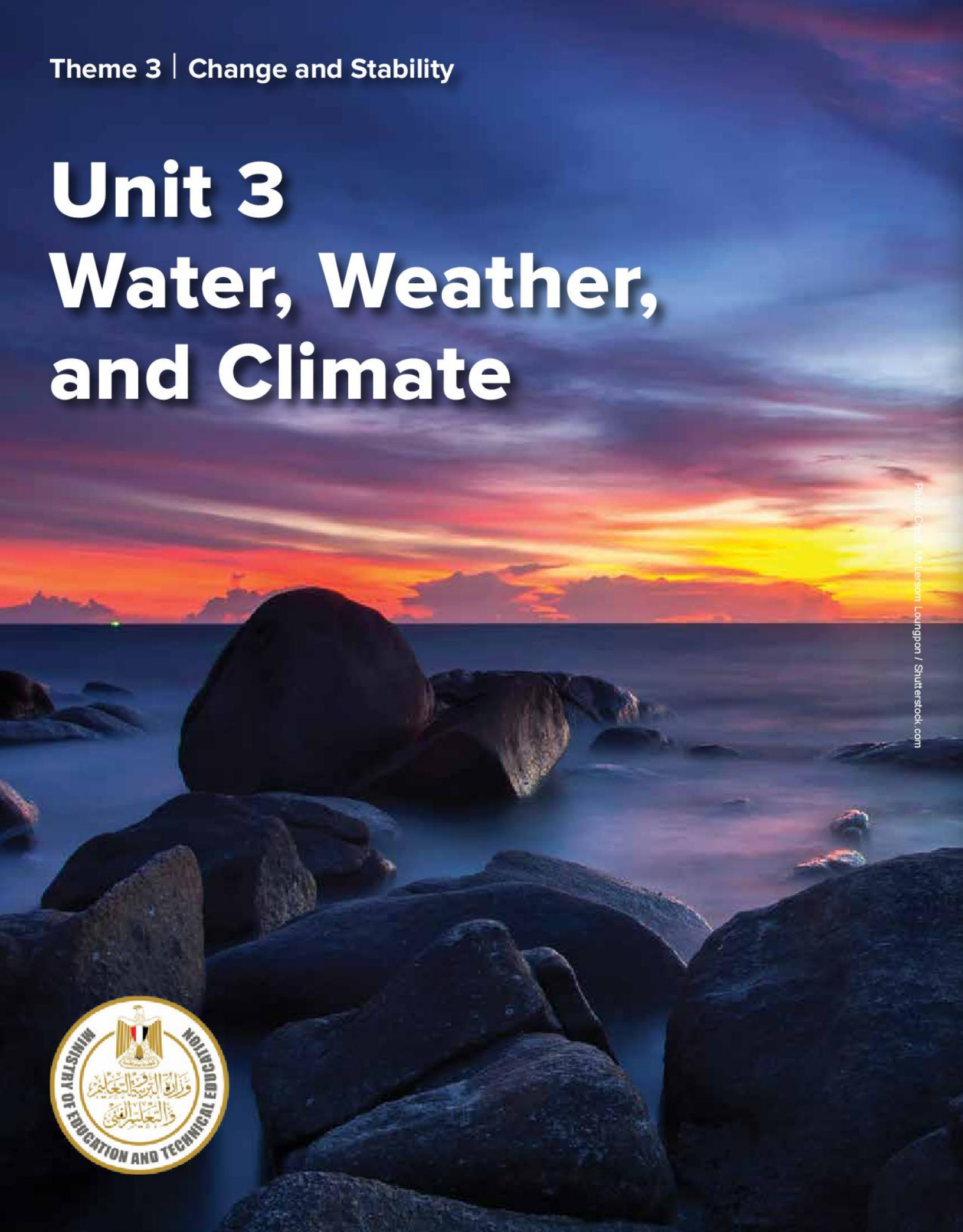


Photo Credit: Mr Lersom Loungpon / Shutterstock.com

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION
وزارة التربية والتعليم والتعليم الفني

# What I Already Know

Quick Code: egs6153

How often do you think about the weather? Do you check a local forecast? Have you ever checked a weather app or a weather site online? Is the weather forecast always accurate? In this unit, you will be learning more about water, weather, and climate. As you look at the images, think about how our surroundings impact the way we live.

The image (1) shows a simple illustration of the water cycle. Think about what you already know about the matter conversions and how water is continuously moving based on transfers of energy. The image(2) shows a dramatic and likely rapidly changing weather situation on a beach. Have you ever been caught outside as the weather suddenly changed? How are daily fluctuations is different from one day to another? The image (3) is a satellite view of Egypt and the surrounding region. What landforms and bodies of water impact the weather and climate in Egypt or your local area?

(1)

(2)

(3)

What examples of energy transfer can you describe in the water cycle? How does your understanding of the water cycle and energy help you explain rapid changes in weather? Finally, how do the various landforms and bodies of water that surround Egypt influence weather and climate?

**Talk Together** This unit is called Water, Weather, and Climate. With a partner, discuss each term. Besides water, what other factors influence weather and climate? What do you think is the difference between weather and climate?

## The Difference Between The Weather And Climate

Most people think of the climate of Egypt is hot,dry in summer and moderate, warm, and rainy in winter. Find where you live. What is the climate like where you live? Does it rain a lot, or is it hot and dry? Is it colder at different times of the year or warm most of the time? think why the climate in your area is what it is. Now think about what the weather is like today. How is weather different from climate? . You have previously studied the difference between these two phenomena in social studies. During this unit,  will learn much more about weather and climate during this unit.

How is energy transfer related to the water cycle? What elements shape local and regional weather changes surrounding you?

Photo Credit: Mr.Lersom Loungpon / Shutterstock.com

# Solve Problems Like a Scientist

Quick Code: egs6154

## Unit Project: Meteorologist Reports

In this activity, you will act like a meteorologist and create your own weather report. You will compare your weather report to one in a newspaper or online. You will also analyze maps and compare data for a month.

Weekly weather

### Ask Questions About the Problem

There are many different types of regional climates. climate determines what types of organisms live and grow in an area. Why is life in Antarctica so dramatically different from life in the Sahara? In each of these places there is also some variation in the weather from one day to the next. What causes changes in the weather? What affects the weather where you live and organisms live ? As you learn about climate and weather, record the answers to your questions.

How does the climate of an area differ from the weather? How can you track changes in the weather?



**Life Skills** **I can anticipate and summarize outcomes.**

CONCEPT 3.1

# Energy Transfer through the Water Cycle

## Student Objectives

By the end of this concept:

- [ ] find the relationships between energy transfer and matter as the sun, wind, and water interact.
- [ ] I can argue from the evidence that the addition or removal of thermal energy drives the water cycle.
- [ ] I can develop a model that describes the components of the water cycle and predicts how changes in one component affect one or more of the other components.
- [ ] I can synthesize information to explain how gravity and energy from the sun drive the cycling of water through Earth's system.

## Key Vocabulary

- [ ] collection the water
- [ ] condensation
- [ ] convection
- [ ] evaporation
- [ ] precipitation
- [ ] reservoir
- [ ] runoff
- [ ] transpiration
- [ ] water cycle
- [ ] water vapor

Quick Code: egs6156

Activity 1

Lesson 1

# Can You Explain?
# Energy Transfer in the Water Cycle

Photo Credit: Stone36 / Shutterstock.com

Think about what you already know about the water cycle. Look at the image of a small puddle.. You can see that the sun is shining brightly on the water. Later in the day, the puddle may be disappear. How does this happen? Use what you have learned about energy transfer and changing states of matter as you consider what factors and processes play a role in making the puddle disappear.

How do water, wind, and sunlight drive energy transfer in the water cycle?

Quick Code:
egs6159

Activity 2

# Ask Questions Like a Scientist

Quick Code: egs6160

## Dropping Water Levels

There was a salt lake in Turkey. Over time, it turned into a small puddle and then dried up completely in the summer. Lake has hosted huge colonies of flamingos that migrate and breed there when the weather is warm. The flamingos feed on algae in the lake's shallow waters. Experts say that drought has hit the Lake region hard, Scientists have set out to discover how Lake has changed in recent decades and determine ways to conserve and rehabilitate the ecosystem to protect it from climate changes.

Observe the difference between the two photos. How has energy transfer in the **water cycle** led to increased **evaporation** in Lake? Brainstorm questions about energy transfer in the water cycle with your partner. Some questions are open-ended, meaning they have lots of ways to be answered. Some questions are simple and can be answered with a *yes* or *no* response. Think about how to make your questions open-ended. Write three questions you have about energy transfer in the water cycle.

The lake after drought

Flamingos at Lake

The water levels of Lake fall as a result of energy transfer in the water cycle. With a partner, talk about what you observe in the image. Record three questions you have about energy transfer in the water cycle.

I wonder . . .

Once you have recorded your Wonder statements, share them with a partner. Add any new questions that come up in your discussion to your list.

Activity 3

# Evaluate Like a Scientist

Quick Code: egs6161

## What Do You Already Know About Energy Transfer in the Water Cycle?

Use the word bank to label each example with the correct part of the water cycle.

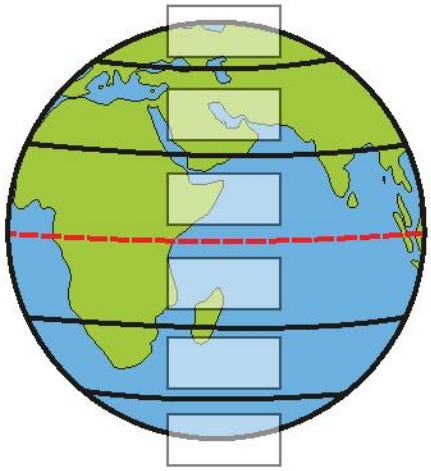
| | | | |
|---|---|---|---|
| condensation | evaporation | precipitation | runoff |

1. A shallow river dries up.
2. Snow falls on a cold afternoon.
3. Fog forms over a field in the morning.
4. Water in a river travels down a mountainside and into the sea.

### Solar Energy Distribution

Look at the image of Earth and think about how energy from the sun is distributed around the world. Which regions are hotter, and which are colder? Use the terms from the word bank to label the appropriate temperature bands and place them in the appropriate place as follows.

| | | |
|---|---|---|
| hottest regions | moderate regions | coolest regions |



The Earth

Activity 4

# Observe Like a Scientist

Lesson 2

Quick Code: egs6162

## How Do Solar Energy and Gravity Drive the Processes of the Water Cycle?

The sun provides the needs of almost everything on Earth. Even in a dry desert environment, the water cycle is taking place. Watch the video and read the text to discover the connection between the sun's energy and gravity in driving Earth's weather processes.


The water cycle is the movement of water among the various reservoirs. A **reservoir** is a storage location of water on Earth. Reservoirs of water include oceans, seas, lakes, rivers, glaciers, soil, rock, living things, and the atmosphere. The main processes that move water among these reservoirs are evaporation, **condensation**, **precipitation**, **collection**, and **runoff**.

All these processes involve force and energy. Water changes state between solid, liquid, and gas when it absorbs or releases energy. Wind energy works to move the water . Water can be pulled downward by gravity . The most important source of energy that drives the water cycle is the sun. Solar radiation (sunlight) provides the energy that melts ice to produce liquid water and that causes evaporation of liquid water to form **water vapor**. The phase changes can also operate in reverse: water vapor releases energy as it condenses, and liquid water releases energy as it freezes to form ice. The two basic factors for water cycle are the heat energy and gravity. Gravity causes ice crystals and water droplets in clouds to fall back to Earth's surface. It causes liquid water to flow downhill in streams and rivers toward larger bodies of water. It causes solid water to flow in glaciers from areas of higher elevation to lower elevation, where the water melts and flows across the land or into bodies of water. Gravity also causes liquid water to percolate down into the ground to the groundwater reservoir. Groundwater itself flows because of gravity from higher elevations to lower elevations.

watch and read the text then write the five most important ideas you understood. Then, compare your list of the top five key ideas with a partner. Work together to consolidate your ideas into a single list and record them in the table.

| My Most Important Ideas | Our Most Important Ideas |
|---|---|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| 5. | 5. |

Summary: Work with your partner and use your list of key ideas to create a one- or two-sentence summary.

.....

.....

Main Idea: Use your summary to write a phrase that identifies the main idea.

.....

.....

Activity 5

# Observe Like a Scientist

Quick Code: egs6163

## Energy and Water

As air moves from place to place in the atmosphere, it can gain or lose energy. Read the passage and match each description of air motion with the correct process to indicate whether it is more likely to result in condensation or evaporation.

## Energy and the Water Cycle

You already know that changes in energy result in changing states of matter. Gains and losses in energy affect what happens to the water molecules in the air. The motion of air from one place to another can result in the change of liquid water into water vapor in the air. This process is known as evaporation. Movement can also result in water in the air condensing back into liquid, in the form of water droplets. When this happens, it is referred to as condensation.

