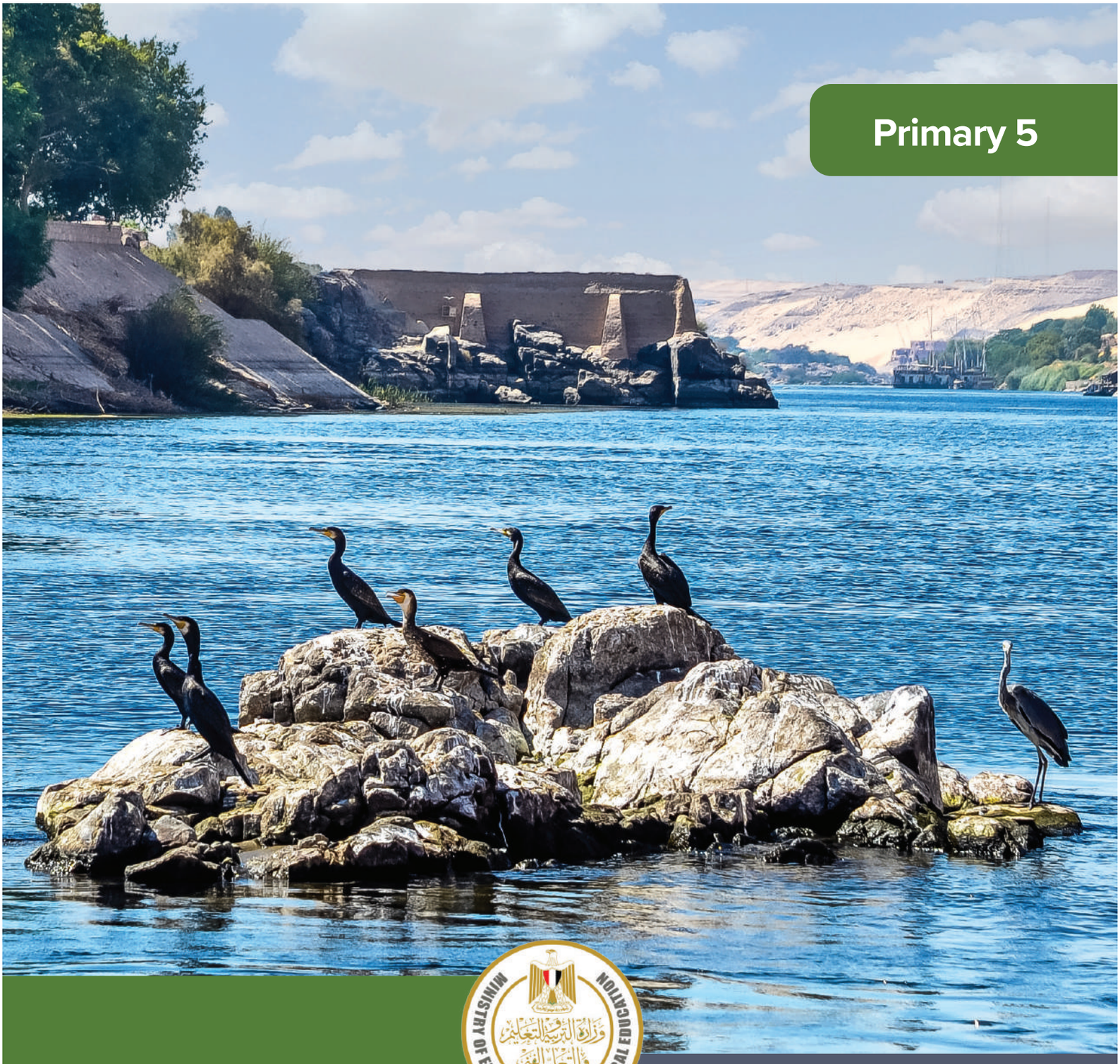

Primary 5

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

وزارة التربية والتعليم والتعليم الفني

Science Term 2

Primary 5 Science

Name _____

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The Central Administration for the Development of Curricula

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Dr. Akram Hassan

Head of the Central Administration for the Development of Curricula

FOREWORD

The MOETE launched Egypt's reform vision for the development of education, and the process of developing curricula comes at the heart of this vision. The implementation of this vision was heralded in 2018, starting with the kindergarten stage in its first and second grades, with the aim of continuing until the end of the secondary stage.

This vision endeavored to make major transformations in the teaching and learning processes, where there is a transition from acquiring knowledge to producing it, and from learning skills to employing them both in specific learning situations and in the general life of the learner outside the classroom. Our curricula also integrate values that contribute to the establishment of our society—values which pose as a protective fort for our homeland. Egypt's reform vision for curriculum development also aims to take into account the specifications of pre-university education graduates, as well as the challenges Egypt faces locally, regionally, and globally. The developed curricula are intended to foster a citizen who is capable of engaging in civilized conversations and positive dialogues with the other, in addition to acquiring digital citizenship skills.

In this regard, the MOETE extends its gratitude and appreciation to the Central Administration for the Development of Curricula and Educational Materials. It also extends its thanks and gratitude to Discovery Education for their active participation in the preparation of this book. Gratefulness also goes to all the Ministry's experts who contributed to the enrichment of this work.

This transformation of Egypt's education system would not have been possible without the significant support of Egypt's current president, His Excellency President Abdel Fattah el-Sisi. Overhauling the education system is part of the President's vision of "rebuilding the Egyptian citizen" and it is closely coordinated with the Ministries of Higher Education and Scientific Research, Culture, and Youth and Sports. The new education system is only a part in a bigger national effort to propel Egypt to the ranks of developed countries, and to ensure a great future for all of its citizens.

WORDS FROM THE MINISTER OF EDUCATION & TECHNICAL EDUCATION

Dear students and fellow teachers,

It gives me great pleasure to celebrate this crucial stage of comprehensive and sustainable development, an epic in which all Egyptian people are taking part. This pivotal stage necessitates paving a foundation for a strong educational system which yields a generation that is not only capable of facing the major challenges the world is witnessing today, but one that also has complete possession of the skills of the future. For this reason, the Egyptian state is keen on empowering its citizens by establishing a top-notch educational system that invests in its children the expertise required to get them to compete at both a regional and global level, at a time when the world is witnessing successive industrial revolutions.

This dictates that our educational system has at its core an emphasis on skills development, deep understanding, and knowledge production. This can only be done through modern curricula that keep up with the changes taking place globally-- curricula which prioritize the development of skills and values, and the integration of knowledge. They are also curricula that focus on the provision of multiple learning sources, and integration of technology to enrich the educational process and to improve its outcomes, while addressing the most important contemporary issues.

To achieve this, we must all join hands to continue to revolutionize our education, and to support it with all that is required to transform it into a globally pioneering educational system.

My warmest regards to you, dear students, and my deepest gratitude to my fellow teachers.

Professor Reda Hegazy

Minister of Education and Technical Education

Dear Parent/Guardian,

This year, your student will be using Science book, 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, Engineering and Technology).

Theme 3: Protecting our Planet	
Unit 3: Natural Resources on Earth's surface	
3.1	**Biosphere and Hydrosphere Interactions**
3.2	**Water as a Valuable Natural Resource**

Theme 4: Change and Stability	
Unit 4: Patterns in the Sky	
4.1	**Effects of Gravity**
4.2	**Patterns of Motion in the Sky**

Science book has 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. It includes QR codes, dynamic content, videos, hands on investigations,labs and game activities that inspire and motivate scientific learning and curiosity.

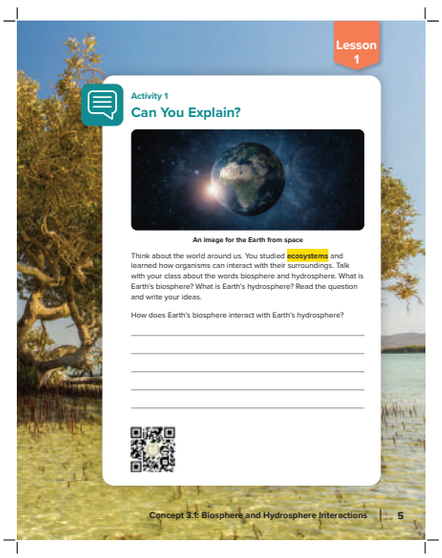
Science book is divided into units, and each unit is divided into concepts. Each concept has three sections: Wonder, Learn, and Share.

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.

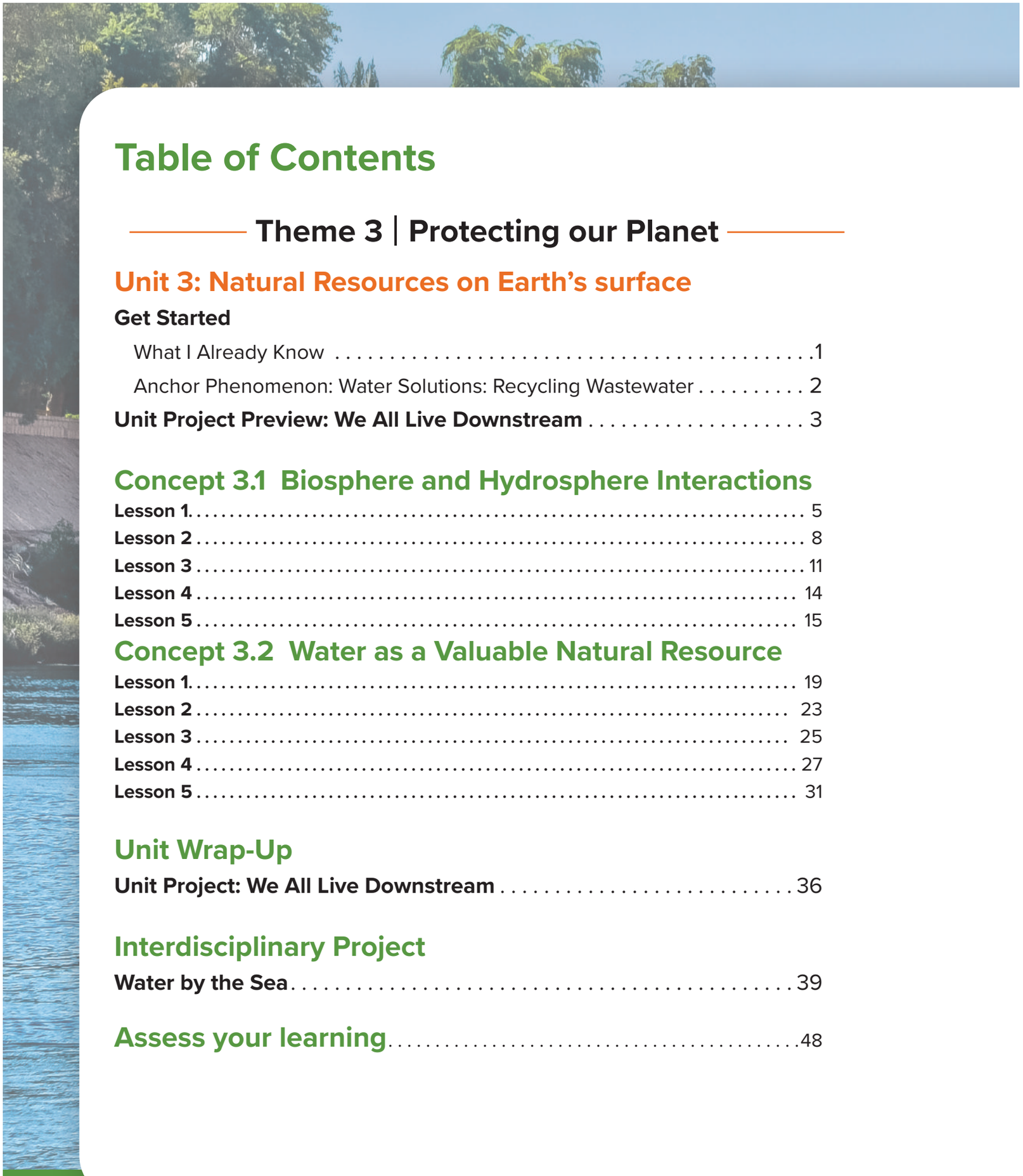


Within this Student Edition, you will find QR codes and quick codes that take you and your student to a corresponding section of Science online.