### Transfer of Energy

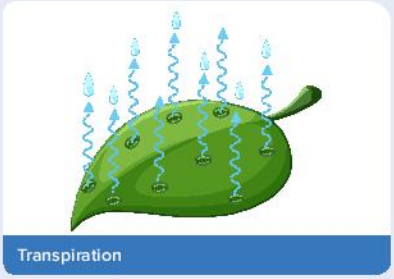
When water changes state in the water cycle, energy is absorbed or released. Condensation and freezing are processes that occur because of the decrease in the heat energy in water particles. Melting, evaporation, and transpiration occur when heat energy is absorbed into water particles.

### Evaporation

Evaporation refers to the transformation of a liquid to a gas. In the water cycle, the sun heats water in oceans, seas, lakes, rivers, streams, and other aquatic bodies, that leads to the evaporation process as a result of gaining heat energy.

### Transpiration

Evaporation also takes place from the leaves of plants. This form of evaporation is called **transpiration**. About 10 percent of the water vapor in the air comes from transpiration. You can observe transpiration as you observe a plant set in the sun with a plastic bag tied around the leaves.



Transpiration

Photo Credit: KPG-Payless / Shutterstock.com

## Condensation

Condensation occurs when a gas cools into a liquid. Condensation occurs when the saturated air from water vapor is cooled. As a result of cooling temperatures, water vapor turns back into a liquid. Condensation occurs when clouds are formed. Clouds consist of tiny water droplets that have condensed out of the air. Water vapor releases energy as it condenses.

Condensation

Have you ever wondered how clouds form? In this activity, you can watch a cloud form right before your eyes. Clouds occur when water vapor condenses into water droplets that attach to particles (of dust, pollen, smoke, and so on) in the air. When billions of these water droplets join together, they form a cloud.

Match each description of air motion and the process to indicate whether it is more likely to result in condensation or in evaporation.

Warm air rises and moves over cooler mountains.

Energy from the sun heats the top layer of water in the sea.

A puddle in a hot desert becomes smaller and smaller.

Warm, moist air touches a cold glass of tea.

| Condensation | Evaporation |
|---|---|
| | |

How does the amount of energy from the sun affect the rate of transpiration in leaves?

Activity 6

# Observe Like a Scientist

Lesson 3

Quick Code: egs6164

## Energy Transfer and the Water Cycle

Have you ever wondered where the water you brush your teeth with comes from? Have you ever considered where rain goes once it hits the ground? Review the different ways water moves through the water cycle and the energy needed to move water through the cycle.

You may see water falling as rain, but even when you cannot see it, water is still in the air around you. So, how can it be invisible in the air? The water you drink has been somewhere else in the world before it was in your body. How could the water inside your body turn into rain or snow one day?


### Why Do We Need Water?

Human, Animals, and Plants need fresh water to survive. The water we need to live can be found on the ground in rivers and lakes, but it also falls from the clouds in the sky. Where do clouds come from? How does all that water get into the sky? To answer these questions, you must first understand what happens in the water cycle.

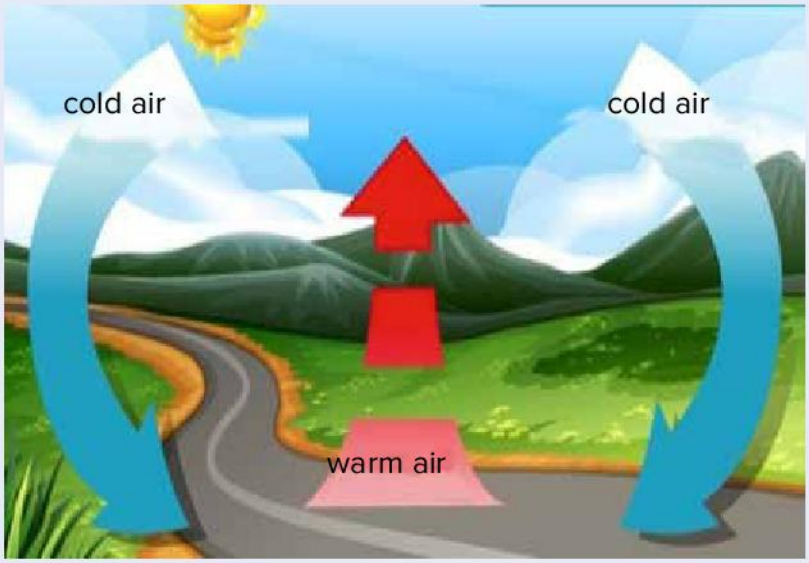
### The Water Cycle in Nature

Nature recycles water. The water cycle involves the continual movement of water from its different sources to the atmosphere. This same water eventually falls back to Earth in the form of rain, sleet, snow, or hail.

Three main steps make up the water cycle. Evaporation is the process by which heated liquid water changes state to become to water vapor. This commonly occurs over oceans, lakes, and rivers. Plants also give off water vapor. When water vapor rises into the atmosphere, it cools and eventually condenses into clouds. Condensation is the process of water vapor changing into liquid water. Clouds are made up of millions of tiny water droplets. When these water droplets become too heavy, they fall in the form of precipitation. Precipitation is the process of water falling to Earth in the form of rain, snow, sleet, or hail. When precipitation hits Earth, it may flow across the land as runoff. Eventually, it collects in streams, rivers, lakes, or the ocean. Here it eventually evaporates, starting the water cycle all over again.

## Convection

**Convection** is one way that heat travels. Solar energy transfers heat through space to Earth's atmosphere through radiation, and this heat energy is transferred throughout Earth's atmosphere as convection currents. The unequal heating of land and oceans causes different temperatures and densities in the ocean and atmosphere. As a liquid or gas is heated, it expands and becomes less dense and therefore lighter, while cold fluids are denser and tend to sink. As warm, moist air rises, it cools and condenses into water droplets. This rising warm fluid and sinking cold fluid creates a cycle of convection currents. Gravitational force allows for the rise and fall of the different densities, creating a circulation of a convection current, which produces wind and ocean currents. Convection currents in Earth's atmosphere help determine regional climates.



convection currents



Consider the roles of evaporation, condensation, and precipitation in the water cycle as you answer the questions.

What happens to water on Earth's surface as it is heated by the sun? What is this process called?

What is the relationship between convection and condensation?

What happens as precipitation sinks into Earth?

How does water return to the ocean?

Activity 7

# Evaluate Like a Scientist

Quick Code: egs6168

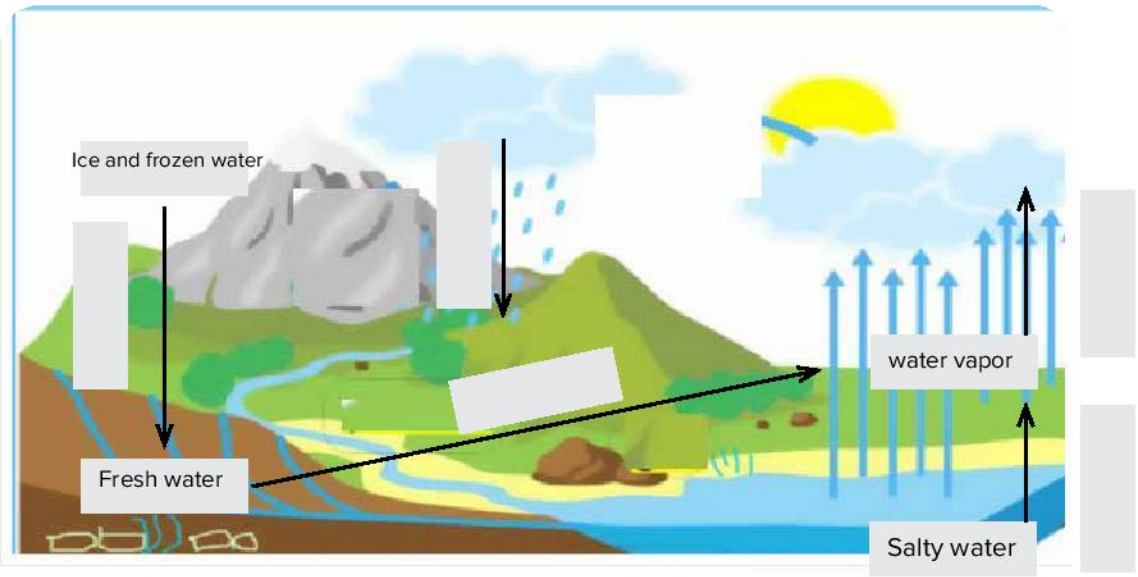
## Water Cycle Model

This model shows how water moves among reservoirs on Earth. You know that in order for a change in state to occur, energy must be either gained or lost. You have also learned about the role of gravity in the water cycle. Decide which process or force drives the movement that happens at each of the steps in the water cycle.

### Water Cycle Model

Fill in the model by selecting the correct words or phrases from the word bank to show what is happening during each step. Words may be used more than once.

| | | |
|---|---|---|
| energy gain | gravity | energy loss |




### Journey through the Water Cycle

Imagine that you are following the path of a single water molecule as it moves through the water cycle. Write or express by drawing about creative story that describes a water molecule's journey through the water cycle. You may start your journey at any part of the water cycle.

Activity 8

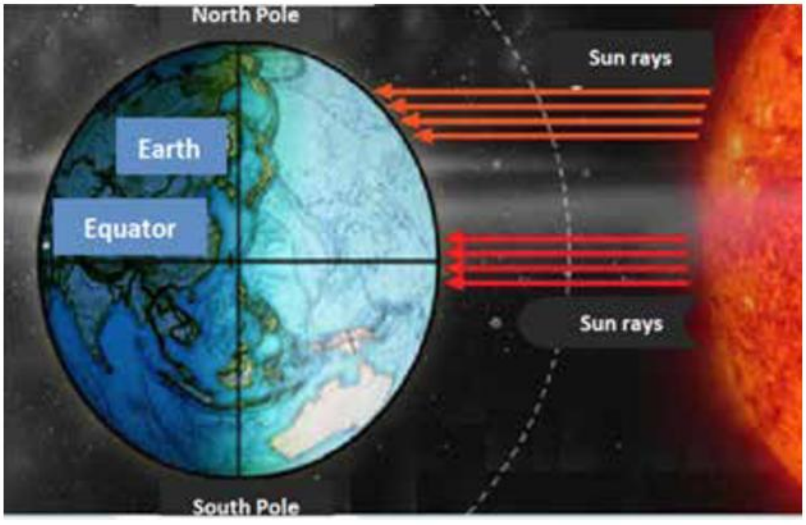
# Analyze Like a Scientist

Quick Code: egs6208

## The Heating of Earth

Think about where you live. If you live near the equator, most likely it is warm and wet. However, if you live farther north, the temperature and precipitation depend on the climate. It can be hot and humid or freezing cold. Other areas of the globe reliably get very little rain, creating vast expanses of desert. Why do deserts get so little rain? Read the text and watch the video to find out.


The perpendicular rays of the sun are focused on a smaller area, so their effect is greater, so we feel hotter. The sun's rays may be slanted on the farest regions, so they are distributed over a larger area and Its effect is less, so you feel warm and moderate in the weather. As for areas very far from the equator The sun's rays are very slanted, so its temperature is distributed over a much larger area and Its effect is less and we feel very cold



Activity 9

# Investigate Like a Scientist

Lesson 4

Quick Code: egs6169

## Hands-On Investigation: Convection Currents and the Water Cycle

Previously, you learned about a type of heat transfer known as convection. Convection is movement that occurs when hotter, less dense particles rises and cooler, denser particles sinks. Water can be found in different states and temperatures all over Earth in the oceans, on land, and in the atmosphere. How does convection cause water to move through the water cycle?

Another driving factor in the water cycle is gravity. If you have ever seen water running downhill, you have observed how gravity affects the movement of water. Think about all the ways that gravity can be a factor in the water cycle.

### Make a Prediction

Talk with a partner about times you have observed water moving through the water cycle. Think about what forces cause the motion.

What are some forces that cause water to move through the water cycle?

What will happen to cold water when it is placed in hot water?

### What materials do you need? (per group)

- 2 Small, identical clear glass jars.
- Food coloring (yellow and blue work best)
- Hot and cold water
- Playing card or laminated index card
- Small tub or tray
- Paper towels

HANDS-ON INVESTIGATION

**Life Skills** I can anticipate and summarize outcomes.

## What Will You Do?

1. Fill one jar so that it nearly overflows with hot water.
2. Fill a second jar with cold water.
3. Add yellow food coloring to one jar and blue food coloring to the other jar.
4. Place the hot jar in a tub or pan to catch spills.
5. Cover the cold jar with a playing card or laminated index card.
6. Turn the cold jar upside down. (Be careful to not spill any of the water.) Have paper towels available in case of spills.
7. Place the cold jar on top of the hot jar. The jar will be inverted, with the mouths of each jar touching, separated by the card.
8. Gently remove the index card.
9. Repeat the experiment with the cold water on the bottom and the hot water on top.

Complete the table with your observations.

| | Observations | Drawing |
|---|---|---|
| Cold Water on Top of Hot Water | | |
| Hot Water on Top of Cold Water | | |

## Think About the Activity

Convection currents occur when there are significant differences in the temperature of fluids. Based on your observations, answer the questions.