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

Sincerely,

The Science Team



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Theme 4 | Change and Stability

Unit 4: Patterns in the Sky

Theme 3 | Protecting Our Planet

Unit 3
Natural Resources on Earth's surface

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

Get Started

What I Already Know

You know in the first term a lot about water. Think about how we use water and where water comes from. Consider ways we can reduce water waste and how we can make sure that living organisms have enough clean water to survive.

Observe the images and write what you already know about water. Use the images to help explain ways we can conserve water and protect this valuable natural resource.

Talk Together People need clean, safe water for drinking and cooking. In some places, people need to use bottled water. In other places, people choose to drink bottled water, even when safe water is easily accessible. What do you think, is drinking bottled water good or bad? Explain your ideas.

Introduction

During this unit you will look for ways to protect water as a valuable resource. You will begin by learning more about how living organisms interact with water sources. You will learn more about where water can be found on Earth and will use evidence to create an argument for conserving fresh water. You will learn about other resources on Earth, and how human activities have major impacts on these resources. You will finally investigate how living organisms interact with water by creating a model of a local watershed in the Unit Project We All Live Downstream.

Water Solutions: Recycling Wastewater

All living organisms rely on water to survive. Human uses water for drinking, cooking, bathing. Earth's freshwater supplies are shrinking. Climate change, pollution, and water waste threaten the supply of water for many people. One solution to this problem is to recycle wastewater. Water that we use for washing and showering. It can be filtered and cleaned and then used again for other purposes. The Bahr Al Baqar waste water treatment plant in Egypt is one of the largest water treatment plants in the world. Water treated here can be used to irrigate farms in Egypt. Can you think of ways to save or recycle water?

Bahr Al-Baqar wastewater treatment plant in Egypt

How do the resources of Earth's spheres interact with one another? How much water is there on Earth? How can we protect and preserve Earth's resources?

Unit Project Preview

Solve Problems Like a Scientist

Unit Project: We All Live Downstream

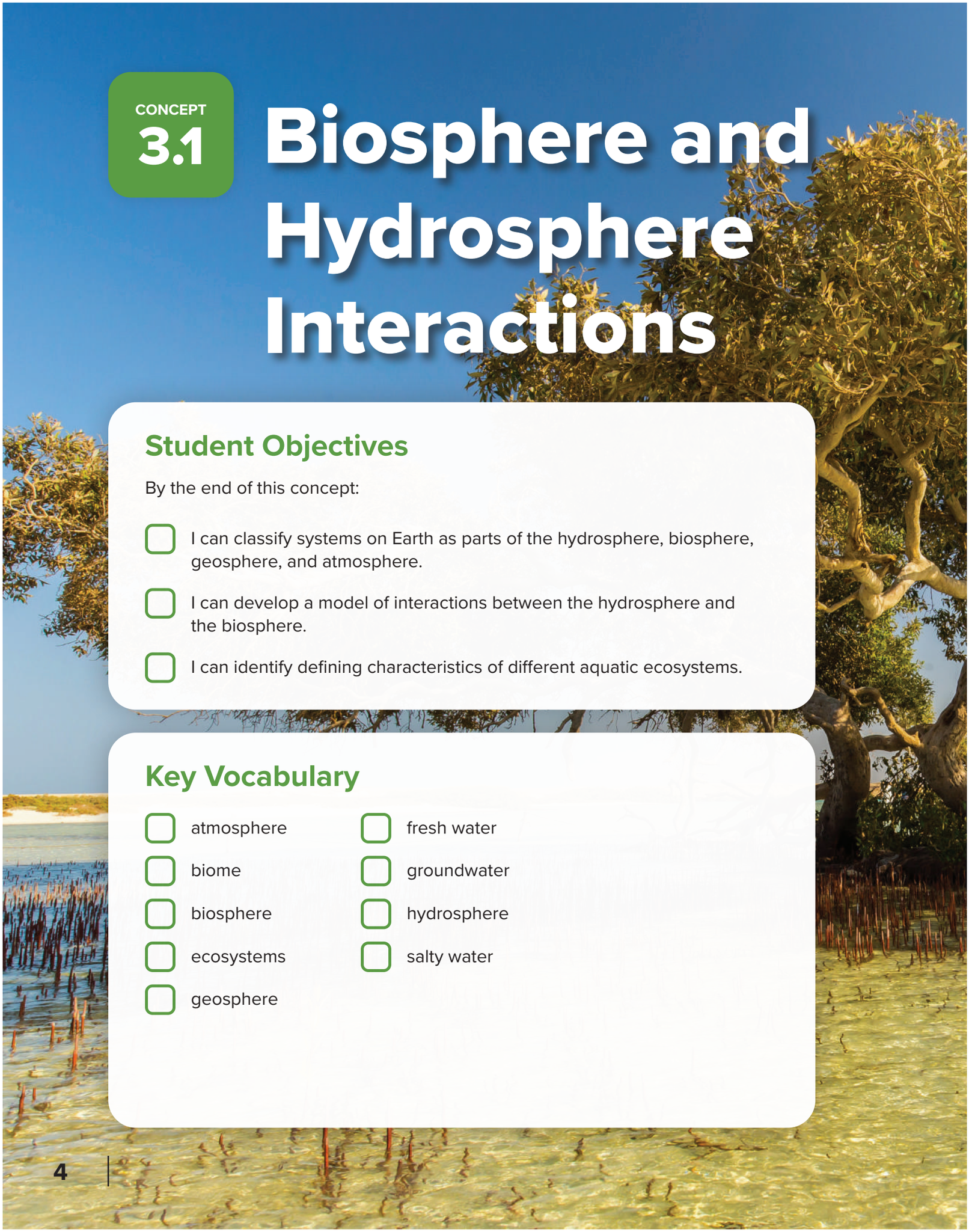
In this project, you will use what you know about water as a natural resource to build a model of water sources in a nearby area. You will investigate how pollution in one body of water can impact other water sources and living organisms.

Nile River, Egypt

Ask Questions About the Problem

Think about what you know about where in the world bodies of water can be found. Consider how living organisms rely on water. What can happen to organisms when pollution enters a water source? How far can the effects of polluted water spread? Write some questions you can ask to learn more about water as a natural resource. As you learn about how living organisms interact with water, and how water sources are connected, record the answers to your questions.

Life Skills **I can apply an idea in a new way.**



CONCEPT
3.1

Biosphere and Hydrosphere Interactions

Student Objectives

By the end of this concept:

- ☐ I can classify systems on Earth as parts of the hydrosphere, biosphere, geosphere, and atmosphere.
- ☐ I can develop a model of interactions between the hydrosphere and the biosphere.
- ☐ I can identify defining characteristics of different aquatic ecosystems.

Key Vocabulary

- ☐ atmosphere
- ☐ biome
- ☐ biosphere
- ☐ ecosystems
- ☐ geosphere
- ☐ fresh water
- ☐ groundwater
- ☐ hydrosphere
- ☐ salty water

Activity 1

Can You Explain?

An image for the Earth from space

Think about the world around us. You studied **ecosystems** and learned how organisms can interact with their surroundings. Talk with your class about the words biosphere and hydrosphere. What is Earth's biosphere? What is Earth's hydrosphere? Read the question and write your ideas.

How does Earth's biosphere interact with Earth's hydrosphere?

Activity 2

Ask Questions Like a Scientist

Water's Impact on living organisms

We use water every day. Look at the image. Think about why water is important.

Watering a Flower Bed

Record any questions you have about water and its uses.

I wonder . . .

Life Skills **I can predict possible outcomes of an event.**

Activity 3

Observe Like a Scientist

The Importance of Water for Life on Earth

Think about your day. How often do you see water? How do you use water in your life? Read the text and think.

Water is everywhere—in lakes, rivers, seas, oceans, and underground. There is so much water on Earth that our planet looks like a blue marble from space. Nearly three-quarters of Earth is covered by water. Water can change from liquid to solid (ice) by freezing. Water may seem to change into the air as water vapor. The total amount of water on Earth does not change, even if its state changes. We can recycle water, but we cannot make new water. We use water to drink, prepare food, bathe, and other daily uses. All plants and animals need water for survival. Humans also use water for cleaning, transfer cargos and traveling on ships, and manufacturing.

Write how water is used on Earth in the first column. Explain why water is important in the second column.

How Is Water Used?	What is the importance of water

Activity 4

Evaluate Like a Scientist

What Do You Already Know About Biosphere and Hydrosphere Interactions?

Think about the different places water is found on Earth. How does the hydrosphere interact with the biosphere?

Forms of Water bodies

Write each word from the wordbank next to the statement that best describes it.

groundwater	lake
ocean (or sea)	river

1. A body of water surrounded by land that is often fresh but sometimes salty. _____
2. A place that the water flows from an area of high altitude to an area with lower altitude in a definite path. _____
3. very large body of salt water. _____
4. Water that lies beneath Earth's surface and has been leaked into Earth through a layer of porous rock. _____

Renewable Resources

Think about what you know about plants and water. Then, answer the questions.

Are plants considered a renewable resource? If so, how are plants renewable? Explain your thinking.

_____

_____

Is water a renewable resource? If so, how is water renewed? Explain your thinking.

_____

Activity 5

Investigate Like a Scientist

Hands-On Investigation:

What is in Your Environment?

You have been thinking about how living and nonliving systems interact on Earth. It is time to think about your own environment. In this investigation, you will explore your environment. You will list and categorize the living organisms and nonliving objects you find.

Make a Prediction

Think about the different categories of living organisms and nonliving things on Earth.

What different types of living organisms and nonliving things do you think you will be able to observe in your environment?

What materials do you need? (per group)

- Book or other writing surface
- Colored pencils, 4 colors
- Writing paper, 6 sheets
- Pencil

HANDS-ON INVESTIGATION

What Will You Do?

1. Individually, spend 15 minutes observing and recording a list of as many objects as possible. Items should be both living and nonliving.
2. Join to your classmates and work in gorups, and combine the items you saw in your environment into a group list.
3. Decide which categories would best suit the items your group observed. Use your colored pencils in the classification.

4. Make a chart of the different categories and the objects in each category. Record the names of the categories in the first row. Record the objects in the second row.
5. Present your group's findings to the class.

Living and Nonliving Items in your environment

Think About the Activity

What patterns do you see in your observations?

In what ways are the living organisms and nonliving things in each system necessary to sustain life?

Life Skills **I can manage my time effectively.**

Activity 6

Analyze Like a Scientist

Earth's Systems

Scientists classify living organisms and nonliving things into four main systems on Earth. Read the text. Underline any words that are unfamiliar to you.

Earth supports life in different ways. To describe how different parts of Earth work together, scientists classify objects, organisms, and phenomena into common groups or systems. Scientists named each of these systems using the word sphere, because Earth's shape is considered as a sphere (Earth is not perfectly a sphere).

Geosphere and Hydrosphere

One system is the **geosphere** known also as lithosphere. This system contains things such as rocks, minerals, landforms, soil, and even molten rocks inside Earth. What objects in the geosphere did you observe near your environment?

Interacting Systems

Another system is the **hydrosphere**. This system contains all water on Earth, such as the oceans, seas, rivers, and **groundwater**. A glacier, which is made of ice, is also part of the hydrosphere.

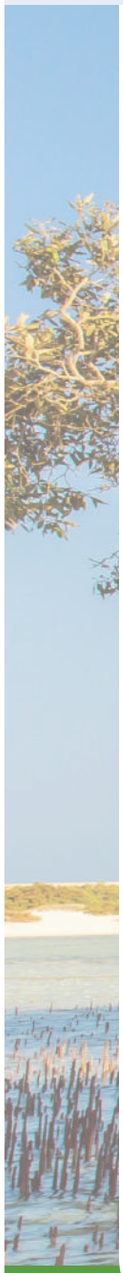
Atmosphere and Biosphere

The third system is the **atmosphere**. The atmosphere contains all the gases that surround Earth. We usually call these gases atmosphere. Atmosphere is a mixture of different gases. Gas is a state of matter.

The last system is the **biosphere**. This system contains all living organisms, including humans. Together, these four spheres make up the Earth system.

Earth Systems Interact

When the hydrosphere interacts with the geosphere, you can observe phenomena such as erosion and lake formation. When the atmosphere interacts with the biosphere, this appears through the processes of photosynthesis and respiration carried out by the plant and produces secondary products. When the geosphere interacts with the biosphere, soil provides nutrients for plants.



Choose two of the systems, and draw a picture of how these systems interact.

Life Skills I can make carefull decisions.

Activity 7

Observe Like a Scientist

Characteristics of the Hydrosphere and Biosphere

All living organisms belong to the biosphere. Organisms are found everywhere on Earth. A **biome** is a large area characterized by greenery, soil, climate, and wildlife that distinguished from other biomes. Examples of biomes are deserts, forests, and wetlands. Humans are part of the biosphere. It is important to remember that humans can impact all of Earth's systems.

The hydrosphere contains all the liquid, solid and gaseous water of our planet. about 71% of Earth is covered by water and almost 96.5% of the water is **salt water**. Salt water is found in oceans, seas, and gulfs.

approximately 3.5 % of the hydrosphere is **fresh water** and can be found in rainwater, most lakes, groundwater, and rivers. Groundwater is water that lies beneath Earth's surface and has been absorbed into Earth through a layer of porous rock, most fresh water is not liquid or flowing but frozen water

What are characteristics of each of these two Earth systems?

Hydrosphere	Biosphere

Think about ways the hydrosphere and biosphere interact. List as many as you can.

Activity 8

Analyze Like a Scientist

Types of Aquatic Ecosystems

Read the text. As you read, underline the characteristics that define each of the aquatic ecosystems. Then, discuss the components of the different types of saltwater and freshwater ecosystems with your class.

There are many different types of aquatic ecosystems that found in water. They can be classified in different ways.

saltwater Ecosystems

Saltwater ecosystems cover a large portion of Earth›s surface include oceans and sea. These aquatic ecosystems have a large number of various living organisms. They include also shallow areas, such as coral reefs and intertidal zones. The intertidal zone is the area along the coast that is underwater at high tide and exposed during low tide. Marine ecosystems also include its deepest areas, called the abyssal zone. The abyssal zone is so deep that sunlight cannot reach it.

Some lakes, like lake Bardawel in Egypt, and Lake Assal in Djibouti, also have saltwater ecosystems, and it has a high concentration of natural salts. Because of this, it is too salty for fish and most other aquatic animals. There is very little vegetation that can grow in this area. Several types of bacteria live in the lake.

Salt Lake Ecosystem

River Ecosystem

Freshwater Ecosystems

Freshwater ecosystems include ponds and most lakes, like Naser Lake in Egypt. In many ponds and lakes, the water is present all year. Other ponds and lakes dry up in the hot summer months. The plants and animals that live there must adapt to the change. Freshwater ecosystems are also found in flowing bodies of water, such as streams and rivers. Different plants and animals thrive in water that is always moving.

Activity 9

Observe Like a Scientist

Aquatic Ecosystems

Read the text passage. Then, record your data in the graphic organizer and answer the questions.

Have you ever wondered why whales live only in oceans and why jellyfish cannot live in ponds? It is because the ecosystems found in ponds and oceans are very different, every organism has its own environment that suits it.

Ponds have fresh water that is still. Water lilies grow in still water. Salamanders, frogs and some types of worms live there.

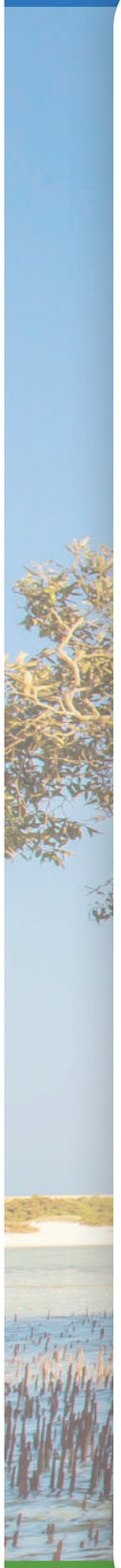
Streams are freshwater ecosystems. Water in streams is cool and flows fast , catfish, and salmon can survive in fast flowing water.

Oceans and seas are the largest of all salt water ecosystems. Seawater is constantly moving. Ocean water circulates around the world in patterns called ocean currents. Within the marine environment there are many smaller ecosystems. Dolphins, starfish, kelp, and flounder, like a Moses fish are some species found in the ocean.

Moses fish

Star fish

Life Skills **I can predict possible outcomes of event.**



Record your data in the graphic organizer.

Ecosystem	Type of Water	Water Movement	Species
Pond			
Stream			
Ocean/Sea			

What is the difference between the type of water in seas and streams?

What is one example of how the hydrosphere and biosphere interact in one of the aquatic ecosystems?

Activity 10

Record Evidence Like a Scientist

Water's Impact

Look at the image Watering a Flower Bed. You first saw this in Wonder.

Now describe the importance of water to living organisms?

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 Earth's biosphere interact with Earth's hydrosphere?

Now you will use your new ideas to write a scientific explanation that answers the Can You Explain? question. To plan your scientific explanation, first write your claim.

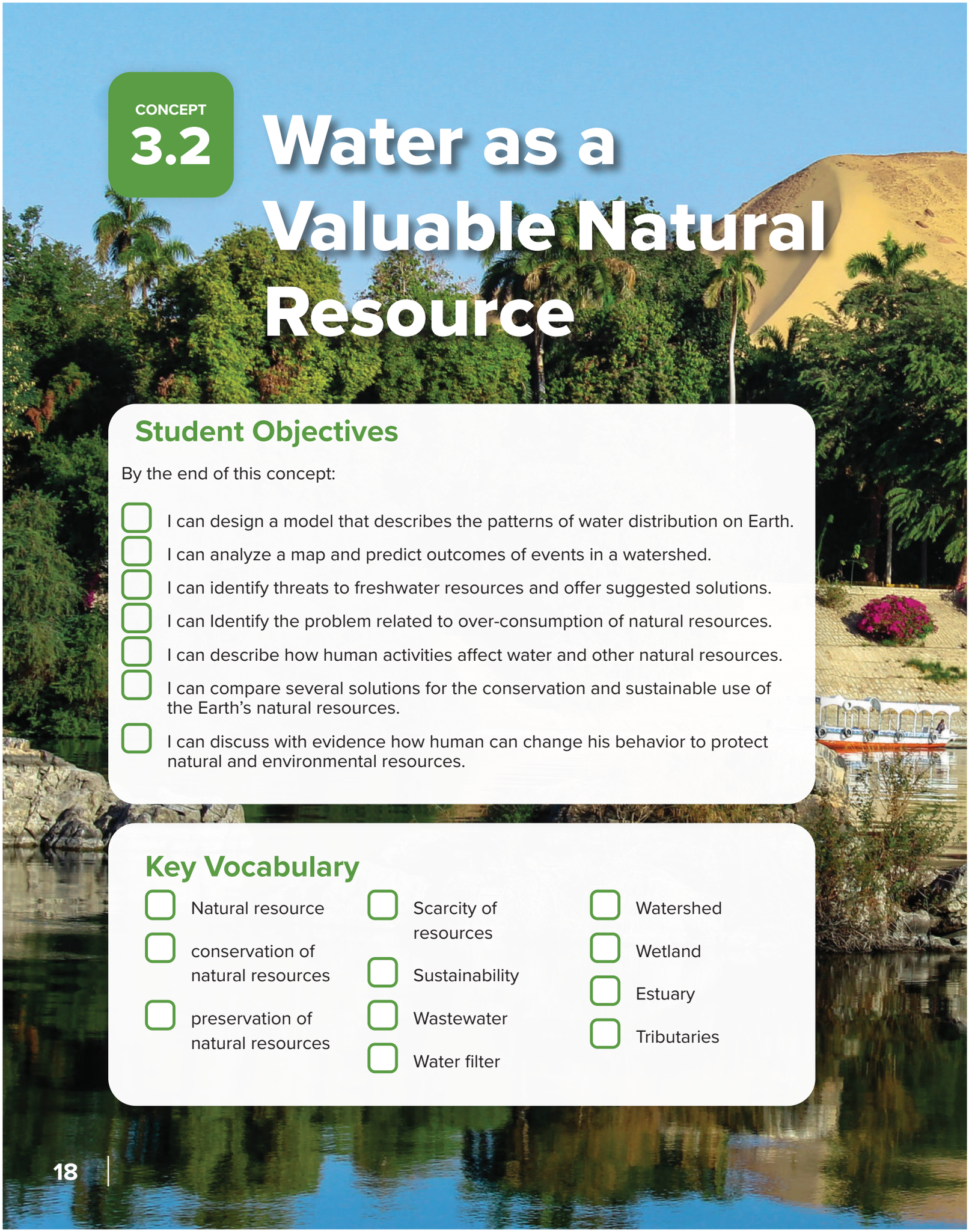
My claim:

Next, record the evidence that supports your claim.

Evidence:

Now write your scientific explanation, including your reasoning.

Life Skills **I can be reflective.**



CONCEPT
3.2

Water as a Valuable Natural Resource

Student Objectives

By the end of this concept:

- [ ] I can design a model that describes the patterns of water distribution on Earth.
- [ ] I can analyze a map and predict outcomes of events in a watershed.
- [ ] I can identify threats to freshwater resources and offer suggested solutions.
- [ ] I can Identify the problem related to over-consumption of natural resources.
- [ ] I can describe how human activities affect water and other natural resources.
- [ ] I can compare several solutions for the conservation and sustainable use of the Earth's natural resources.
- [ ] I can discuss with evidence how human can change his behavior to protect natural and environmental resources.

Key Vocabulary

- [ ] Natural resource
- [ ] conservation of natural resources
- [ ] preservation of natural resources
- [ ] Scarcity of resources
- [ ] Sustainability
- [ ] Wastewater
- [ ] Water filter
- [ ] Watershed
- [ ] Wetland
- [ ] Estuary
- [ ] Tributaries

Activity 1

Can You Explain?

The **natural resources** are many and varied, like metal as Gold, Silver, Aluminium, and others. The water is considered as one of important natural resources on Earth. Think about how often you use water or water uses in your community. Read the question and write your ideas.

How can we protect the natural resources on Earth's surface?

Why is water considered a valuable natural resource on Earth's surface?

Activity 2

Ask Questions Like a Scientist

The Importance of Water

Think of all the ways of your daily uses of water . Read the text, then Think about the text and discuss it with your class.

Human rely on water in many different ways. Cleaning vegetables, drinking, washing your face .

Water is found in many places and used in different ways. In Egypt, water is used to generate electricity at the Aswan High Dam. It is also used for agriculture. Around the world, many people work on the water by fishing, use boats and transport goods.

There are many sources for water on Earth, including rivers, streams,and lakes. Not every water source is appropriate to use as drinkingwater, however it is necessary to know the sources and usages of water.

Write what you wonder about the importance of water.

I wonder . . .

Activity 3

Evaluate Like a Scientist

What Do You Already Know About Water as a Valuable Natural Resource?

Think about the many places on Earth where water is found. What different types of water can be found on Earth? What can you do to conserve water, and rationalize its consumption? Answer the questions that follow.