What did you observe when the index card was removed each time?

What caused the water to move when the cold water was on top but stay in place when the hot water was on top?

Where does the energy that drives convection currents come from?

Activity 10

# Observe Like a Scientist

Quick Code: egs6171

## Earth's Wind

How does wind form? Why is wind important? What is the relationship between wind and the transfer of energy in the water cycle? Watch the video and read the text to learn more about Earth's wind.


Earth has a global wind system that consists of winds that blow in a constant direction over long periods of time. Their direction is determined by the amount of solar radiation received at different latitudes and the rotation of Earth.

As air warmed by the sun's radiation rises, it is replaced by cooler air flowing from nearby. This process causes wind. If the warm air contains enough water vapor as it rises, it loses this water in the form of rain. Cooler air masses flow in to replace.

Rising warm air. When warm air flows away from where it is, it cools and descends. By the time

When it reaches the surface of the Earth again, the air is dry. This dry air forms a group of deserts around. The planet. Then the air flows again to the same place



How does energy from the sun drive the cycling of wind and water around Earth?

How do global winds affect the climate of an area?

What would happen if there was no wind?

**Life Skills** **I can apply an idea in an innovative way.**

Activity 11

# Record Evidence Like a Scientist

Quick Code: egs6174

## Circle Back: Energy Transfer in the Water Cycle

Now that you have learned about energy transfer in the water cycle, look again at Dropping Water Levels. You first saw these in Wonder.

The Lake after drought

Flamingos at Lake

How can you describe Dropping Water Levels now?
How is your explanation different from before?

Look at the Can You Explain? question. You first read this question at the beginning of the concept.

### Can You Explain?

How do water, wind, and sunlight drive energy transfer in the water cycle?

Now you will use your new ideas about Dropping Water Levels to defend a claim using evidence. First, write your claim. A claim is a one-sentence answer to the question you investigated. It answers, What can you conclude? It should not start with a *yes* or *no*.

**My claim:**

Next, write a scientific explanation with evidence that supports your claim. Evidence can come from videos, readings, interactives, and Hands-On Investigations.

Evidence-based scientific explanation:

Choose one additional idea that you would like to research. What would you do to learn more? What resources would you use to extend your research? How would you build upon your investigations?

Research and resources:

**Linking to the unit project:**

Energy transfer during the water cycle

How does what you learned about the transfer of energy through the water cycle relate to the unit project (Meteorologists Reports)

What research and resources will you need to complete the unit project?

CONCEPT
3.2

# Heat and Weather Changes

## Student Objectives

By the end of this concept:

- [ ] I can gather and analyze data to describe patterns in heating of air, land, and water and to predict the effects of on weather and climate in local and global environments.
- [ ] I can synthesize information to explain how physical properties of the atmosphere vary and use these explanations to predict how the weather can change in response to the effects of changes in thermal energy.
- [ ] I can analyze data to develop models that describe and predict how the motions and interactions of air masses result in changes in weather conditions.

## Key Vocabulary

- [ ] atmospheric pressure
- [ ] anemometer
- [ ] barometer
- [ ] humidity
- [ ] meteorology
- [ ] radar
- [ ] rain gauge
- [ ] rain shadow
- [ ] satellite

Quick Code:
egs6178


Photo Credit: crystaldream / Shutterstock.com

Activity 1

# Can You Explain?
# Heat and weather changes

Lesson 1

Photo Credit: (a) crystaldream / Shutterstock.com, (b) John D Sirlin / Shutterstock.com

Think about what you already know about weather. Look at the image. Earlier in the day, the sky was clear and bright. What caused this change in weather? Use what you have learned about energy transfer in the water cycle as you consider what cause changes in weather.

How does a meteorologist predict what the weather will be?

Quick Code:
egs6181

Activity 2

# Ask Questions Like a Scientist

Quick Code: egs6182

## Farming the Desert

Deserts receive about 250 millimeters of rain per year—the least amount of rain of all the biomes. The hot and dry, or arid, climate of the desert makes farming difficult. Farmers have had to adapt by developing highly water-efficient farming practices.

Watch the video and read the text. Brainstorm questions about weather. Some questions are open-ended, meaning they have lots of ways to be answered. Some questions are simple and can be answered with a yes or no response. Think about how to make your questions open-ended.

As population growth pushes more people to settle on desert land, farmers are coming up with innovative ways to make the dry desert soil fertile and fruitful. Farmers grow crops that are able to withstand the heat and low-fertility soil. With very little rain, farmers have found new ways to irrigate crops, including reusing water and improving soil quality. Farmers also take advantage of wind and sun conditions by powering farms with solar energy or wind turbines.




Farmers face a particular challenge in deserts because more water evaporates than falls by precipitation. With a partner, talk about what you learned and discuss questions you have. Record three questions you have about weather.

I wonder . . .

Once you have recorded your I Wonder questions, share them with a partner. Add any new questions.

.....

.....

.....

Activity 3

# Evaluate Like a Scientist

Quick Code: egs6183

## What Do You Already Know About Weather changes?

### Mountain Effects

Mountain ranges often have two sides: a wet side and a dry side. Order the steps to describe the process that causes this phenomenon, which is known as a **rain shadow**. If you are unsure of the order of the steps, discuss with a classmate.

| | |
|---|---|
| Air cools. | Humid air encounters a mountain range. |
| Water vapor condenses. | Air dries the land. |
| Air rises. | Air warms. |
| Precipitation occurs. | Air descends. |

### Changes in the Atmosphere

A hiker climbs to the top of a very tall mountain. She compares different properties of the atmosphere at the top of the mountain with the properties at the bottom of the mountain. Match the terms from the word bank that best describe the properties at the top of the mountain compared with those at the bottom. Each term may be used more than once.

| | | |
|---|---|---|
| the same | higher | lower |

At the top of the mountain:

The air pressure is ..... ..... ..... .....

The temperature is ..... ..... ..... .....

The air density is ..... ..... ..... .....

### Explain Your Answer

Choose one of your responses from the previous question and explain why it is correct.

Activity 4

# Observe Like a Scientist

Lesson 2

Quick Code: egs6185

## Meteorology: The Science of Predicting Weather

Should you plan a party outside, or will it be too hot? How do scientists predict the weather? Watch the video and read the passage all the way through without taking notes. Review the passage a second time and write down five ideas that are important. Discuss your ideas with a partner and then combine your lists into one list of six or seven words or phrases.


Photo Credit: crystaldream / Shutterstock.com

Have you ever watched a weather report on television? These reports often feature a person standing in front of a large map of your region explaining what sort of weather the viewer is likely to encounter over the next few days. Predicting weather is something that is done all over the world. In fact, people studied and predicted weather well before there were televisions.

### Gathering Data

How do scientists gather data to make actual weather forecasts? In this concept, you will learn about **meteorology**, the science of studying and predicting the weather. A meteorologist is a scientist that uses a variety of tools and instruments to study and forecast weather. Some instruments like thermometers and barometers are designed to measure weather state in different locations. A thermometer measures temperature, and a **barometer** measures **atmospheric pressure**. Atmospheric pressure is the amount of force that air exerts on its surroundings, or the weight of the air above a location.

### Collecting Data

Other types of tools, such as satellites, airplanes, and weather balloons, are designed to carry measurement tools high into the atmosphere so that conditions can be measured from different altitudes. Weather stations and satellites also include devices designed to transmit data from the station or **satellite** to scientists. Scientists gather and analyze the data. Meteorologists try to collect as much data as they can about air temperature, air pressure, wind, precipitation, and other conditions. **Humidity**, the measure of how much water vapor is present in the air, is also considered. Collecting this data helps meteorologists ensure that they have as complete an understanding of the weather as possible. For example, collecting data from the ground to high in the atmosphere over a wide area and collecting data over time provides important information. It helps meteorologists understand how the weather is changing. It also helps them to predict what weather conditions may be in the near future.

## Analyzing the Data

Meteorologists compile data from different places and over periods of time so that they can analyze it. One of the most useful ways to compile weather data is on a map. Mapping measurements like air temperature, air pressure, and humidity allows meteorologists to see important patterns. Mapping data allows meteorologists to identify air masses and track how they are moving and interacting with each other. Weather maps are also used to communicate information to other meteorologists and the public Weather maps are also used to communicate information .

## Putting It All Together

Collecting and analyzing current data about the atmosphere is just one part of predicting the weather. Meteorologists also need to apply what they know about how other factors, such as landforms affect the atmosphere. Today, meteorologists use complex computer models to predict how different factors will interact.

Weather forecasts can be uncertain, especially when it comes to forecasting weather conditions in the coming days or weeks. Small, unexpected changes in wind, air or ocean temperature, or humidity in the air can affect... Next week's weather conditions are very high,as it is sometimes said that there is a 40 percent chance of rain Unlike what actually happens, conditions may change so quickly and unpredictably that it is almost impossible to predict Weather conditions.



Identify the most important points that you understood about how to predict the weather?

Now share your list with a partner. Work together to choose six or seven words or phrases that summarize the most important ideas you learned.

Activity 5

# Investigate Like a Scientist

Quick Code: egs6188

## Hands-On Investigation: The Unequal Heating of Earth

Previously, you learned how atmospheric conditions can drive weather changes. In this investigation, you will look for geographic causes of weather changes that can be observed in different areas. You will conduct an investigation to produce data to show differences in the effects of thermal energy from the sun on land and water and how these differences may impact air temperature in a given area.

### Make a Prediction

How will the temperature change in a container of sand compared to a container of water? Explain your answer.

### What materials do you need? (per group)

- Clear, incandescent light bulb
- 2 Beakers, plastic trays, or containers, 250 mL.
- Stopwatch
- 2 Thermometers.
- Measuring cups
- Metric ruler
- Sand, 150 mL
- Water, 150 mL

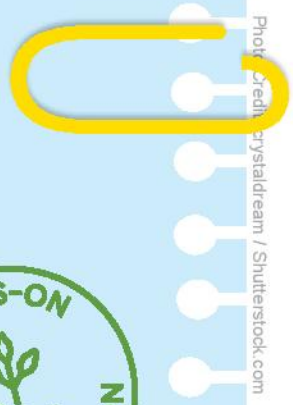


Photo Credit: crystaldream / Shutterstock.com

HANDS-ON INVESTIGATION

### What Will You Do?

1. Place 150 milliliters of sand in one beaker and 150 milliliters of water in the other beaker.
2. Place the beakers next to each other.
3. Place a thermometer in each beaker and record the starting temperature.
4. Position the lamp 10 centimeters from the top of both beakers.
5. Turn on the lamp and record the temperature of each beaker every minute for 10 minutes.
6. Turn off the lamp and record the temperature of each beaker every minute for 10 minutes.
7. Graph the results.

**Life Skills** **I can carry out solutions and evaluate results.**

## Results

Record your data.

| Light Bulb On (Simulating Daylight) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Starting Temperature | 1 min | 2 min | 3 min | 4 min | 5 min | 6 min | 7 min | 8 min | 9 min | 10 min |
| Sand °C | | | | | | | | | | | |
| Water °C | | | | | | | | | | | |

| Light Bulb Off (Simulating Night) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Starting Temperature | 1 min | 2 min | 3 min | 4 min | 5 min | 6 min | 7 min | 8 min | 9 min | 10 min |
| Sand °C | | | | | | | | | | | |
| Water °C | | | | | | | | | | | |

Graph your results using a double line graph with time on the x-axis and temperature on the y-axis. Include a key for the sand and water lines.

## Think About the Activity

After the investigation, analyze your data and answer the questions.

1. **Sand:** Heated by _____ degrees in 10 minutes and cooled by _____ degrees in 10 minutes.
2. **Water:** Heated by _____ degrees in 10 minutes and cooled by _____ degrees in 10 minutes.
3. Based on your data, which material heated up faster?
4. Based on your data, which material cooled off faster?
5. How do these results compare to your hypothesis?
6. How well did your experiment mimic Earth's environments? What limitations does this model have?

Activity 6

# Investigate Like a Scientist

Lesson 3

Quick Code: egs6191

## Hands-On Investigation: Spinning Paper Spiral

Solar energy warms our Earth. But not all places on Earth receive the same amount of sunlight, and not all surfaces absorb the warmth of the sun equally. You have learned that temperature changes affect the way that air moves. When air is heated, it expands as its molecules spread out away from each other. Watch what happens when less dense, warm air rises and denser, cold air comes in to take its place.

### Make a Prediction

Observe as your teacher demonstrates by sprinkling powder over a cool lamp. Observe what happens as the lamp heats up and your teacher sprinkles powder again. Think about what is happening to create any movements you observe. Cut a piece of paper into a circle. Then cut the circle into a spiral. Think about whether the spiral will move in similar ways to the powder.

Predict what will happen when a paper spiral is held over a cool lamp and a warm lamp.

### What materials do you need? (per group)

- Paper
- Lamp or a candle
- Thread, 15–30 cm long
- Tape
- scissors.
- Talcum powder.