Sources of Water

Where does the water you use in your daily life come from? Write water sources in the first column. Then, put a check in either the "Salt Water" or "Fresh Water"

Source of Water	Salt Water	Fresh Water

Rationallize the consumption of Water

Choose the three most practical ways to rationallize the consumption of water.

A. Drink more juice instead of water.

B. Turn off the faucet while brushing your teeth.

C. Take a quick shower.

D. Turn off the water while washing your hair.

Life Skills **I can make careful decisions.**

Activity 4

Analyze Like a Scientist

Water bodies of Earth

Read the text. Record your observations in the data table.

Most of Earth is covered with water. Rivers, streams, lakes, and ponds hold Earth's fresh water. Oceans and seas contain salt water. There is even some water underground.

A river is a body of fresh water. A river often starts in the mountains Rivers eventually end when they join a sea or a larger river.

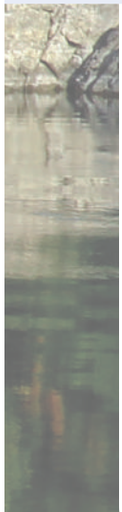
A **lake** is a large body of water surrounded by land. Most lakes contain fresh water. A lake forms when water pools in a low-lying area.

Fresh water can also be found in a **wetland**, which is an above-ground land area partially covered with water. Swamps, and ponds are different kinds of wetlands.

An estuary is where a river meets the ocean or sea. Salt water from the ocean mixes with the fresh water in the river. Estuary is an ecosystem and home to thousands of plants and animals.

Water stored in the cracks and spaces of underground rock is called groundwater. There is more groundwater on Earth than all the water found in rivers and lakes.

Oceans are large bodies of salt water. The oceans surround the continents. All of the oceans are connected to each other. The ocean's floor has mountains, and plains.



Use the information provided in the text. Record the most important facts about each of the water bodies.

Water Body	Type of Water	Location	Other Information
Rivers			
Lakes			
Wetlands			
Estuaries			
Groundwater			
Oceans			

Activity 5

Analyze Like a Scientist

Earth's Fresh Water Bodies

Why is water important to you? Read the text and underline two reasons the amount of water on Earth is important. Then, answer a question about a personal reason why water is important to you. Then compare your answer with your team

It has never been more important to protect our freshwater environments. Fresh water is used for drinking water, irrigation, agriculture, industry, and power generation. 10% of the world's animal species live only in freshwater habitats. Many are threatened with extinction.

Glaciers and mountains

Two main concerns are **scarcity of resources** and poor quality. Water has become scarce or limited in many areas of the world. The quality of fresh water is just as important. Poor water quality leads to thousands of deaths each year. Poor water quality also puts many fish and amphibians at risk of extinction.

Why is water important to you?

Activity 6

Observe Like a Scientist

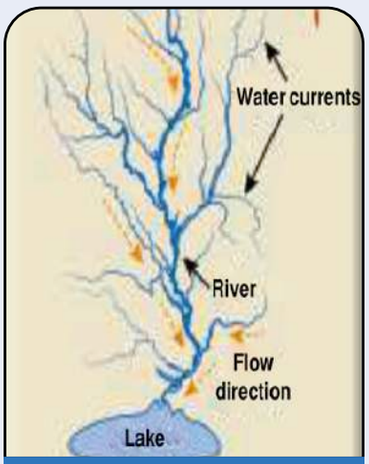
Fresh Water: A Precious Resource

Read the text, complete the information in the chart. Compare your answers with what others wrote.

Much of the study of water is focused on fresh water because of its vital importance to human. In some parts of the world, there are serious conflicts over water. Finding and preserving fresh water will be one of the major challenges of this century.

Fresh water is a precious resource because human and most other animals can only drink fresh water, and plants need it to survive and grow. Human controls and conserves water in a variety of ways, such as building dams to save water. However, many people in the world still do not have access to fresh water, usually because of drought.

A **watershed** is an area of land where all the water that flows across it drains downhill to a common location and one direction that is usually a large body of water, such as a lake, bay ocean, or low-lying area of land where water collects. When there is more rainfall than the river or stream can handle, there will be flooding. If there is too little rainfall, the level of water will drop, and the stream or river may dry up.



Watershed

Factual Statement	Question
Vocabulary Word with Definition	**Drawing**

Life Skills I can apply an idea in a new way.

Activity 7

Investigate Like a Scientist

Hands-On Investigation:

Watershed Predictions

A watershed is any area of land where all the water flows from many sources towards a common certain area. Streams are **tributaries** that flow into bigger rivers, which lead to even larger bodies of water, such as bays and oceans. As you know, water bodies are connected to each other, so what happened upstream will affect water bodies downstream, for example if the water of upstream decreases, the water of downstream will decrease.

As you view the image Watershed Map, look for the different water features in the image. Then, use the information in the image to predict what might happen if human intervention affected this watershed.

Make a Prediction

How can using a map help us make predictions about which bodies of water will be affected by an event occurring in the watershed?

What materials do you need? (per group)

- Colored pencils, four colors

HANDS-ON INVESTIGATION

What Will You Do?

1. Read through each of the scenarios provided.
2. Work together with a partner or a small group. Discuss what you have read about each scenario.
3. Track the possible impact of each event on the watershed map, using a colored pencil to follow the flow of the water. Use a different color for each scenario.
4. Once you have finished marking your predictions on the map, compare your map to those of your group members.

5. Discuss any differences by reading through the scenario again together and following the flow to come to a resolution.
6. As a group, pick a river or stream on the map and think of a scenario in which human intervention could affect the watershed. Write down your scenario. Ask another group to figure out which bodies of water will be affected.

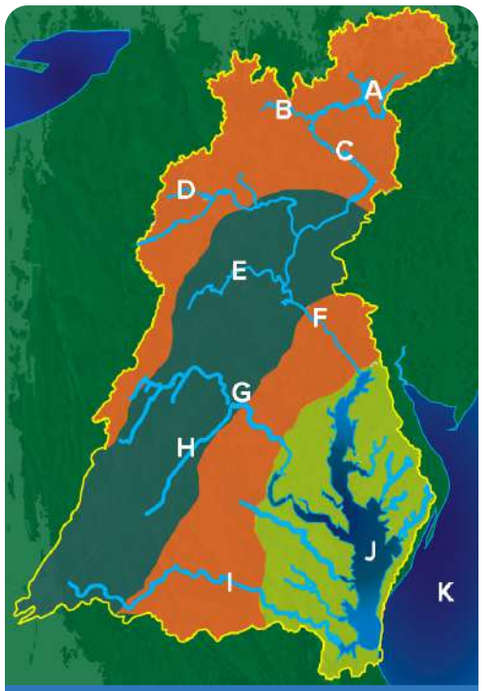
How would this watershed be affected if a change occurred near one of the Nile river tributaries? Look at the watershed map to track the impact of each scenario on the bodies of water in this area. Discuss the impact of each scenario and then create your own scenario. After considering the impact of this new scenario, answer the questions that follow.

Scenario : A factory is built near letter (A). Which other bodies of water would be affected if the factory polluted the water?

Scenario : A dam is built at letter (F). Which bodies of water would be affected by the dam waste?

Scenario : A farm is established near letter (D) has a herd of cattle. Waste from the farm is leaking into the water. Where will this waste flow?

Scenario : A trash dump has been established near letter (I). On windy days, litter is blown into the water. Where will the litter end up?



Watershed Map

New scenario:

Think About the Activity

How did you track the impact of an event that occurred in one area of the watershed?

What information cannot be obtained using this type of map?

Can you think of any other reasons why a watershed map might be useful?

Activity 8

Analyze Like a Scientist

Conservation, Preservation, and Sustainability

What are some ways humans can conserve natural resources? Read the text. Consider the different ways that can protect Earth's resources.

Conservation

Many things we use every day are made of natural resources. Paper is made from trees. Most plastic is made from oil products. Clothes are made from plant and animal products. It is important to conserve resources so there will be enough when we need them. Conserve means to protect or preserve. Conservation of resources can be done in a variety of ways.

Clean Water

Preservation of Resources

How can we conserve our natural resources? **Preservation of natural resources** means restricting access to or use of a resource. Establishing protected areas of land, such as Ras Mohammed Protectorate in South Sinai and Wadi-Al Hitan in Fayoum, which are two examples for preservation of natural resources, where resources cann't be drained.

An example of the depletion of resources is the overfishing of fish, If the catch or consumption of fish by human increases more than what is compensated by their reproduction, then the fish becomes more scarce, and it follows that the fishing opportunities decrease after that. This is a problem that exists in most of the seas and oceans of the world, and similarly in some places of the world the water in the well is used more than what is compensated from rains. the result will be that the water runs out and the wells dry up. perhaps one way to reduce this is to use these resources more carefully and this is called **resource conservation**.

Renewable Does Not Mean Unlimited

Did you know that even renewable resources can be used up if people do not use them responsibly? Water is one example. Pollution has made much of Earth's

water undrinkable. Pollution from burning nonrenewable resources such as coal or oil can Pollute soil and cause plants and animals to die. Renewable resources can be destroyed in other ways,and Forests can be destroyed by deforestation when too many trees are cut down, blowing wind and flowing water can carry away soil through erosion. How can resources be used so that we will not run out?

Sustainability

Sustainability is also an important part of resource conservation. Unlike preservation, sustainable use means that we will still use these resources but in a sustainable way. Sustainability means using a resource in a way that does not negatively affect the future availability of that resource. Using resources in a sustainable way requires management of how a resource is used.

An example of an unsustainable situation;Grass grows slowly. What would happen if the cows began eating all the grass before new grass could grow? The grass would be gone, and the cows would starve. If the cows have access to enough space that the grass in some areas can grow back while the cows still have more to eat, the situation is sustainable.

To maintain our resources, society needs to move toward resource sustainability. We must be careful not to overuse or damage our resources. Some factors that affect sustainability are overpopulation, overconsumption of resources, unequal distribution of resources, and pollution.

Have you ever seen an area in nature that has been destroyed by human activity? Are any resources that you use scarce? Think about the different types of conservation ways that you just read about as you answer the questions that follow. Then, discuss what you learned with a partner.

What is one example of preserving a resource?

Why is practicing sustainable use of resources important?

Talk Together What are some of the different ways to conserve natural resourses? How is preservation different from sustainable use? can you think in a situation in which one solution might be better than the other?

Life Skills **I can choose the best solution to a problem.**

Activity 9

Think like a Scientisit

How Much Water Do You Use?

Many places around the world are facing water shortages due to persistent drought. This activity will help you find out the amount of water that you use every day.

What Will You Do?

We use water all day, every day for many different reasons. In this activity, you will find out how much you use doing just a few simple tasks. Complete the table to calculate the amount of water you use on a normal weekday. You will estimate this information, so do not worry if you are not sure of the exact answers.

1. Read the list of activities in the first column.
2. Enter the number of minutes or times in the second column. Note that you might not do every activity in one day.
3. Calculate the total water used in that activity each day.

Life Skills **I can make careful decisions.**

Amount of Water Used, by Activity					
Activity Using Water	**Number of Minutes Used**	**×**	**Amount of Water Used Each Minute**	**=**	**Total Liters**
Shower		×	9.5 liters	=	
Brushing Teeth, with Water Running		×	8.25 liters	=	
Activity Using Water	**Number of Times Done in One Day**	**×**	**Amount of Water Used Each Time**	**=**	**Total Liters**
Flushing a Toilet		×	13 liters	=	
Taking a Bath		×	150 liters	=	
Brushing Teeth, with No Water Running		×	1.75 liters	=	
Washing Hands		×	2 liters	=	

What habits and behaviors could you change to reduce and rationing your overall water consumption?

Think About the Activity

List three ways that you and your household could conserve water duringthe day. How could you make conserving water a fun challenge?