HANDS-ON INVESTIGATION

### What Will You Do?

1. Cut out a spiral from a sheet of paper.
2. Attach a small piece of thread to the center of the paper spiral with a piece of tape.
3. Hold the paper spiral over a lamp with the light turned off and record your observations.
4. Turn on a lamp. Wait a minute or two for it to heat up. Be careful to not touch the light bulb with your body or the paper. Do not stare into the light.
5. Hold the paper spiral over a lamp with the light turned on and record your observations.

## Results

Record your observations.

| | Talcum Powder | Paper Spiral |
|---|---|---|
| Lamp Off | | |
| Lamp On | | |

## Think About the Activity

Think about what you observed in both activities. Explain your responses.

Why did the paper spiral spin when the lamp was turned on?

How does this activity relate to air currents and wind?

Activity 7

# Observe Like a Scientist

Quick Code: egs6196

## Tools for Forecasting

Forecasting the weather can be a difficult job. Tools and technology can help meteorologists make more accurate predictions. Read the passage and watch the video to learn more about tools used in forecasting the weather. Then, complete the matching activity.


Meteorologists try to collect as much data as they can about air temperature, air pressure, humidity, wind, and other conditions. To do this, They use a variety of tools to study weather and forecast with it. Including an **anemometer** that records the speed of wind blowing. Changes in Pressure and wind speed help predict changes in weather conditions

**Radar** is another tool often used. Radar detects precipitation and helps track thunderstorms and hurricanes. Once precipitation is falling, a **rain gauge** can record how much falls in a given area.

When small water droplets form in a cloud, the air can carry them away. But as the water vapor continues to gradually condense, the water droplets become larger and heavier. Eventually, the force of gravity pulls these droplets towards the Earth. This is what happens when it rains. Snow forms when the air in the clouds is cold enough to allow ice crystals to form.What is known as snowfall

Meteorologists take different types of measurements. Match the tool to the meteorologist's goal.

Anemometer

Rain Gauge

Weather Satellite

Barometer

| If a meteorologist wants to know . . . | They should use . . . |
|---|---|
| the speed of a tornado's winds | |
| whether it rained more this summer or last summer | |
| the possible path of a hurricane | |
| the current atmospheric pressure | |

Activity 8

# Analyze Like a Scientist

Lesson 4

Quick Code: egs6217

## Extreme Weather: Floods and Sandstorms

In recent years, there has been an increase in the number of extreme weather events worldwide. The number and severity of weather disasters is expected to increase in the future due to global climate change. Read the passage and watch the video.

## The Effects and Costs of Too Much or Too Little Precipitation

Extreme precipitation events, either too much or too little rain, can change ecosystems and cause damage to human structures and agricultural systems. These events also can lead to injuries and deaths.

### Drought

Droughts occur when there is a long period of dry weather during which there is not enough water to sustain people, plants, and animals. Droughts can be trigged by a variety of causes from extended heat waves to atmospheric weather cycles. A drought means that there is less water available for growing crops, farming animals, industry, and cities.

### Flooding


About every two years in a natural system, the increase in flow from rainfall will be so rapid that the water flows over the edges of a riverbank and onto the land around the river. This is called a flood. More extreme floods take place less frequently. Every few decades, very extreme floods will occur. These infrequent floods that humans are not prepared for cause the most damage and loss of life. Flooding can also be caused by the sudden melting of snow and ice over a region. Flooding is worse if the ground is frozen and cannot absorb water in these conditions. Flooding damages buildings by causing water damage or by moving or breaking them. It can lead to drownings of people and livestock and disrupts lives and economies. In general, ecosystems eventually recover from flooding. Some ecosystems even rely on periodic flooding, like those along the Nile.

### Sandstorms

Sometimes called a dust storm, sandstorms happen when very strong winds blow up sand and/or dust from an area that is extremely dry. Sandstorms are common in deserts but can also happen in an area that has experienced prolonged drought. A sandstorm looks like a solid wall of debris and dust traveling on the horizon.

Sandstorms can be several miles long and thousands of feet high, which makes them easy to see. Other than seeing a wall of brown dust approaching in the distance, you will not have much warning before a dust storm arrives. Sandstorms are especially hazardous to motorists because they greatly reduce visibility. These storms are often accompanied by high winds that carry debris and cause damage. Dust can build up on solar panels, disrupting power. Dust can fill irrigation canals, affecting water quality. Dust can even disrupt plane travel and damage engines. The dust can also pose health risks if it is inhaled or blows into your eyes.

Use the following idea chart to record your thoughts. Then prepare an infographic poster to share Information about extreme weather event (This infographic uses images and text to highlight Highlight key information and ideas).

Extreme Weather Event:

| | |
|---|---|
| Describe your extreme weather event. | |
| What are the dangers of your extreme weather event? | |
| What would your community look like before and after your extreme weather event? | |
| How might your extreme weather event affect people, businesses, schools, plants, animals, and transportation? | |
| What can you do to prepare for your extreme weather event? | |

Activity 9

# Record Evidence Like a Scientist

Quick Code: egs6197

## Circle Back: Heat and weather changes


Now that you have learned about weather patterns, look again at Farming the Desert. You first saw this in Wonder.

How can you describe Farming the Desert now?

How is your explanation different from before?

Look at the Can You Explain? question. You first read this question at the beginning of the concept.

### Can You Explain?

How does a meteorologist predict what the weather will be?

Photo Credit: crystaldream / Shutterstock.com

Now you will use your new ideas about Farming the Desert to defend a claim using evidence. First, write your claim. A claim is a one-sentence answer to the question you investigated. It answers, What can you conclude? It should not start with a yes or no.

**My claim:**

Next, record the evidence that supports your claim. Evidence can come from videos, readings, interactives, and Hands-On Investigations.

**Evidence-based scientific explanation:**

Choose one additional idea that you would like to research. What would you do to learn more? What resources would you use to extend your research? How would you build upon your investigations?

**Research and resources:**

**Linking to the unit project:**

The transfer of energy through the water cycle

How does what you learned about weather patterns relate to the unit project (meteorologists' reports) What research and resources will you need to complete the unit project

**Life Skills** **I can apply an idea in an innovative way.**

# Solve Problems Like a Scientist

Quick Code: egs6225

## Unit Project: Meteorologist Reports

You have learned a lot about weather and climate in this unit. Now it is your turn to be a meteorologist. Consider the factors that impact both the long-term trends of climate and the daily conditions of weather. Use what you have learned to analyze and compare data, find reasons for trends, and make your own observations.

| Day | SUN | MON | TUE | WED | THU | FRI | SAT |
|---|---|---|---|---|---|---|---|
| Weather state | | | | | | | |
| Temperature maximum | ▲ 25 | ▲ 27 | ▲ 24 | ▲ 21 | ▲ 22 | ▲ 25 | ▲ 23 |
| minimum | ▼ 19 | ▼ 20 | ▼ 16 | ▼ 15 | ▼ 16 | ▼ 20 | ▼ 18 |

Weekly Forecast

The factors that cause weather are influenced by geography. The presence of a body of water can affect humidity. Different types of soil will heat faster or slower than one another. Mountains can stop wind from blowing across them. Elevation from sea level can affect temperature, humidity, and precipitation.



### Creating a Weather Report

In this activity, you will act like a meteorologist and create your own weather report. You will compare your weather report to one in a newspaper or online.

1. Find and read a five-day weather forecast. You can find the local weather forecast online or in a newspaper.
2. Create your own weather data chart. For the next five days, record the actual weather in the data table. Make sure that you begin recording the weather on the same day that the forecast you chose begins.
3. Record the following in the data table:
   - temperature
   - precipitation amount
   - wind speed or conditions if you cannot calculate wind speed
   - description of the weather, such as sunny, cloudy, or partly cloudy
4. After five days, compare your weather data chart with the weather forecast.

**Life Skills** **I can carry out solutions and evaluate results.**

Record the weather in the data table for five days.

| Weather | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|---|---|---|---|---|---|
| Temperature | | | | | |
| Precipitation | | | | | |
| Wind | | | | | |
| Description | | | | | |

Use the information from your weather data chart to answer the questions.

Did the five-day forecast predict the weather accurately? If not, how was it different?

According to weather and climate reports in Egypt, violent weather events such as (extreme high temperatures, torrents, dust storms, floods), as well as sea level rise, are considered among the most important negative impacts resulting from climate change on the Arab Republic of Egypt.

Think about solutions to the problem of sea level rise in northern Egypt.

## Unit Assessment

1- The climate is.....

a) The amount of rain the area receives.

b) The state of the atmosphere at a specific place and time.

c) Air temperature.

d) The average weather condition over an extended period of time.

2- When we say: “The average temperature this week was 35 degrees.” Thus, half...

a) Climate

b) Humidity

c) Weather

d) Load currents

3- The temperature may reach more than 50 degrees in Aswan in the summer. This reflects...

a) Humidity

b) Atmosphere

c) Weather

d) Climate

4- Which of these following statements is correct?

a) Water and land usually have the same temperature.

b) Water heats and cools faster than the Earth’s surface.

c) The Earth’s surface heats and cools faster than water.

d) The Earth absorbs and stores more thermal energy than the oceans and seas

5- The anemometer is used to measure...

a) Adaptation.

b) Rainfall.

c) Evaporation.

d) Wind speed.

6-.....It is the transformation of water vapor into liquid water droplets in the air

a) Transpiration.

b) Evaporation.

c) Condensation.

d) Melting

7- The thermometer is used to ...

a) Measure the temperature.

b) Know tomorrow's weather.

c) Predict the time of rain.

d) Measure wind speed

8- The evaporation of water from plant leaves is called...

a) Condensation.

b) Transpiration.

c) Rainfall.

d) Freezing.

9- What is happen when the clouds become so heavy that they cannot hold water? .....

a) Water falling on the ground.

b) Water evaporates.

c) Another cloud forms.

d) The clouds become very large.

10- Among the forms of precipitation...

a) Rain, hail and snow.

b) Sun, rain and snow.

c) Seas, rivers and oceans.

d) Mountains, valleys and rivers.

11- The amount of water vapor in the air is known as...

a) Humidity.

b) Evaporation.

c) Condensation.

d) The cloud.

12- In the convection process, heat is transferred from...

a) Highs to lows.

b) Wet areas to dry areas.

c) Cold regions to warm regions.

d) Warm regions to cold regions.

13- The main factor affecting the movement of wind and water on the Earth's surface...

a) The unequal solar heating system

b) Transpiration process in plants.

c) The evaporation process from oceans and seas.

d) The flow of water across the Earth's surface due to gravity.

14- Oceans help improve the world's climate through...

a) Heat absorption.

b) Nitrogen gas absorption.

c) Salt storage.

d) Water storage.

15- At the tops of mountains, the air pressure is...

a) Higher.

b) Less.

c) It is equal to the pressure at the foot of the mountains.

d) Vanishing.

Theme 4 | Protecting Our Planet

# Unit 4
# Adapting to Change

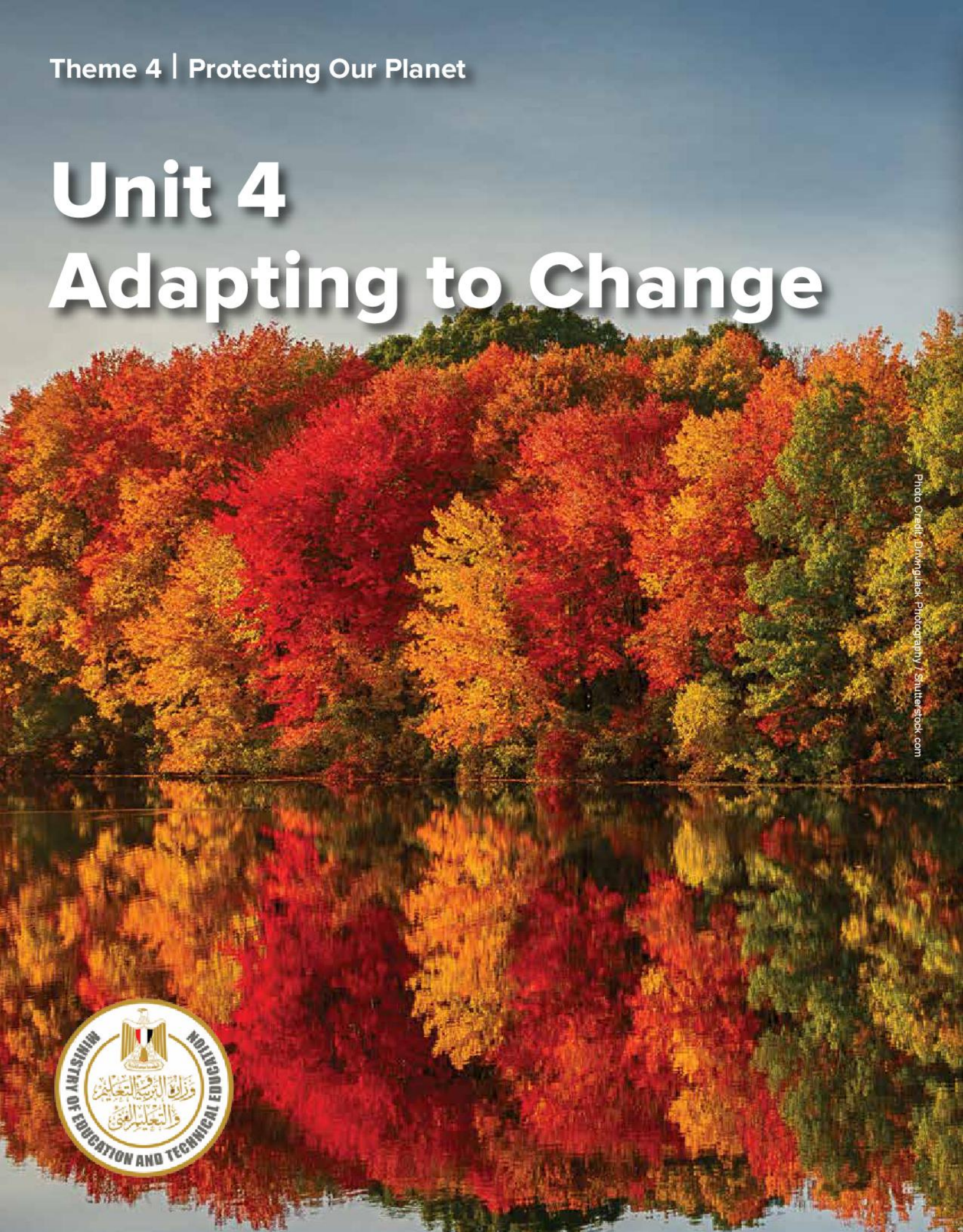


Photo Credit: Drivinglack Photography / Shutterstock.com

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION
وزارة التربية والتعليم والتعليم الفني

## What I Already Know

Quick Code: egs6226

You previously studied different types of adaptations, physical or structural and behavioral. In this unit, you will consider how nonliving factors influence the overall life cycle of living organisms, including soil, air, water, and sunlight. As humans and other living organisms interact with their environment, you can observe changes that may affect the overall health of not only our communities but our entire planet. Keeping our Earth healthy will require us to look critically at some of our behaviors and interactions. You will be challenged to come up with solutions to help protect our living environment, from small-scale changes to global ideas for combating things like climate change.

As you look at the images shown, think of ways you interact with the environment around you. What are ways that you can help safeguard your community from environmental harm? What are tools that scientists, engineers, and community members use to understand the impact of human behavior on their surroundings? What are some big ideas you have to help preserve the health of our planet?

Write about some ideas you have that are both local and global that will help preserve the health of our environment. What tools are needed to monitor the impact of human behavior? Explain how you can make both big and small changes to help safeguard planet Earth.

**Talk Together** How can you use images to inspire others to care about environmental preservation? Talk with a partner about ways you can talk to people in your community about taking care of our planet.

# Measuring Climate Change


Throughout this unit, you will learn how organisms adapt to survive in specific environmental conditions. You will also learn about a group of interconnected systems that support life on this planet. Finally, you will investigate how human activity is changing the climate of our planet. For example, change have occurred in global average temperatures per decade between 1990 and 2021. Consider what this trend can tell you about what has happened over the past three decades. What do you notice about how temperatures have changed globally? How has the temperature changed where you live? How will organisms be affected by these changes? Watch the video and analyze the data. Then, begin thinking about the questions that follow.

How do environmental factors, such as climate, affect organisms? What is climate change?

How are humans affecting global climate, and what can be done to lessen the impact of human activity?

# Solve Problems Like a Scientist

Quick Code: egs6227

## Unit project: Building environmentally friendly cities

In this activity, you you are going to apply what you have learned about behavior and human activity, how it changes the environment, and how you can contribute to innovation to keep pace with change. You are going to think also about alternative systems for building environmentally friendly green cities to reduce the impact of human activities on the environment.

### Ask questions about the problem

Think about what you have already learned about how humans interact with their surrounding environment. You may have noticed that the climate on Earth is constantly changing, and modify to and noticed that the human interaction with the environment, as well as their behavior and activity, result in some problems which might in turn lead to interaction with the environment. Write down some questions you can ask to learn more about the impact of human activity or behavior and its relationship to environmental or climate change. After you learn more about new ways to be more sustainable, record answers to the questions you asked.

• Can you design an ecosystem or a miniature model of a sustainable, environmentally friendly green city that reduces the impact of pollution on the environment?

CONCEPT 4.1

# Adapting to Survive

## Student Objectives

By the end of this concept:

- [ ] I can argue from the evidence that living organisms are well adapted to the climates in which they live.
- [ ] I can conclude ways of adaptations of living organisms.
- [ ] I can develop models to describe types in adaptations of living organisms.
- [ ] I can investigate the effect of various abiotic factors on a plant's growth and analyze data to evaluate the significance of each factor.
- [ ] I can collect information to predict how both environmental and genetic factors affect an organism's growth.
- [ ] I can construct a scientific explanation for how inherited traits and environmental factors influence the growth of organisms.

## Key Vocabulary

- [ ] abiotic
- [ ] adaptation
- [ ] biotic
- [ ] environment
- [ ] genes
- [ ] genetic factors
- [ ] migration
- [ ] breed
- [ ] offspring
- [ ] Hereditary traits

Quick Code: egs6229

Activity 1

Lesson 1

# Can You Explain?
# Environmental and Genetic Influences

Look at the image of a dorcas gazelle. The dorcas gazelle is native to the desert and semidesert of Egypt and the Middle East. The desert **environment** is a challenging place to survive. Consider what types of survival ways the gazelle might use. What role do genetics play in the ability of these animals to survive in this extreme climate?

How do the environment and genetic factors affect the growth of living organisms?

Quick Code:
egs6232

Activity 2

# Ask Questions Like a Scientist

Quick Code: egs6233

## Bird Migration

Observe the images (Flight of the steppe eagle- migratory birds in Egypt) and read the text. Then, write three questions you have about migration and adaptation.

### Adaptations for Survival

Steppe Eagle in Flight

You have learned previously about different types of adaptations in living organisms. An **adaptation** is a process in which an organism becomes able to live in the environment in a way that enables it to survive. You studied that the structural adaptations of an organism's body are linked to the structure of its body. Thick fur covers the body of an animal that lives in a cold climate, or the adaptation of plant structures such as thorns on the stems of some plants, these are considered physical or structural adaptations. Behavioral adaptations are anything that a living thing does or the way that an animal acts that promotes survival. For example, a plant growing toward light or animals living in a herd are behavioral adaptations. **Migration** is a behavioral adaptation in which animals move from one place to another, usually seasonally. Most often these animals then return to the place where they started, and the cycle of migration repeats.

### Migratory Birds in Egypt

Migratory Birds

The Red Sea and Nile River are important stopovers for millions of migratory birds every year, including falcons and eagles . The moderate winter climate in Egypt is the main attractions for migrating flocks. The Red Sea area includes marine, coastal, and mountain environments. Birds migrate to find the best resources for successful breeding, different food sources, or suitable homelands at different times of the year. Consider what factors may prompt birds to leave their home environments and move to another area. Are they the same factors that would cause people to migrate to a place? What changes prompt animals to return to their homelands rather than stay in the place to which they have migrated?

## Environmental and Genetic Influences on Migratory Birds

Animals that migrate face many challenges during their migration journey such as extreme weather, predators, limited access to food and water, and limited resting sites due to habitat loss. Consider what physical traits would help some birds to survive the journey more than others. How do you think adaptation to environmental conditions and **genetics** influenced how these birds survive difficult journeys?

Record three questions you have about migration and adaptation.

I wonder . . .

.....

.....

.....

Once you have recorded your I Wonder questions, share them with a partner. Add any new questions to your list.

**Talk Together** about the groups of birds that can migrate from their habitats to other habitats, while discussing the factors that led to their migration and the characteristics that will help them adapt to new habitats and survive.

Activity 3

# Evaluate Like a Scientist

Quick Code: egs6234

## What Do You Already Know About Environmental and Genetic factors Influences?

Previously, you studied the impact of environmental factors in the behavior of some living organisms. Think about what you already know. Answer the questions that follow.

### Basic Needs

What are an organism's basic needs for survival? What happens when the organism struggles to meet those needs?

.....

### Influencing Growth

Write the environmental factor or factors next to the type of organism behavior it would affect. Some behaviors will be affected by more than one environmental factor.

size of habitat water availability of light

| Organism Behavior Affected | Environmental Factors |
|---|---|
| A plant that carries out photosynthesis | |
| Trees and shrubs growing in an ecosystem | |
| The amount of food that living organisms decides to forage | |
| Animal growth during its life cycle | |
| Number of different species living in one place | |

## Hereditary Traits

Select all the statements that indicate that a genetic factor has most likely influenced the living organisms.

Cats

Bears

A. A kitten becomes a full-size adult, just like its parents.

B. A rabbit has brown spots on its fur, just like its parents.

C. A plant experiences dryness after record high temperatures during August.

D. The grass plants are usually shorter than the tall flowering plants in a forest.

E. Organisms compete for survival and suitable habitat in an ecosystem.

F. The organisms that are best adapted to the surroundings survive.

Activity 4

# Analyze Like a Scientist

Lesson 2

Quick Code: egs6238

## Characteristics of the environment and ways of adaptation of living organisms

Think about what you have already learned about Environments with different climatic characteristics and their effect on animals . How animals adapt to these environments?

### Different Environments, and Different characteristics

There is a region in Egypt that has a desert character, with a number of oases and the fertile Nile Valley. Other areas of the world can be quite different, though. Different kinds of environments have plants and animals . However, these plants have traits that benefit their survival. For example, the emperor penguin has thick blubber covered with dense feathers to withstand low temperatures to keep it from freezing in the Antarctic. However, the African penguin, which lives along the coast of South Africa, has  circle of skin completely devoid of feathers surrounding each of its eyes, to cool its body to withstand high temperatures.

Emperor Penguin

African Penguin

### Plants in Egypt

Large parts of Egypt's Western Desert have little to no vegetation. The plants that do grow are adapted to the arid conditions. These plants are usually small, wiry and often have small, leathery leaves; long shallow roots to draw any available water; prickles or thorns to keep away herbivores; and thick stems and leaves to store water. Acacia trees, palms, Opuntia, spiny shrubs, and grasses are some examples. Some plants sprout into life when rain falls, rapidly reach the flowering stage, and produce seeds that can withstand extreme conditions for a long time.

Look at the animals in the chart. Think about what adaptations each has and how those adaptations are useful to each environment. For each animal, indicate if the animal is adapted to the arctic, desert, or tropical rain forest. Then, list any physical adaptations you can identify that help the animal to survive in the environment in which they live.

| Animal | Environment | Physical Adaptations |
|---|---|---|
|  Fox | | |
|  Lizard | | |
|  Poison dart frog | | |

Activity 5

# Analyze Like a Scientist

Quick Code: egs6239

## Abiotic Factors and Adaptation

You already know that an ecosystem is a community of living and nonliving factors. Read the text that follows. Circle the nonliving factors that influence the survival of organisms in an ecosystem.

### Biotic and Abiotic Factors

Abiotic and Biotic Factors

Plants and animals living in the same area rely upon one another to live and reproduce. This area is called an ecosystem. An ecosystem can be small, like a patch of land between buildings that contains grass, insects, and weeds. Or it can be quite large, like the arctic, where caribou feed off the grasses, and wolves hunt the caribou and other prey. Regardless of the size of the ecosystem, the organisms in an ecosystem adapt to environmental factors. Living organisms in an environment are called **biotic** factors. The **abiotic** factors are nonliving factors such as sunlight, air, soil, water availability, precipitation, and temperature. Abiotic factors can influence the growth and survival of organisms in the ecosystem.

You know that plants need water, sunlight, and air to grow. But did you know that the amount of light and the intensity of the light will also affect a plant's growth? In general, light helps plant growth. However, light that is too intense can damage plant parts and cause drying or burning. Plants also respond to the amount of light and dark they receive daily. Some flowering plants may bear fruit when the days are longer than the nights in some environment.

### Limited Resources in the Desert

Sahara

Deserts are some of the most extreme environments on Earth. All deserts have very little rainfall. Groundwater is a very small amount of water far below the surface. Some plants are adapted to these environments with long roots to reach the needed groundwater. Other plants have very short root systems, ready to catch even the smallest drop of dew. Temporary pools of water form in rocks during the occasional rains. A small amount of this water then evaporates due to the dry conditions of the desert environment, causing clouds to form.

Deserts exist all over the world, but they are not just in hot areas. In Antarctica is a desert biome where temperatures are cold all year round. Temperatures go below freezing in the winter and only reach a maximum of 21°C in the short summer.

Antarctica

## Abiotic Factors and Adaptation

The importance of abiotic factors, such as water and light, to the biotic community of organisms in an ecosystem is the primary factor in adaptation. Adaptations occur in response to the abundance or limitation of these resources. Organisms that can benefit from these resources survive, and those that cannot survive. Physical traits that allow some organisms to get the things they need to survive lead to the development of adaptations in living organism. These traits are then passed on to offspring of this species. Over time, this physical trait is transmitted that helps them to survive.