Activity 10

Investigate Like a Scientist

Hands-On Investigation:

Drinking Water

Across the world, people use water every day—for drinking, cleaning, and bathing. Why is clean drinking water important? What advantage is there to having a technological system that cleanses drinking water? How can a **water filter** be constructed?

Make a Prediction

Water is a non-renewable natural resource that all living organisms, including humans, depend on for survival.

Think about ways you can turn dirty water into clean water.

What is the problem?

What ideas do you have to solve the problem? Write about your ideas. Make a separate drawing to help you plan your ideas.

What materials do you need? (per group)

- Plastic bottle with lid, 250 mL
- Plastic container, 350 mL
- Charcoal
- Cotton balls
- Dirt
- Sand
- Scissors
- Water

HANDS-ON INVESTIGATION

Life Skills **I can choose the best solution to a problem.**

How will you pick one idea to test?

How will you know your idea works?

What Will You Do?

Follow the steps with your teacher to observe how visually filter a sample of dirty water becomes after being filtered. Remember: Never taste dirty water, even your sample after filtration.

Test your design. Draw or write to show how you tested it.

Think About the Activity

Think about the water filter you made and answer the following questions.

What worked in your model?

What did not work in your model?

What could work better?

Activity 11

Record Evidence Like a Scientist

The Importance of Water

Now that you have learned about water as a valuable resource, look again at The Importance of Water.

How can you describe The Importance of Water 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 can we protect the natural resources on Earth? Why is water considered a valuable natural resource?

Now you will use your new ideas about water as a valuable natural resource to write a scientific explanation that answers the Can You Explain? question. To plan your scientific explanation, first write your claim.

My claim:

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

Evidence:

Now, write your scientific explanation and include your reasoning.

STEM in Action

Activity 12

Analyze Like a Scientist

Wastewater Engineers

Read the passage and then complete the activities that follow.

Working with Water

Recycling Water

Water on the Earth is recycled and reused. It does this with the help of solar energy driving the water cycle in nature. Humans help move water on Earth, too. Humans use and recycle water. We use water to wash dishes. We use it to clean cars. We use water to brush our teeth and to cook food. Wherever there is human activity, water is being used. But how do we reuse the water we have already used?

Wastewater Treatment Plant

Wastewater is water that has already been used.It could have even been used as part of an industrial process. Wastewater engineers design and make tools that provide us with clean water. They monitor water quality and check for contaminants.

Life Skills **I can choose the best solution to a problem.**

Wastewater Engineers

Some wastewater engineers work in water treatment plants. They plan ways to remove harmful materials from the water. They help decide where to build water treatment facilities. These engineers observe and check each step in the process, to make sure things work properly. They also test the treated water, before the water is released to rivers and lakes or used by humans. They want to make sure it is safe.

Wastewater Engineers

They can design ways to protect a community from floods. They can test a community's supply of drinking water. This is done to make sure it is safe to drink.

Talk Together What other careers help manage how people interact with water?

Life Skills **I can be reflective.**

Solve Problems Like a Scientist

Unit Project: We All Live Downstream

Wherever you live, chances are there is water nearby. That water could be a small stream, pond, or large river. It could even be the sea. Can you name the body of water that is closest to you?

Nile River

Irrigation Canal

What does the saying “we all live downstream” mean?

To answer this question, you will create a model of a watershed and simulate the introduction of pollutants. You will observe how pollutants travel and affect many different water resources. Complete the model and then answer the questions that follow.

What materials do you need? (per group)

- Map of your country or local area with watersheds and elevation clearly marked
- Aluminum foil, 3 m
- Hardcover book, medium-sized
- Food coloring
- Flat baking pan, large
- clay
- Cooking oil
- Water, 0.5 L

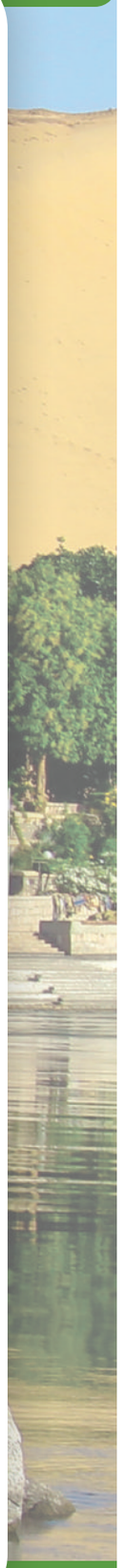
HANDS-ON INVESTIGATION

Life Skills **I can apply an idea in a new way.**

Make a Prediction

You have learned about how bodies of water are connected in a watershed. Look at the supplies that are available. How can you use these supplies to create a model of a watershed and investigate how pollution would affect bodies of water downstream from an event?

Now sketch how your model will look. Be sure to label the supplies you will use.



What Will You Do?

1. Add food coloring to a bottle of cooking oil. Shake the bottle so that the dye mixes with the oil. It will not blend completely with the oil, but it will help you see the oil more clearly.
2. Wrap the baking pan in aluminum foil.
3. Use a map to determine where to put rivers, lakes, bays, and estuaries.
4. Use the clay and aluminum foil to create landforms and changes in elevation.
5. Create simple labels for the different features on your watershed model.
6. Predict what will happen when you pour water onto the propped-up end of the model. Use the data table provided to record your predictions.
7. Slowly pour half of the water on the model over the propped-up end and observe what happens. Record notes on the row of the data table labeled Trial 1.

8. Imagine now that a landowner near the beginning of the main river has added pollution to the water. Pour about 10 mL of oil into the rest of the water to represent polluted water.
9. Make and record a prediction about what will happen when the polluted water moves through the watershed.
10. Carefully pour the water onto the same area of the model that you did before. Record your observations on the row of the data table labeled Trial 2.

Trial	Water Quality	Where will the water move to?	What did the water do?	Potential Effects of the Water Flow
Trial 1				
Trial 2				

Think About the Activity

Answer the following questions about the experiment:

- What happens when pollution enters a watershed?

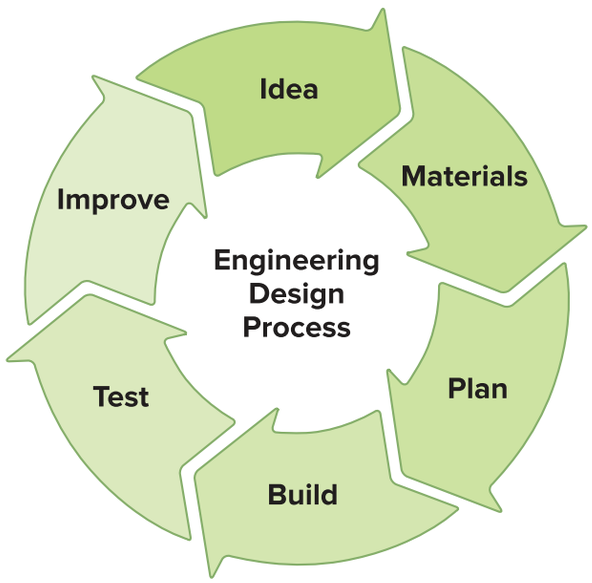
- What does the saying “we all live downstream” mean?

- Why is it important to monitor the health and quality of different water resources?

Interdisciplinary Project

Interdisciplinary Project: Water by the Sea

In this interdisciplinary project, you will use your science and math skills to find a solution to a real-world problem. First, you will read a story about a fictional group of characters, called the STEM Solution Seekers. Then, 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.



Consider what you already know about the process of removing salt from ocean water. The project Water by the Sea challenges you to create a solar still that removes salt from salt water to make it fresh enough to drink.

Water by the Sea

STEM Solution Seekers Jaber, Ahmed, and Maisa are building a sandcastle on the beach.

“I am thirsty,” says Ahmed, looking through a beach bag for some water. He holds up an empty water bottle. “There is no water in here.”

Jaber says, “I am thirsty, too.”

“You cannot do that,” says Maisa. “The sea is salty. It does not taste good.” Jaber and Ahmed decide to try anyway. They spit it out, saying, “Yuck!” at the same time.

“I told you so,” Maisa smiles. “My mom told me seawater can make you sick and even more thirsty than when you started.”

Ahmed says, “I am thirstier now. I wonder if there is a way to take the salt out of the water.”

Maisa thinks for a moment. “We learned about evaporation in school. When a sea dries up, the water goes into the air. It leaves the salt behind. That is why we have Salt water flats in Egypt,” she says.

“Cool,” says Ahmed. “But we want to get the salt out and have the water left. Salt water flats have the salt without the water.”

Jaber says. “Let’s take some seawater to Professor Gamila’s lab.”

Maisa takes the empty bottle edge and says, “I will put some in here.”

“That water has seaweed in it,” says Ahmed.

The team takes the water to Professor Gamila’s lab. “What is in the bottle, young seekers?” she asks.

Gaber goes to her computer and types in his question about separating salt from sea water.

Maisa says, “I was thinking about evaporation. But we would have to find a way to save the unsalted water, right?”

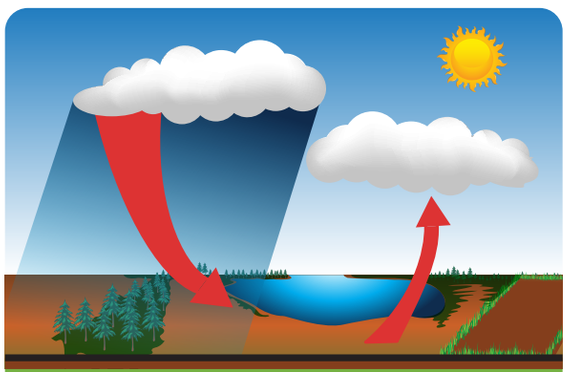
The team sits on the floor with the bottle of seawater, some tubes, and plastic containers

“Hmmmm,” says Maisa. “I wonder if we can make some kind of filter to catch the salt.” “We should make a plan and get to work building,” says Ahmed.

Desalination

Humans cannot drink salt water because the excessive salt upsets our internal balance and leads to organ dysfunction and eventually death.

Desalination is the process of removing dissolved salts and minerals from water. This process involves heating salt water to produce water vapor that is then condensed and collected as fresh water.



Water Cycle

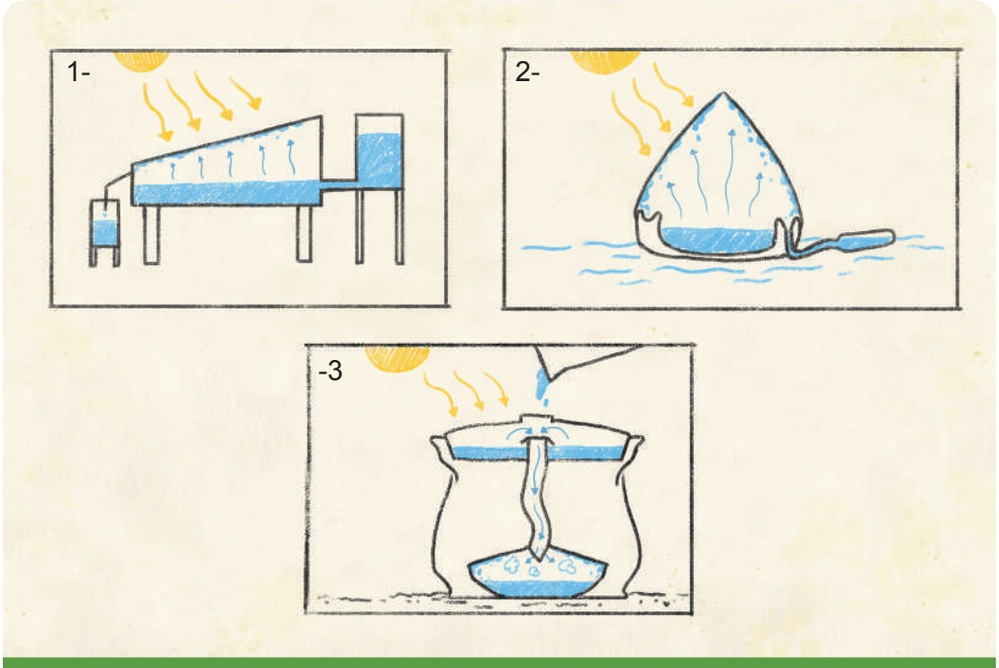
In nature, this process is referred to as the water cycle where the sun supplies the energy needed to cause water to evaporate from surface sources such as oceans and lakes. The water vapor rises into the air where cooler temperatures cause it to condense into clouds and fall back to the earth in the form of precipitation.