Activity 6

# Analyze Like a Scientist

Quick Code: egs6242

## Light as an Environmental Factor

You have learned about how important abiotic factors are in the survival of organisms. Now think about the effect of light. How does the light that plants receive affect their growth? Read the following passage and watch the video.

You know that plants need water, sunlight, and air to grow. But did you know that the amount of light will affect a plant's growth? Or that the intensity of the light will affect its growth? Plants also respond to the amount of light and dark they receive daily. Some flowering plants bear fruit when the days are longer than the nights. Some are the opposite. Chrysanthemum is a plant that only grows when the days are shorter and the nights are longer.


Chrysanthemum Plants

Photo Credit: Jdross75 / Shutterstock.com

Cooperate with your classmates and create an album featuring a variety of different environments, and display it to your class.

Plant growth is affected by the intensity, and duration of the light to which it is exposed. The intensity or quantity of sunlight also affects plant growth. The duration of light, or the amount of time a plant is exposed to light, determines whether it will grow well or not.

## Ideas

Discuss with your partner the effect of light as a major and important factor, and the extent of its influence on plant growth.

**Life Skills** **I can carry out solutions and evaluate results.**

Activity 7

# Analyze Like a Scientist

Lesson 3

Quick Code: egs6243

## Inheritance of Traits in Living Organisms

You know that environmental factors influence how organisms are adapted for survival. These adaptations shape how a plant or animal looks. But what about the traits that living organisms get from their parent plants or animals? These traits are transmitted genetically. The **hereditary traits** new plants and animals receive from the cells of their parents, and the cell nucleus helps in reproduction. These cellular instructions determine everything from a person's eye color to the shape of his nose. They also influence details such as what types of leaves will grow on a tree and how pointy a cat's ears are. You will now begin to learn more about the role that inherited traits play in the structure of living organisms. Read the text that follows. Then use the text, images, and your own experiences to identify the inherited traits of the cat and plant species that can be observed.

# Inherited Traits in Living Organisms

### Cat Types

Birman and Hairless Sphynx

Cat **breeds** can have many different hair lengths. Despite their differences, all pet cats are the same species. The species is called Felis catus. Look at the image of the longhair Birman and the hairless Sphynx. A Sphynx does not have any hair or may have only very fine hair. A Birman has long, silky hair with varying colors. A Sphynx kitten inherits its hairless body from its parents . Each cat may not end up having the exact same hair or skin texture as its parents. But you know you are never going to see a Sphynx that has long hair like a Birman. A genetic factor controls what traits get passed down, or inherited, from parent to **offspring**.

### Desert Plants

Many ecosystems have a variety of plants. They are all different colors, shapes, and sizes in desert, you can find an occasional bush or tree. There are even flowering plants. All these plants are of different heights. They all grow in the same soil and are exposed to the same amount of light.

## Inherited Traits in Living organisms, continued

How can this be? All living organisms inherit traits that influence the way or process of their growth. Each of the plants in this ecosystem has different genetic factors that help determine how tall it can grow, what types of leaves it has, and what its root structure can do.

Scientists in one of the most arid deserts on Earth analyzed 32 plant species that grow there. What they found was that over time, plants in desert have adapted to the environmental pressures of extreme sun exposure and very little rainfall. The instructions for survival in challenging conditions are built into their **genes**. Each generation of plants becomes stronger and able to adapt as parent plants pass on genes to their offspring.

Plants in the Desert

Use the text and previous images to identify the inherited traits of the cat and plant species that can be observed.

| Species | Inherited Traits |
|---|---|
| Felis catus | |
| Plants in the desert | |

Share your partner in designing a simple album or magazine that collects information and pictures of different types of animals so that their inherited traits appear.


Activity 8

# Analyze Like a Scientist

Quick Code: egs6245

## Factors That Influence Human Growth and Behavior Development

inherited traits determines how a plant or animal looks, as you saw with the cats and desert plants. Think How can these factors all work at once to determine health in human? Read the text. Then, record examples of each type of factor that influences human growth and development of behavior.

If you turn on the TV, chances are you will soon see a commercial that promises to help you grow healthy and strong. If you believe everything you see on TV, you might think that all it takes to be healthy is some good cereal or fancy juice. Our diet can indeed affect how we grow and develop, but it is not the only factor involved in this growth process.

Family Exercising

### Lifestyle Choices

Many of the lifestyle choices we make can impact our health. You probably follow some things that are bad for you or could harm your development. Smoking, can have a very negative effect on our health. Other factors, like diet and exercise, also play a role in growth, health and behavior development. Our bodies need proper nutrition, so a diet full of chips and soda will harm your growth.

### Environmental Factors

There are other outside factors, besides lifestyle choices, that we might not have the ability to control. We call these environmental factors. If the environment around you is healthy and clean, chances are you do not need to worry. In some places, people lack many of the basic needs of life. In these places, health care might not be available. Environment might be unsafe, or water may be far away or unsafe to drink. Food can be hard to come by, and sanitation can be lacking, which can lead to the spread of diseases.

## Genetic Factors

Have you ever noticed how people in your family look similar? They might have the same type of hair or similar facial structure. This is called genetic traits. We inherit traits from our parents. Your parents each pass on genes to you. It is these genes that determine the way your earlobes hang, the length of your fingers, and how tall you can become with proper nutrition, as well as other environmental and health factors.

Living methods, lifestyle choices, environmental factors, and genetic factors determine your internal and external makeup and who you are now. Explain this in the following table .

| Lifestyle Choices | Environmental Factors | Genetic Factors |
|---|---|---|
| | | |

Activity 9

# Record Evidence Like a Scientist

Quick Code: egs6248

## Circle Back: Adapting to Survive

Now that you have learned about environmental and genetic factors that impact growth, look again at Steppe Eagle in Flight. You first saw this in Wonder.

How can you describe Steppe Eagle in Flight now?

How is your explanation different from before?

Look at the Can You Explain? question. You first read this question at the beginning of the concept.

## Can You Explain?

How do the environment and genetics factors affect the growth of living organisms?

Now you will use your new ideas about Steppe Eagle in Flight to defend a claim using evidence. First, write your claim. A claim is a one-sentence answer to the question you investigated. It answers, What can you conclude? It should not start with a yes or no.

**My claim:**

Record the evidence that supports your claim. Evidence can come from videos, readings, interactives, and Hands-On Investigations.

**Evidence-based scientific explanation:**

Choose one additional idea that you would like to research. What would you do to learn more? What resources would you use to extend your research? How would you build upon your investigations?

Research and resources: Use multiple sources and resources to conduct your research

**Linking to the unit project:**

Adapting for Survival Building environmentally friendly cities

How does what you learned about changing environmental conditions relate to the unit project (building environmentally friendly cities)? What research and resources you will need it to complete the unit project

**Life Skills** **I can apply an idea in an innovative way.**

CONCEPT
4.2

# Soil and Environmental Change

## Student Objectives

By the end of this concept:

- [ ] I can explain the role of decomposers in nutrient cycling and soil formation in an ecosystem.
- [ ] I can identify different types of soil based on their properties and characteristics.
- [ ] I can provide evidence for how soil resources and properties affect biodiversity in an ecosystem.
- [ ] I can propose solutions for environmental problems related to soil such as erosion and desertification.

## Key Vocabulary

- [ ] clay
- [ ] desertification
- [ ] humus
- [ ] inorganic
- [ ] mineral
- [ ] organi matter
- [ ] pore space
- [ ] silt
- [ ] soil
- [ ] soil depletion
- [ ] Climate change
- [ ] deforestation
- [ ] Overgrazing
- [ ] Extinction

Quick Code:
egs6252

Lesson 1

Activity 1

# Can You Explain? Soil and Environmental Change

Imagine you go outside and play football or go for a walk. When you get back inside, you may need to wash soil off your hands or shoes. Where did the soil come from? Soil is all around us. But how important is it? Is soil important in your life? Is soil important to the environment? Why? Look at the image. Consider both the environment you see and the soil. Then, answer the question that follows.

How are soil and environmental change related?

Quick Code: egs6255

Activity 2

# Ask Questions Like a Scientist

Quick Code: egs6256

## Soil Variety

**Soil** comes in many colors and textures. Look at the three images. How are they different? How are they the same? What are the reasons behind these differences? What would happen if one type of soil changed to become more like another type? How would this affect the environment around us? Ask questions about soil and environment. Some questions are open-ended, meaning they have lots of ways to be answered. Some questions are simple and can be answered with a yes or no response. Think about how to make your questions open-ended , they are questions that have more than one correct answer.

Silt soil

Clay soil

Sand soil

Record three questions you have about soil.

Share it with your partner. Feel free to add any new questions you think of while discussing with your partner to your list.

I wonder . . .

.....

.....

Activity 3

# Evaluate Like a Scientist

Quick Code: egs6257

## What Do You Already Know About Soil?

Think about what you already know about soil, what it is made of, where it comes from, and its role in the environment. Answer the questions that follow.

### Where Does Soil Come From?

Soil is all around us, but where does soil come from? Explain your understanding of how soil is formed and what it contains.

Soil Samples

### Importance of Soil

Think about the importance of soil and what role soil plays in the environment?

Rooftop Garden

Activity 4

# Analyze Like a Scientist

Lesson 2

Quick Code: egs6258

## How Does Soil Form?

Previously you learned about the processes of weathering and erosion. Did you know that these two processes are major factors in the making of soil? Soil is all around us, but where does it come from Read the passage and underline important facts to remember. Be prepared to share your thoughts with a partner.

# Soil Formation

### Importance of Soil

Soil

Have you ever thought about the importance of soil? But you and everyone else on Earth depend on soil every day. Soil is a very important natural resource. Without soil, the plants that people and animals need to survive would not exist. Virtually all our food supply depends on soil. Soil contains the food, air, and water that plants need to grow. It is also home to many different organisms, including worms, insects, fungi, and bacteria. Did you know that a small scoop of soil contains many organisms? But what are the ingredients that make up soil, and how is it formed?

### Composition of Soil

If you took a handful of soil and looked at it closely with a hand lens, what do you think you would find? You would probably notice lots of tiny rock particles, bits and pieces of leaves and twigs, and some dark-colored matter that you may not be able to identify. Soil is a mixture of different things, some that you can see and some that you cannot see. The amount of each of these things you find in the soil depends on the source of the soil. But all soils contain some combination of four things: rock and mineral components, **organic matter**, air, and water. **Minerals** and organic matter make up about half of most soils. The other half of the soil consists of spaces between the particles , they are called pores. Each **pore space** is filled with air or water.

### Inorganic Ingredients

Rocks Weathered by Water

Air and water are not alive, and neither are rocks. The nonliving components of soil are known as the **inorganic** parts. Minerals are the building blocks of rocks. Each rock may be made up of a variety of different minerals. Both rocks and minerals are found in soil in small pieces. Rocks break and break down into smaller and smaller pieces through the process of weathering . These pieces are carried away and mixed with other particles during erosion.

Eventually, these small pieces precipitate, and combine with other ingredients to form soil.

## Organic Ingredients

Decomposers play a crucial role in recycling nutrients in the ecosystem. When plants and animals die, they become food for decomposers such as bacteria, fungi, and earthworms. Decomposers recycle dead plants and animals into chemical nutrients such as carbon, nitrogen, and oxygen that are released back into the soil, air, and water, contributing to the flow of energy in the environment again.

Decomposers break down the organic matter of dead organisms into nutrient-rich components called **humus**, which help plants grow, so these components enter back into the nutrient cycle for plants and animals.

Decomposers are environmental cleaners that break down dead organisms from plants and animals. Decomposers also help create a biosphere for new life. Decomposers therefore play a crucial role in balancing the ecosystem

## Different types of soil with different components

Arid Climate Soil Mixtures

Soils differ from one another due to the different amounts of ingredients that comprise them. The amount of organic matter affects not only the appearance of the soil but also the amount of nutrients that are available for plants. Differences in the size of the particles of inorganic material can change the appearance and texture of the soil as well as its ability to retain water and allow for root growth. One method of identifying and classifying soil is by the percent of the inorganic components. Sand, **silt**, and **clay** particles are the products of rock weathering. Sand particles are the largest, clay particles are the smallest, and silt are particles that are in between the smallest and largest sizes.

What are the organic ingredients that make up the soil?

What role do decomposers play in the making of soil and nutrient recycling in an ecosystem?

What are the inorganic ingredients that make up the soil?

How do inorganic components turn into soil?

Activity 5

# Investigate Like a Scientist

Quick Code: egs6263

## Hands-On Investigation: Different types of soil

Use materials and tools to discover the types of soil and how each type differs from the other. Identify the characteristics that distinguish each type.

### Make a Prediction

How do you think soil types differ? Write down your expectations and explain them.

.....

### What materials do you need? (per group)

- Three identical quantities of different soil samples (sand - silt - clay)
- Magnifying glass
- (3) Measuring cup
- (3) Paper/plastic cups (equal size)
- Stop Watch
- Water
- Pencil

HANDS-ON INVESTIGATION

### What Will You Do?

1. Examine each of the three samples with a magnifying glass.
2. Notice the particle size in each sample.
3. Notice the color in each of the three soil samples.
4. With your group, carefully examine any materials you can see and identify in the soil.
5. Record any materials you observe.
6. Use a pen to make one hole in the middle or bottom of each of the three cups.
7. Fill each cup halfway with equal amounts of each type of soil, and record the type of soil on it.
8. Place the cup in a high stand, then add 50 ml of water to each cup, and attach a measuring cup to the bottom.
9. Record every minute for 10 minutes the amount of water leaking from each cup.
10. Record your group's findings.

**Life Skills** **I can** analyze the situation and come to a conclusion.

## Think About the Activity

Review your expectations. Did the results of the experiment provide evidence to support your expectations? Or have you found evidence that contradicts your expectations? Explain what you have learned.

.....

How did the soil samples differ from each other? Which samples retained water the longest? For what does that indicate?

.....

.....

Record your answers and conclusions in the table

| Type of soil | Color | Particles size | Degree of water retention |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

Activity 6

# Analyze Like a Scientist

Quick Code: egs6265

## Ecosystems Depend on Soil

If you were to dig deep into the ground, you would find that soil changes the deeper you go. You would also notice that the soil forms distinct layers . How does the soil profile in an area affect the organisms that live there? Read the text about how soil is the foundation of ecosystems, and then answer the questions that follow.

# Soil: The Foundation of Ecosystems

### Soil and Climate

Soil Profile

The climate in an area affects the characteristics of the soil that is found there. For example, climate affects the soil of humid areas. The soil contains a large amount of water. During precipitation, nutrients may be washed away from the soil. Minerals may fall below the soil layers. Which leads to the formation of a hard layer that the plant's roots cannot penetrate. Waterlogged soils may contain very little air for roots to grow or soil organisms to live. In hot, dry areas that have clay-rich soil, the dry clay forms a layer that cannot absorb much water . Soil can also affect the climate in an area. The types of plants that can grow in the soil can have a large impact on the temperature and weather conditions in an area.

## Desert Soils

Dry Soil on the Savanna

Sand soils drains water quickly. Large trees often do not grow in dry, loose soil in grassland ecosystems, such as savannas, where they are found in large quantities in central Africa. It contains a variety of grasses and some small plants. Herbivorous animals such as deer depend on these grassy fields, and thus large and fast carnivores such as lions and leopards depend on them. Think for a moment why speed is an adaptation in animals on the savannah?.

## Soil in a Bog

Wet Soil in a Bog

Clay-rich soils hold water so well that the soil may be wet most of the time. includes plants that can grow in wet environments. These plants form the basis of a bog ecosystem. The moist conditions and very cool temperatures. Insects, such as mosquitoes, and frogs are the most common animals that live in bogs.



What can we learn about an ecosystem by examining its soil?

Explain how the porosity of soil affects the type of ecosystem.

Activity 7

# Analyze Like a Scientist

Lesson 3

Quick Code: egs6266

## How Soil Impacts Earth Systems

You have learned a lot about what soil is and how it is formed. What happens when soil changes? How do you think it impacts the ecosystem? Read the text and watch the video .


Soil is Earth's delicate loose skin that is comprised of countless species, and it varies widely from place to place.

Without healthy topsoil, it is more difficult to grow crops. Poor agricultural practices can cause **soil depletion**. Nearly half of the topsoil on the planet has been lost in the last 150 years due to the conversion of arable land to cities, factories, and pastures as well as overuse of pesticides, chemical fertilizers, and other pollutants.

Land that suffers extreme **deforestation**, drought, or **overgrazing** can become infertile in a process called **desertification**. Today, the world's deserts are growing too quickly. Up to 38 percent of the world's land is composed of arid regions that are vulnerable to desertification.

To restore and maintain soil health, soil scientists and farmers can add back the nutrients that have been depleted using crop residues such as straw and stalks, or natural fertilizers such as animal manure. Crop diversification and rotation can also be beneficial. It is possible to restore soil all over the world if everyone works together.

Tomato crops benefit from regular and moderate watering with the addition of an appropriate amount of organic fertilizer. Inappropriate environmental factors can lead to the production of weak plants, decreased crop yields, and the spread of plant diseases.

Activity 8

# Observe Like a Scientist

Quick Code: egs6268

## Reducing Soil Erosion

What can be done to slow down erosion in the parks and gardens in your environment? Explore the effect of variables on soil erosion.

Read the text and complete the interactive. Then, answer the questions.

Variables such as soil type, removal of vegetation, increased water volume, and increased slope of the land affect erosion. Increased slope of the land increases the speed of water movement over the ground, which erodes the soil, leading to erosion. Planting plants or digging trenches in an area helps to reduce erosion. Soil restoration by adding sand and silt also helps to alleviate the effects of water movement over the ground.


What can be done to slow down erosion of soil?

.....

.....

.....

**Life Skills** **I can adjust my plan of action as I seek solutions.**

Activity 9

# Analyze Like a Scientist

Quick Code: egs6283

## Climate and Habitat Destruction

Read the passage with a partner. Work together to identify both the natural processes and human activities that can lead to habitat destruction. You and your partner should decide who will track natural processes and who will track human activities. Highlight, underline, or circle any evidence that describes natural processes or human activities. Your partner should do the same with the other type of changes.

### Habitat Destruction

A habitat is a place where an organism lives. Habitats can be deserts, forests, streams, oceans, grasslands, and so on. Despite the variety, all habitats provide resources for an organism: food, water and shelter. When one of those resources is depleted or taken away entirely, it is called habitat destruction.

Habitat Destroyed to Build Homes

It is almost impossible to make a single change to habitat and expect a single reaction. As you read, you will learn about some of the consequences of habitat destruction, both naturally occurring or because of human activity.

### Dynamic Environment

Earth has a dynamic environment, which means that it is constantly going through changes. Many of these natural changes can cause habitat destruction. For example, hurricanes, fires, floods, volcanic eruptions, and earthquakes can all be destructive. As well as diseases and lack of food for many living organisms. Some of these natural processes are cycles in nature.

Forest Fire

Volcanic eruptions make the soil in an area fertile, forest fires release seeds from sealed pods, and diseases keep populations of animals to a manageable number in an ecosystem. Although many forms of habitat destruction are natural, human activities can cause or accelerate habitat destruction, which contributes to **climate change**.

**increase in the number of a certain species beyond the usual**

When populations produce more offspring than can be sustained in the habitat, habitat destruction can occur. Overpopulation leads to less food, water, shelter, and space for other populations that live in the area. Overpopulation can occur in a variety of ways. When large predators disappear from an area, prey populations can grow unchecked, straining the amount of resources that an area can provide for the growing population. When new species come into an area, whether naturally or brought by humans, they can become invasive species. Because kill off native plants and animals. In some areas of the Red Sea, it is estimated that lionfish are responsible for the loss of 79 percent of young fish in the native species population. Invasive species can even become the dominant population. In some places, humans are doing the same damage as invasive species. The overpopulation of humans has caused resource shortages for both humans and other organisms on Earth.

Invasive Lionfish, Red Sea

## Development and Waste

Development can be harmful to habitats in various ways. As the human population grows, so does the need for housing, factories to produce goods, and infrastructure for the transportation of both people and materials. Natural spaces, such as hills, prairies, and valleys, are turned into factories and homes. Industries have led to deforestation. Lands have been ripped up for mining, roads, and airport runways. Human activities pollution and waste disposal to landfills led to increase the percentage of carbon dioxide gas and other gases; at the end, leads to a high temperature of the earth.

Plastic in a Landfill

## Climate Change

Plants and animals depend on their habitats for space, food, shelter, and water. Humans are increasing the rate at which the climate is changing on Earth. This rate is changing the habitats upon which we all depend. When habitats change, plant and animal populations respond. They do so by changing their behavior to adapt to the new habitat. Sometimes populations are not able to adapt or move. When this happens, they risk becoming **extinct**.

Choose which student's statement most accurately describes habitat destruction:

- Malak: Habitat destruction happens, but only because climate change is increasing tornadoes that destroy land habitats.
- Kareem: Habitat destruction can happen to lakes and oceans but rarely affects land habitats.
- Sami: Habitat destruction can happen because of climate change, human-made events, and natural events.
- Nora: Habitat destruction happens because of natural events, like hurricanes.
- Sara: Habitat destruction can only happen when human-made events, like construction, occur.

List evidence that supports the correct statement and evidence that shows why the other statements are incorrect.

Activity 10

# Analyze Like a Scientist

Lesson 4

Quick Code: egs6287

## Reducing Pollution

You have learned that human activity can negatively affect the environment, which affects living organisms. During your reading identifies the reasons that lead to water pollution and reduce it.

### Reducing Water Pollution

The human population is constantly growing. The number of industries that use and possibly pollute water is increasing too. Pollution can be cleaned up with a lot of time and effort. Preventing pollution is more effective and efficient. The main method for reducing pollution is through effectively enforced laws. Treatment of sewage and industrial water is vital. Simple measures, such as keeping natural vegetation, correctly applying fertilizers, correctly disposing of trash, and using soil fences and sedimentation ponds, can be very effective. Controlling air pollution from cars and industry can greatly reduce water pollution as well.

Pesticides Sprayed on Crops Enter the Water

- What do you think is the best solution for water pollution?
- Choose one type of activity that results in water pollution. Design a solution to the problem using one of the following methods. Describe and/or draw your solution.
- Suggest new alternatives to things that lead to water pollution.
- Create a model of a device that can clean up the pollution after it has entered the water.

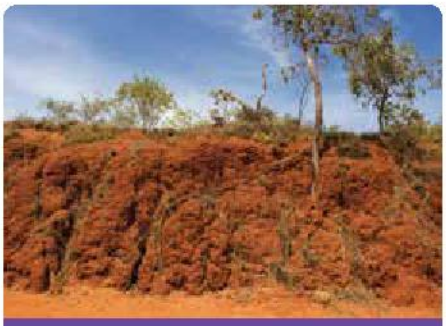
Activity 11

# Record Evidence Like a Scientist

Quick Code: egs6271

## Circle Back: Soil and Environmental Change

Now that you have learned about how soil and the environment are related, look again at Soil Variety. You first saw this in Wonder.



Silt soil

Clay soil

Sand soil

How can you describe Soil Variety now?

How is your explanation different from before?

Look at the Can You Explain? question. You first read this question at the beginning of the concept.

### Can You Explain?

How are soil and environmental change related?

Now you will use your new ideas about Soil Variety to defend a claim using evidence. First, write your claim. A claim is a one-sentence answer to the question you investigated. It answers, What can you conclude? It should not start with a yes or no.

My claim:

Record the evidence that supports your claim. Evidence can come from videos, readings, interactives, and Hands-On Investigations.

Evidence-based scientific explanation:

Choose one additional idea that you would like to research. What would you do to learn more? What resources would you use to extend your research? How would you build upon your investigations?

Research and resources: Use multiple sources and resources to conduct your research

**Life Skills** **I can apply an idea in an innovative way.**

STEM in Action

Quick Code: egs6272

Activity 12

# Analyze Like a Scientist

## Using Soil to Build Sustainable Homes

You now know that healthy soil is important to maintain a healthy ecosystem. Plants and animals rely on soil to meet their needs to survive. Like other animals, humans need shelter to survive. The process of making building materials can harm the environment by causing a lot of pollution. Did you ever consider how soil could help build homes? Read the text and watch the video. Then answer the questions that follow.

This object may look like brick, but it is actually soil that has been chemically altered. Soil scientists and engineers hope it could one day cut our dependence on traditional brick and concrete, which are both environmentally damaging. Bricks must be fired to over 1,000°C, and the ingredients needed for cement must be fired to 1,450°C. It requires a lot of energy and produces a lot of pollution.


In the lab, scientists are adding chemicals to the soil, which turn the clay in the soil into a kind of glue. This glue-like substance binds the material together, transforming everyday soil into a building material. The soil used in this process is not topsoil, which we use for agriculture. Instead, scientists use subsoil, which is available widely around the world.



Soil is the foundation of ecosystems. Healthy soil is needed by plants and animals to survive. There is also a great need to ensure humans around the world have shelter. Do you think it is a good idea to use soil to build homes? State your opinion on whether you think using soil to create building materials is a good idea. Be sure to give specific examples to support your opinion.

### Linking to the unit project: soil and environmental change

How is what you learned about soil and biotic and abiotic factors and its importance to the environment in the unit project ( Building environmentally friendly cities )?

What research and resources you will need to complete the unit project?

Quick Code:
egs6299

## Unit Project: Building environmentally friendly cities

# Building cities and changing the environment

The Earth's population is constantly increasing and this creates some problems and we cannot solve all of them, but we can try to reduce our impact on the environment. Through careful planning and thoughtful use of the land, we can help reduce many of the problems that affect the world around us.

### We must confront many issues related to how we use the land.

As vegetation is removed to build houses, the soil can be damaged; Which leads to more erosion and increases the possibility of floods. As land changes from rural to urban, causing migration to other places. This can cause a change in the ecosystem and biological community.