Interdisciplinary Project

Solar Stills

When water is heated, evaporated, and then collected again as a liquid, the process is called distillation. The device used to do this is called a solar still.

Many stills use heat and energy from the sun. They are called solar stills. Your team is going to learn more about solar stills. Then you will design and create your own.



Three Solar Still Sketches

Talk Together What is the same and what is different about these three solar stills? Could you and your teammates build a solar still?

Hands-On Investigation

Engineering Your Solution

Challenge

Your challenge is to design and build a solar still that will heat salt water until it evaporates, and then collect condensation as fresh water.

Objectives

In this activity, you will . . .

- Sketch a prototype for your solar still.
- Use what you know about evaporation and condensation.
- Create your design and list the materials your group uses.
- Test your still and decide if your prototype was successful.
- Describe any problems you encounter and explain how you solved them.

What materials do you need? (per group)

- Salt water, 1 L
- Mixing bowls
- Paper or plastic cups
- Sheet pan
- Buckets
- Wax paper
- Plastic wrap
- Cardboard
- Aluminum foil
- Craft sticks
- Rulers
- Masking tape
- Duct tape
- Rubber bands
- Glue

HANDS-ON INVESTIGATION

Life Skills **I can choose the best solution to a problem.**

Interdisciplinary Project

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, Build, and Test** With your teammates, gather materials and begin building your solar still. 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. Identify ways you could improve. Prepare to share with your class.

Group roles

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

Design Requirements

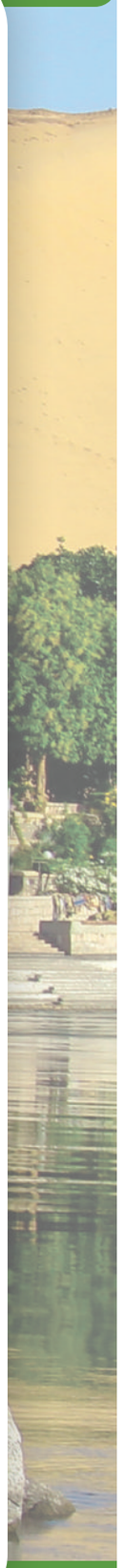
- [ ] Your design should have a place where the salt water is held, where the evaporation and condensation happen, and where the fresh water is collected.
- [ ] Your team's final sketch lists the materials needed and how the design will work.
- [ ] Your group collaborates to use the materials listed to create a solar still.

Sketching Our Design

On your own, sketch your initial idea for your team's solar still prototype. Then, take turns 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 explaining how your prototype will work.

With your team, discuss these two questions:

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



Plan, Build, and Test

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. Next to each item, write down the function it has in your solar still. Remember all three things your solar still should do: hold salt water, have a place for evaporation and condensation, and collect fresh water.

STEP 2 Gather the materials you identified in your blueprint. You may need to make adjustments to 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 solar still. 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 so that they can look for places to make improvements.

STEP 4 For safety reasons, teams must be able to test their water without drinking it. Instead, consider the following questions when testing the effectiveness of your team's solar still:

- Does condensation occur?
- Is the condensation trapped in the solar still?
- Are you able to collect the residual runoff?

STEP 5 Once your project is complete, work with your team to create a presentation to share both your product and your process. Share how you think your solar still could help others collect fresh water from salt water. Also, prepare to share how your team worked together, whether you encountered any problems, and how you worked to make improvements.

Presentation Notes

Analysis and Conclusions

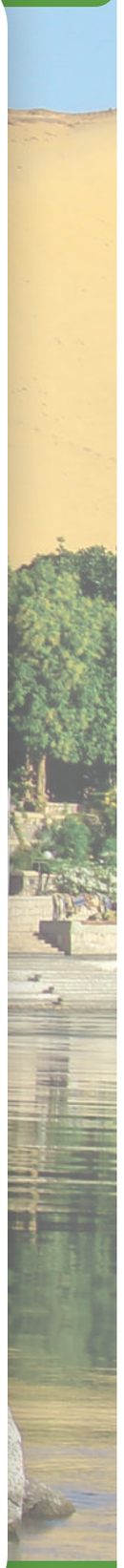
Reflect on the following questions:

1. How did you make sure that your team worked together to create a solar still?

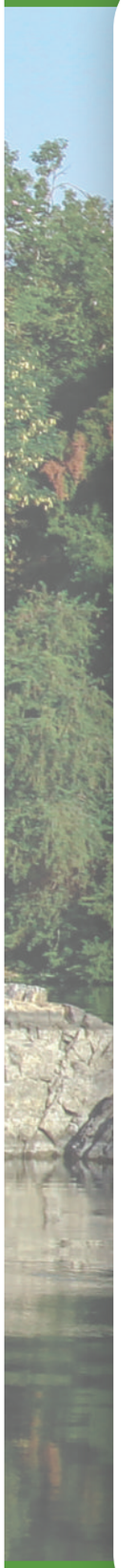
2. Which materials did you use?

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?



Assess your learning



Read and answer the following questions

1. Fresh water that seeps under Earth's surface through a layer of porous rock is . .....

   a. Mediterranean sea water
   b. Bahr Al Baqar plant water.
   c. Assal lake
   d. groundwater

2. ..... are part of geosphere .

   a. Plants
   b. Rocks.
   c. Gases
   d. Water bodies

3. An area of land where water flows in a specific path from a high altitude area to a lower altitude area is .....

   a. river
   b. sea
   c. lake
   d. ocean

4. It results from biosphere and atmosphere interaction.....

   a. Availability of oxygen gas
   b. Soil fertility
   c. Increased pollution
   d. Photosynthesis

5. An example of salt water is ecosystem. .....

   a. Nile River
   b. Assal lake
   c. A glacier
   d. Nasser Lake

6. Most of fresh water on earth is found in the form of .....

   a. groundwater
   b. rivers
   c. glacier rivers still
   d. streams

7. A group of plants and animals which live together in a large area characterized by its climate is called.....

   a. atmosphere
   b. hydrosphere
   c. biome
   d. geosphere

8. Weathering of rocks by water indicates an interaction between..... .

   a. hydrosphere and geosphere
   b. biosphere and hydrosphere
   c. biosphere and atmosphere
   d. atmosphere and hydrosphere

9. Water that covers most of the Earth's surface is..... .

   a. fresh water in rivers
   b. salty water in seas and oceans
   c. fresh water in glaciers
   d. fresh water in groundwater

10. Ther Reserve is one example of .....

   a. sustainability of natural resources
   b. depletion of natural resources
   c. the quality of natural resources
   d. preservation of natural resources

11. Sea and ocean water meet with rivers water at .....

   a. watershed
   b. estuary
   c. surface canal
   d. stream

12. ..... of resources, requires managing its usage methods.

   a. Depletion
   b. Sustainability
   c. Renewability
   d. scarcity

13. Pollution of sea water leads to .....

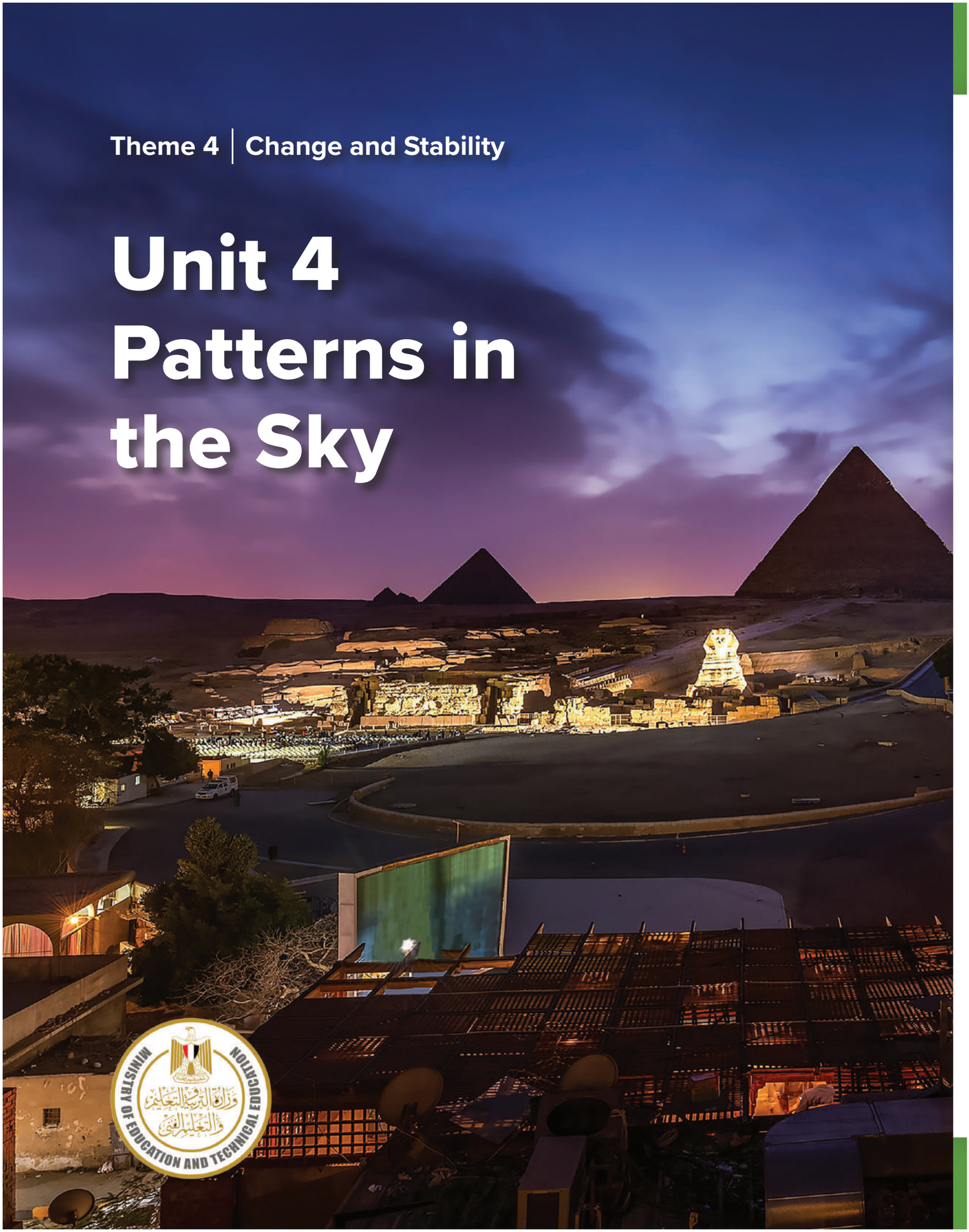
   a. Pollution of water of a tributary.
   b. Pollution of oceans water.
   c. Pollution of water streams.
   d. Wetland pollution.

14. Wastewater engineers work in Egypt in .....

   a. Ras Mohamed Reserve.
   b. Qarun lake.
   c. Bahr El Baqar plant.
   d. electrical power plant.

Theme 4 | Change and Stability

Unit 4
Patterns in the Sky



Get Started

What I Already Know

Have you ever observed the sky at night. Have you watched as **the apparant motion of the sun** across the sky during the day? Have you observed the changes in the shape of the moon? Think about what you already know about patterns in the sky as you look at the image.