### Solutions and strategies

What can we do to address these issues? Environmental activists argue that major changes must be made in the process of building cities, and that other strategies must be considered to solve the problem of city building and environmental change. In your opinion, what impact can entire cities have on the environment? Keep reading to learn about some of the potential solutions that scientists and construction engineers are already investigating.

### Developing our system for building green cities

There are several ways we can reduce or eliminate these problems. One way to protect the land is to require permits for all new development. Permit applications are reviewed by city officials to decide whether new construction is appropriate. If the development plan follows all guidelines, the project is allowed to continue. If the plan is classified as malicious, the project will be stopped. Permits help cities keep track of how land is being used.

### Reviewing a City Plan

You studied that cities have a special set of environmental challenges and impacts. Imagine that you have been hired as a city planner. Your goal is to reduce the impact of your urban area on the surrounding environment. Your first task is to review the plan for a new, green, eco-friendly city.

The city will be located next to the foothills of the mountains, and a river will run through the city center.

## City Plan

How does building cities cause environmental change?

1. Draw a plan for building the current city.

2. Identify three or more environmental problems with the plan to build a new city.

3. Provide at least three solutions to the problems you have identified.

## The impact of city construction on the environment

The proliferation of developments on land near cities, called urban sprawl, can wipe out entire ecosystems. When wetlands are lost, we lose many plants and animals as well as the wetlands' ability to naturally filter water. Another problem with sprawl is increased car use.

When people live far from the city center, they are more likely to drive to get the things they need. Increased driving directly leads to more pollution that causes many problems for air, water, and human health.



## Solution design

With your group, develop a plan to reduce the negative impact of city building on environmental change. The solution must be something that can be implemented in building a new city. The solution must be safe and inexpensive. Your plan could be a solution to the problem as cities continue to be built. Your plan could also be an idea that includes replacing building materials with others. You can think about designing ways to recycle city waste to reduce the effects of pollution caused by human activity. You can also make a plan that combines both ideas. Add a written explanation of your plan as well as a drawing.

## Design modifications

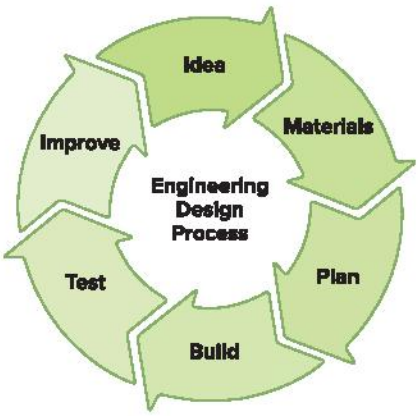
Share your design with the class, and record your classmates' feedback. Next, draw and/or describe changes you could make to improve your design.

**Life Skills** **I can adjust my plan while searching for solutions.**

# Interdisciplinary Project:
# New Modern Irrigation System

Quick Code:
egs6301

In this interdisciplinary project, you will use your science and math skills to find a solution to a real-world problem. You will study some background information, and you will design, test, and refine a solution to the overall challenge. You will go through the steps of the Engineering Design Process, as shown in the diagram. You will also do some additional work in your math class related to this challenge.




The project New Irrigation System challenges you to design, build, and test an irrigation system that reduces water waste. You will consider ways to create a device that can help city workers and residents irrigate their gardens more efficiently so that there is adequate water supply for other city gardens.

# Irrigation and Water Waste

## Why Is It Important to Conserve Water?

Do you recall that fresh water accounts for only 3 percent of Earth's total water supply? Do you think there is enough fresh water to sustain the world's growing population? The answer is a bit complicated. In some areas of the world, yes. In many other areas, no. The answer is also likely no for the future if we consider current water usage multiplied by a growing population.

The global water crisis is one of the major risks facing our planet. This does not mean that the overall amount of water on our planet is shrinking. The problem is where water is found and if it is clean enough to use.

## How Do Irrigation Systems Waste Water?

Irrigation is essential for supplying food to livestock and people around the world. Worldwide, agriculture accounts for about 70 percent of fresh water use. However, many methods used for moving water from its source to crops waste water in the process. Water can be wasted through evaporation, leakage, or runoff. Some systems also apply more water than the crops need.

You know that a system is a set of parts that work together to accomplish a goal. The main components of any irrigation system are

- a method for accessing the source water
- a method of moving water to the field (often requires energy)
- a method for applying water to the crops

Automated irrigation systems also include a method for controlling when water is delivered. Each of these elements can be simple or complex.

## Irrigation Innovation

From professional farmers to amateur gardeners, people are beginning to consider new methods to more efficiently water crops without wasting vast amounts of water. Some solutions to limit water waste are quite simple, while other solutions involve complex systems. Thinking in a method of minimizing water waste associated with watering residential lawns, using a robot with a moisture sensor that can accurately inform people of their garden's water needs so that they can adjust their sprinklers and not waste water. Similar innovations could be used on large farms.

LawnBot

Photo Credit: Inside Creative House / Shutterstock.com

As you watch the following video, take notes on the main parts of each system. Use the space provided to briefly sketch each type of irrigation system and label the major parts.

Hands-On Investigation

# Engineering Your Solution

## Challenge

Your challenge is to design, build, and test an irrigation system that reduces water waste in irrigation of farm land. Your system must not cause a problem with soil erosion.

To present your design for the village's farm, you will need to build a smaller prototype. The model will be a great visual for your presentation and will demonstrate that your system works. This part of the unit is where your design becomes reality!

## Objectives

In this activity, you will

- create a list of components needed to create your design and a list of materials that will represent those components in the prototype
- build a working prototype, documenting problems and solutions as you encounter them

Traditional Irrigation System

**Life Skills** **I can carry out solutions and evaluate results.**

## What materials do you need? (per group)

Choose from the following possible materials:

- Plastic straws
- Plastic or rubber tubing
- Paper cups
- Funnel
- Scissors
- Tape
- Cardboard
- Aluminum foil
- Plastic bags
- Rubber bands
- Toothpicks
- Paper clips
- Water
- Measuring cup or graduated cylinder
- Trays or outdoor space for testing


## Procedure

1. **Review the Challenge** Study the challenge and design requirements for this project.
2. **Assign Group Roles** Decide the roles for the members of your group and record the names next to each role.
3. **Sketch Ideas** Review the materials available with your teammates and begin brainstorming. Each team member should make their own sketch. Review your sketches as a group and decide on one design to fully develop. Add more details to make it your blueprint that you will use to help you create your solution.
4. **Plan and Build** With your teammates, gather materials and begin building your prototype. Make sure to keep track of your steps and process. Follow your group roles and work together. As you build, you will likely run into problems or challenges that you did not anticipate. Keep going. Solve one problem at a time, using your group's creativity to come up with solutions. Try multiple solutions to see what works best.
5. **Reflect and Present** Once your project is finished, reflect on your process and final product. Complete the Analysis and Conclusions section of your Student Investigation Sheet. Identify ways you could improve. Prepare to share with your class.

## Group Roles

| Roles | Student Name |
|---|---|
| **Team Captain**<br>Provide encouragement and support. Help other team members with their roles if needed. Keep track of timeline. | |
| **Materials Manager**<br>Gather and organize materials. Request additional materials if needed. Adjust materials as needed (cut, size, fold, and so on). | |
| **Engineer**<br>Coordinate building the model. Suggest when a test may be needed. Make sure the team is building safely. | |
| **Reporter**<br>Record all steps of the process. Share the process the team went through to complete the challenge. | |

## Design Requirements

You will be applying your ideas and knowledge to design a solution to the challenge. The first step in the design process is to consider the purpose of what you will create and how a farmer will use it.

You will tackle each of these tasks step-by-step through the following activities and prompts. For now, let's start with identifying your main goals. Here are a few questions to help you get started. Check each box once you answer the question with your teammates.

- ☐ How will you incorporate a place where the water is held and stored?
- ☐ How will the water be distributed?
- ☐ How will the water be collected after it is used?
- ☐ What materials would you use to build your irrigation system?
- ☐ How can you minimize the possibility of soil erosion due to the movement of water?

## Sketching Our Design

Scientists and engineers do not usually start out by building their design. Often, they sketch their ideas and then create a prototype, or model, which comes closer to the full product.

Sketching first saves resources, time, and money. Changes are much easier to make on paper or on a small-scale model than in full-size products.

You will begin designing your irrigation system using sketches. As you work, be sure to record each change you make and why you are making it. Talk with your group and identify what remaining questions you have before you begin sketching.

Do you need to explore additional resources for more information? As you sketch, discuss what materials you want to use with your group.

On your own, sketch your initial idea for your team's efficient water irrigation system. Then, take turns in sharing your ideas with your teammates. After you and your teammates share your ideas, vote on one final design to create. Label the materials needed, and add a short paragraph to the bottom of your sketch with how your prototype will work.

With your team, discuss these two questions for your ideas:

- What do you like about these ideas?
- Where can you make improvements to the design?

## Plan, Build, and Test

Follow these steps to complete the activity:

**STEP 1** Now that you have selected one design idea, create a separate diagram with additional details that you will share during your presentation. This detailed diagram is the blueprint for your prototype. Identify any materials that you will use on the detailed diagram.

**STEP 2** Gather the materials you identified in your blueprint. You may need to adjust these materials as you are building. Keep track of what you actually use. Ask your teacher what other materials you have available to use in your classroom.

**STEP 3** With your teammates, begin building your prototype. As you build, you may run into problems or challenges. Focus on one problem at a time, and use your group's creativity and collaboration skills to find solutions. Engineers use notebooks and documentation to troubleshoot when things go wrong so that they can look for places to make improvements.

**STEP 4** Consider the following questions when testing the effectiveness of your team's irrigation system: How much total water did you use? Were you able to collect any wastewater? If so, how much? Once your project is complete, work with your team to create a presentation to share both your project and your process. Share how you think this irrigation system will be water efficient. Also, prepare to share how your team worked together, if you encountered any problems, and how you worked to make improvements.

### Presentation Notes

## Analysis and Conclusions

1. How did you make sure that your team worked together to create a water-efficient irrigation system?
2. Which materials did you use?
3. What challenges did you face? List at least two problems and how you solved them?
4. Was your design successful? How did you decide if your prototype was successful?

# Unit Assessment

**Choose the correct answer from below:**

1. Understanding the climate phenomena in a specific region helps in making predictions about .....
   a. the various living organisms inhabiting this region.
   b. the types of living organisms found in the region.
   c. the area of this region.
   d. the number of landforms in this region.

2. The polar bear's ability to live in extremely cold regions is considered .....
   a. behavioral adaptation.
   b. reproduction ways.
   c. structural adaptation.
   d. environmental change.

3. Behavioral adaptations include .....
   a. lack of response by living organism to environmental factors.
   b. penguin's adaptation to higher temperatures.
   c. changes that occur in a living organism throughout their life.
   d. migration of geese to warmer regions.

4. Water, sunlight, and air are all examples of a type of ..... factors in the ecosystem.
   a. biotic
   b. living
   c. non-essential
   d. abiotic

5. The baby rabbits look like their parents as a result of .....
   a. behavioral adaptations they have.
   b. genes transferring from parents to offspring.
   c. structures that enhance running ability.
   d. observable behaviors.

6. The reason for the appearance of the characteristics of Dorcas, is .....

a. the brain

b. the gene

c. the factor

d. the environment factor

7 .What adaptation does not protect a plant from being eaten by herbivores? .....

a. Leaves of a plant with small, sharp spines

b. The leaves of the plant which have a very bitter taste

c. Poisonous plant leaves

d. Plant leaves which store large amounts of water

8. What environmental factor is most likely to lead to a decline in the number of fungi in humid environmental conditions? .....

a. High temperature

b. Reduced amount of precipitation

c. The few number of days the sun shines during the month

d. Fewer herbivores in a region.

9. Which of the following is an abiotic component of soil?

a. Decomposers, plants, and decomposing materials

b .Rocks, air, and water

c. Plants, rocks, and air

d. Decomposers, air, and water

10. The two processes related to the disintegration of rocks and minerals that make up soil are .....

a. evaporation and weathering.

b. erosion and condensation.

c. deposition and evaporation.

d. weathering and erosion.

11 .Humus are.....

a. components resulting from decomposition.

b. fine and inorganic rocks.

c. large particles of metal.

d. the rock from which soil particles break down.

12. Soils with large spaces between the particles are characterized by the ability to seep in water.....and retain it.....

a . slowly, well

b. quickly, well

c. quickly, poorly

d. slowly, poorly

13. The arrangement of soil types according to the size of soil particles from largest to smallest is...

a. sand, silt, clay.

b. silt, sand, clay.

c. clay, sand, silt.

d. sand, clay, silt.

14. What types of plants are likely to grow in dry, porous soil?

a. Herbaceous plants

b. Tall trees

c. Ferns

d. Algae

15. Desertification results from .....

a. horticulture.

b. over-cutting of forests.

c. allowing native plants to flourish.

d. gradual farming.

16. What is the method through which we reduce the occurrence of erosion due to water?

a. Weed removal

b. Adding clay to the soil

c. Create more ramps

d. Digging trenches

17. Which of the following is a method of reducing erosion due to both wind and water?

a. Planting a rain garden

b. Building a dam

c. planting trees

d. Weed removal

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