As you observe the image, write what you already know about objects in the sky. What objects can you see during the day? What objects can you see at night?

Talk Together Have you ever traveled somewhere and noticed differences in the night sky? What about observations at different times of the year? Share your ideas with your classmates.

Introduction

During this unit, you will discover some patterns in the sky. You will use what you already know about sunlight and shadows, and what you have likely observed about other celestial objects such as the moon and stars. You will learn about the effects of gravity and how this force affects the movement of objects and holds our solar system. You will design models to help describe the movement of Earth in space and explore ways this movement affects patterns like the seasons, the location of stars in the sky, and so on. You will explore changes in shadow length and direction. You will learn more about the sun and about star brightness. Finally, you will bring all of these ideas together in the Unit Project Sundial as you engineer a device to track the movement of Earth and tell time through shadows.

Missing Shadow

Throughout this unit, you will explore patterns of shadows to see how they change during the day and even over a period of months. You will discover what causes shadows to move and change. Shadows are fun to observe and predict. The light for shadows comes from the sun. But the sun is not the only big object in the sky that gives off light. Stars that you see in the night sky do, too. Even though other stars do not make shadows on Earth, they do move in patterns that you can observe.

Camel Caravan Shadows, Sahara Desert

How far away from Earth are stars, like the sun? How can we tell? What patterns are there in the movement of the sun and other stars?

Unit Project Preview

Solve Problems Like a Scientist

Unit Project: Sundial

In this project, you will predict the movement of the sun across the sky and use that information to design sundial.

Sundial

Ask Questions About the Problem

To complete the Unit Project Sundial, you will design and test a sundial using what you know about the movement of the sun across the sky. You will use what you learn during a sundial investigation to make your own original tool for tracking time. Write some questions you can ask to learn more about the problem. As you learn about patterns of motion in the sky in this unit, write down the answers to your questions.

Life Skills **I can choose the best solution to a problem.**

CONCEPT
4.1

Effects of Gravity

Student Objectives

By the end of this concept:

- [ ] I can describe patterns in objects experiencing gravitational force on small scales, and large scales.
- [ ] I can argue from evidence that the gravitational force Earth exerts on objects is directed downward, toward the center of Earth.
- [ ] I can plan and conduct an investigation to produce data to show evidence of the effects of gravity and air resistance on different objects.

Key Vocabulary

- [ ] Air resistance
- [ ] ellipse
- [ ] force
- [ ] friction
- [ ] gravity
- [ ] magnetism
- [ ] motion
- [ ] orbit

Activity 1

Can You Explain?

Look at the image of skydivers in the air. Predict what will happen as they descend toward the ground. why do objects fall toward the ground? What is the **gravity**? in What other ways does gravity affect the motion of objects?

How does gravity affect the movement of objects?

Life Skills **I can share ideas I am not yet sure about.**

Activity 2

Ask Questions Like a Scientist

Gravity

With a partner, look at the images. What they have in common. As you observe, write your observations in the spaces provided.

Girl on Bike Falling Over

Pouring Oil

What do the two images have in common?

What is the cause of motion in each of the images?

Where else do we see gravity in action? Consider small phenomena and large phenomena.

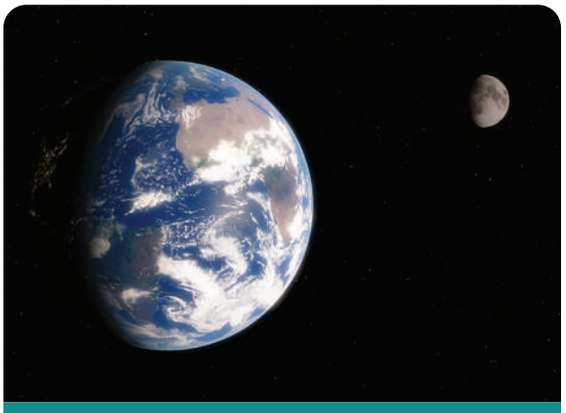
Activity 3

Ask Questions Like a Scientist

Effect the gravity on the movement of objects

Look at each image. Then, answer the questions that follow.

Boy on a Slide



The Earth-Moon System

Why is the boy on the slide moving toward the ground?

Would the boy slide down if there were no gravity? Why or why not?

What keeps the moon in orbit around Earth?

Activity 4

Evaluate Like a Scientist

What Do You Already Know About the Effects of Gravity?

Gravity

Read the statements about gravity. Select all the statements that are true.

A. Gravity pushes an object toward another object.

B. Gravity pulls objects toward the center of Earth.

C. Gravity is caused by Earth's rotation on its axis.

D. Gravity is in effect even when two objects do not touch.

E. Gravity increases as the height of an object above the ground increases.

Mass and Gravitational Force

Think about what you know about gravity in space. Then, answer the question.

Predict what would happen to the gravitational force between Earth and the moon if the moon were twice as large in mass? Explain your answer.

Distance and Gravitational Force

Predict what would happen to the gravitational force between Earth and the moon if the moon were twice as far from Earth? Select the statement that is true.

A. The gravitational force between them would not change.

B. The gravitational force between them would become zero.

C. The gravitational force between them would become greater.

D. The gravitational force between them would become smaller.

Activity 5

Observe Like a Scientist

Forces

Have you ever wondered what causes something to move? Look at these two images. Think about what action results in **motion** in each image.

Forces are needed to make things move. Read the text. Look for examples of cause and effect. Record your ideas in the chart.

A Kick Is a Force

How Things Move

Forces pull and push on objects. Some forces are weak, like that of a push toy truck. Other forces are strong, like that of a real truck. Forces push or pull in different directions.

Magnetism Is a Force

Types of Forces

There are different kinds of forces. Magnets can exert a push or a pull **force**.

A magnet can pull paper clips by using the force of **magnetism**. A magnet can also push away another magnet. Gravity pulls a glass you drop to the floor. Your foot exerts a force against the ground. Wind pushes on the blades of a wind turbine.

Cause	Effect

Activity 6

Observe Like a Scientist

What Is Gravity?

Gravity is all around us. Read the text, and look for cause-and-effect relationships. As you identify a cause-and-effect relationship, write it down.

Gravity is a force of attraction between objects. We know gravity is a force because we can see it in action, such as when something falls. For example, an egg could slip out of your hand and fall to the floor, or you could drop a ball or a book. The force of gravity keeps us from floating into space like an astronaut. In space, there are large and small planets. As the mass of the object increases, the more gravity it has. The force of gravity keeps the planets in an **orbit** or on a path around the sun.

Record your cause-and-effect relationships.

For each example you recorded, think of one question you have regarding the real-world phenomenon that occurred.

Activity 7

Analyze Like a Scientist

The Force of Gravity

Gravity is a force of attraction between objects. Read the text. As you read, highlight evidence that supports the initial ideas about gravity that you recorded in Wonder. Then, answer the questions that follow.

What goes up, must come down

You know that every time you throw a ball up into the air, the ball will come back down. You can test it out. Throw a ball into the air anywhere you want. The ball will go up into the air and then fall back to the ground every time. As the ball flies through the air, the direction it is moving changes. At first, it is moving up. Then, its direction changes, and it starts falling down toward the ground. The ball's direction changes because a force is acting on the ball.

Tennis Ball in Air

The Force of Gravity

This force is gravity. Gravity pulls the ball toward the ground. Throw a paper airplane or a wooden stick into the air. Gravity will always change the object's direction and make it falls towards the ground.

Relation between gravity and Mass

All objects produce gravity because they all have mass. Mass of the Earth is greater than the mass of the moon,so the Earth's gravity is greater than the moon exert greater force on objects around them. Think about the Earth-and moon system. Earth is bigger than the moon; it has more mass. Earth has stronger gravity to the objects than the moon. The moon stays in an orbit around Earth due to Earth's gravity.

make it fall toward the ground.

What keeps the moon in orbit around Earth? What keeps it from crashing into Earth?

What other activities demonstrate gravity's downward pull?

Activity 8

Investigate Like a Scientist

Hands-On Investigation: What Does Down Mean?

Why do you land on the ground when you jump up? Why does a ball fall to the ground when you throw it? What does the term down really mean? In this activity, you will collect, analyze, and interpret data about the force of gravity.

Think about an object falling to the ground. What angle does the object make when it falls? During this investigation, you will be investigating the angle at which an object is pulled toward the ground by the force of gravity.

Make a Prediction

Use the left side of the T-Chart to make predictions about what you think is going to happen. On the right, record how your prediction changed after completing the experiment (reflections).

- How do you think gravity affects the angles at which objects fall toward Earth?
- Why do scientists take multiple measurements and calculate the average?

Predictions	Reflections

What materials do you need? (per group)

- Carpenter's level or calibrated
- Paper
- Scissors
- Pencils
- Protractor
- Meterstick
- String
- Tape
- Small weight
- smartphone app
- Books, several

HANDS-ON INVESTIGATION

What Will You Do?

1. Organize into teams of two or three and gather your materials.
2. Tie a string to a meterstick. Use a piece of tape to hold it in place. Attach a weight to the end of the string.
3. Suspend the meterstick on several books or between benches so the string and the weight can move freely. The weight will not fall, because it is attached to the string. However, you can use the path of the string to measure the path of the weight's movement toward the ground.
4. Use a level or smartphone app to ensure the meterstick is perfectly horizontal.
5. Measure the angle between the meterstick and the string.
6. Using a few more books, tilt the meterstick up on one end and make another measurement of the angle. Then, tilt the meterstick down and measure the angle again. Repeat this step so that you have two measurements for each direction in which the stick is tilted.
7. Record your data in the table. Look for patterns in the data to share with the class. After analyzing your data, answer the questions that follow.

	Trial 1	Trial 2	Average
Level			
Tilt Up			
Tilt Down			

Think About the Activity

Think about the reasons for the different angle measurements. What factors influenced these measurements?

How does gravity affect the measurements of angles in this activity?

What pattern did you notice in the angles when you tilted the meterstick?

Life Skills **I can predict possible outcomes of an event.**

Activity 9

Observe Like a Scientist

Pull and Gravity around Us

What are the effects of gravity that we can see? look for examples of cause-and-effect about gravity, as well as any ideas you find interesting.

Gravity is a force that pulls. Objects with more mass pull objects with less mass toward them. The sun pulls all planets toward it. On Earth, gravity pulls everything toward the center of Earth. A skydiver and their parachute are pulled downward toward Earth's surface. Everything, including us, is held to the ground by Earth's gravitational pull. This is why objects like balls drop to the ground after being thrown up into the air.

Magnetism, Friction, and Air Resistance

Magnetism is another force that attracts metal objects by pulling on them such as iron,nickle and cobalt. **Friction** is a force generated between two touching surfaces. Friction slows the movement of objects. For an example: a bicycle brake pulls back the movement of the tires by friction when it rubs against the tires. Skydivers release parachutes to slow their drop. Parachutes catch the upward flow of wind, creating **air resistance** which pulls skydivers backward and slows their fall to Earth. When an object falls or slows down, a force is acting on that object.

Gravity is all around us. It exists everywhere. It holds tables and chairs on Earth. It holds rocks, animals, and bodies of water on Earth. You cannot see gravity, but you know it is there because you can see the effects of gravity. A ball falls to the floor due to the gravity pulling on it.

Read the text, complete the following table.

Cause-and-effect relationships related to gravity are . . .	
Two ideas I found interesting are . . .	
One question I still have is . . .	

Activity 10

Investigate Like a Scientist

Hands-On Investigation: Gravity and Motion

In this investigation, you will drop balls of different shapes, sizes (small, medium, and large), and materials to see how gravity acts on objects differently. Some of the balls may have holes in them, and some may be made from different materials that are heavier or lighter. After you complete your investigation, discuss the idea of air resistance with your class.

Make a Prediction

Look at the balls you can use for this investigation. Consider what you know about gravity and air resistance.

Which ball will hit the ground first? List the balls in order from first to last.

What materials do you need? (per group)

- Several balls of different shapes and sizes
- Balance or scale
- Safety goggles (per student)

HANDS-ON INVESTIGATION

What Will You Do?

1. Mass each ball. Record each mass in the data table.
2. Compare between the size of different balls. Record the size in the data table (small,medium and large).
3. Choose two different balls and drop them both at the same time from a height of 1.5 m. Record your observations.
4. Repeat until you have tested each of the balls at least once.

Race	Type of Ball	Mass (g)	Size (small, medium, large)	Observations
1				
2				
3				
4				
5				

Think About the Activity

Which type of ball reached the ground first? Why?

Think about the demonstration that your teacher performed. How can you explain how air resistance kept the feather from reaching the ground at the same time as the paper clip?

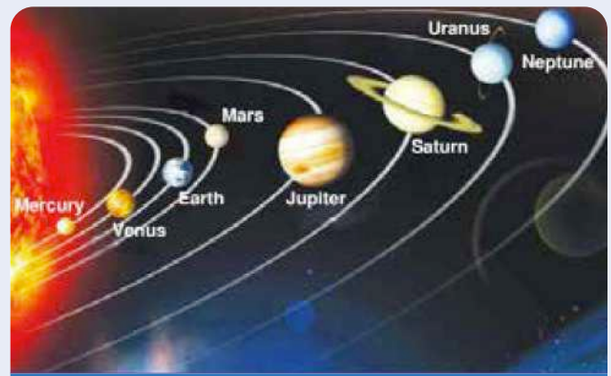
Activity 11

Observe Like a Scientist

The Revolving Planets

As you read this, our planet is moving in a path around the sun. What keeps our planet on this path? Read the text below. Then, use the materials your teacher gives you to model the path of one object revolving around another object. Finally, answer the questions.

In 1543, Nicolaus Copernicus stated that Earth revolved around the sun. Planets travel or revolve around the sun in a path called an orbit. The path is like a flattened circle or an **ellipse**. Right now, we are orbiting the sun at 107,000 km per hour.



Solar System

What makes the planets move in fixed orbits around the sun?

There is an invisible force holding all the planets in place—gravity. Gravity is a force of attraction, or pull, between objects. The sun's powerful gravitational force makes the planets revolving around the sun. Without gravity, the planets would fly off into space The sun and the group of surrounding planets are called solar system.

Use your models to help you answer the following questions. Share your ideas with a partner.

Why is the sun the center of motion of the planets in the solar system?

What combination of objects would best model a planet revolving around the sun?

What type of pattern results from the motion of planets revolving around the sun?

Activity 12

Record Evidence Like a Scientist

Gravity

Now that you have learned about the effects of gravity, look again at the images Girl on Bike Falling Over and Pouring Oil. You first saw these in Wonder.

Girl on Bike Falling Over

Pouring Oil

How can you describe the Girl on Bike Falling Over and Pouring Oil images 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 gravity affect the movement of objects?

Life Skills **I can be reflective.**

Now you will use your new ideas about gravity to write a scientific explanation that answers the Can You Explain? question. To plan your scientific explanation, 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 yes or no.

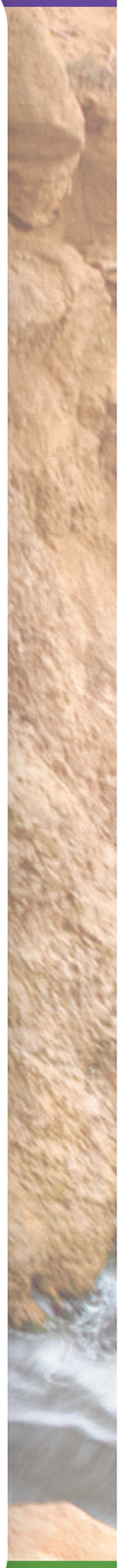
My claim:

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

Evidence:

Now, write your scientific explanation and include your reasoning.

Scientific explanation with reasoning:



CONCEPT
4.2

Patterns of Motion in the Sky

Student Objectives

By the end of this concept:

- [ ] I can develop models that describe how the movement of Earth in space causes cyclical patterns of night and day, seasons, and the apparent movement of the sun, planets, and stars.
- [ ] I can analyze and interpret data to evaluate the claim that sunrise times differ in different cities and over time and describe patterns in sunrise times.
- [ ] I can model patterns of daily changes in the length and direction of shadows, day and night, and the appearance of changes in the moon in the night sky.

Key Vocabulary

- [ ] axis
- [ ] constellation
- [ ] cycle
- [ ] orbit
- [ ] revolution
- [ ] rotation
- [ ] tilt
- [ ] The apparent motion of the sun

Activity 1

Can You Explain?

Have you observed objects in the sky during the day and at night? Share your observations with your class. As you both share and listen to your classmates, consider the question that follows.

What causes the cycle of day and night, and why do the sun, planets, and stars appear to move across the sky (the apparent motion of the sun)?

Life Skills **I can share ideas I am not yet sure about.**

Activity 2

Ask Questions Like a Scientist

Day and Night

Share what you already know about patterns of motion in the sky with your class. Read the text. Think about what causes day and night. Where is the sun during the night?

At this moment, do you feel Earth spinning? No. So, how do we know that Earth is spinning if we cannot feel it? The simple answer is the regular pattern of day and night. You know that the sun sets every evening and darkness falls with time, and that it rises every morning, and it will become light. Why does this phenomenon occur day after day?

We have day and night because Earth rotates, or spins, on its **axis**. Earth's axis is an imaginary line passing through the North and South poles. Earth takes a whole day, or 24 hours, to make one complete turn. At any time during its **rotation**, half of Earth faces the sun. This part experiences day. The other half of Earth faces away from the sun and receives no light. This part experiences night. The sun appears to move across the sky. It is Earth rotating which makes it seem as if the sun is moving across the sky. Let's find out what causes day and night.

Record questions you have about day and night.

I wonder . . .

Activity 3

Evaluate Like a Scientist

What Do You Already Know About Patterns of Motion in the Sky?

The items that follow will help your teacher understand what you and your classmates already know about patterns of motion in the sky. Do not worry if you do not know the correct answers at this point in the lesson. Discuss any questions you have with your teacher.

Where Is the Sun in the Sky?

Imagine that you are facing south. Answer the questions.

Where would the sun be in the early morning? To your left, directly above you, or to your right?

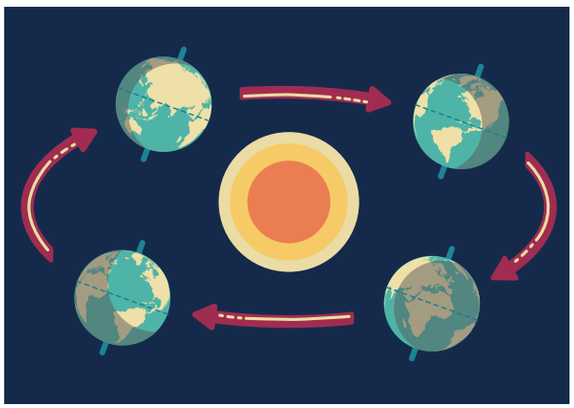
Where would the sun be at noon? To your left, directly above you, or to your right?

Where would the sun be in the late afternoon? To your left, directly above you, or to your right?

Rotation or Revolution

Look at the images. Use the word bank to label each image with the correct term.

revolution	rotation



Cycle of Day and Night

How does Earth's motion explain the cycle of day and night? Select the phrase that completes each sentence correctly.

Earth **[revolves / rotates]** on its axis every

[12 hours/ 24 hours/ month/ year]

This motion causes any location on Earth's surface to experience

[day / night] when facing the sun and **[day / night]** when facing

away from the sun.

Activity 4

Observe Like a Scientist

Rotation

Every day you experience day and night. Why? Read the text. Think about the terms rotation and **cycle**.

Rotation is the spinning of an object on its axis. An axis is an imaginary line that runs through the center of an object. If you look at a globe, you will notice that Earth spins around its axis, which runs vertically through the poles. It takes 24 hours for Earth to make one rotation. We call this an Earth day. Different planets rotate at different speeds. Jupiter is the fastest rotating planet in our solar system.

Day and Night

When Earth rotates, one side faces away from the sun, causing night. One side faces the sun, causing day. Earth rotates counterclockwise from west to east . The spinning causes the motion of the moon and stars in the sky to appear to rise and set. What do you think would happen if Earth stopped spinning on its axis?

Rotation of Earth around its axis from West to East

Day and Night from the International Space Station

What causes the cycle of day and night, and why do the sun, planets, and stars appear to move across the sky?

Activity 5

Analyze Like a Scientist

Sunrise

Earth's path around the sun is not perfectly circular. It is elliptical, like an elongated circle, or oval. Earth rotates counterclockwise on its axis. Earth is also slightly tilted on its axis. The angle of the **tilt** changes throughout the year. The combination of Earth's elliptical **orbit** and the tilt of Earth on its axis results in the sun appearing to travel in different paths across the sky at slightly different speeds each day. This gives us different sunrise and sunset times each day on Earth.

Egypt

Analyze the map and data tables to answer the questions.

Which of these cities in Egypt is located the furthest to the east?

A. Asyut
B. Marsa Alam
C. Siwa

Which of these cities in Egypt is located the furthest to the west?

A. Asyut
B. Marsa Alam
C. Siwa

Which of the cities listed above will see the sunrise first? Why?

Sun in Marsa Alam			
2021	Sunrise/Sunset		
Nov	Sunrise	Sunset	Length
Nov 27	6:05 am	4:50 pm	10:44:35
Nov 28	6:06 am	4:50 pm	10:43:50
Nov 29	6:07 am	4:50 pm	10:43:06
Nov 30	6:07 am	4:50 pm	10:42:24
Dec 1	6:08 am	4:50 pm	10:41:44
Dec 2	6:09 am	4:50 pm	10:41:05
Dec 3	6:09 am	4:50 pm	10:40:28

Sun in Siwa Oasis			
2021	Sunrise/Sunset		
Nov	Sunrise	Sunset	Length
Nov 27	6:51 am	5:19 pm	10:28:22
Nov 28	6:52 am	5:19 pm	10:27:27
Nov 29	6:52 am	5:19 pm	10:26:34
Nov 30	6:53 am	5:19 pm	10:25:44
Dec 1	6:54 am	5:19 pm	10:24:55
Dec 2	6:55 am	5:19 pm	10:24:08
Dec 3	6:55 am	5:19 pm	10:23:23

Compare the data in both tables. Circle the true statements.

A. Marsa Alam sees the sunrise 46 minutes before Siwa.

B. From November 27 to December 2, each day the sun rises earlier than the previous day.

C. The length of the day decreases in Marsa Alam and Siwa from November to December.

D. The sun sets at the same time in Siwa from November 27 to December 3.

E. Marsa Alam has more daylight than Siwa on November 27.

Activity 6

Analyze Like a Scientist

Effects of Earth's Rotation

Does it feel like you are moving? Why do the planets and stars seem to move in the sky? Read the text. Highlight evidence that supports your thinking of how day and night occur and why objects appear to move together as Earth rotates.

Our planet rotates at a speed of more than 1,600 kilometers per hour on its axis. This is very fast, but from our viewpoint, it seems like Earth is standing still. That is because we are moving with Earth. It is like traveling in an airplane. If you are high above the clouds and you look out the window, it can be hard to tell that you are moving. But in fact, you are traveling at hundreds of miles per hour.

Movement of Objects in the Sky

We may not feel Earth rotating, but we notice its effects. For example, the sun appears to move across the sky every day. Earth rotates from west to east, so the sun appears to rise in the east and set in the west. Shadows offer some evidence to support this. The stars and planets also seem to move in the sky at night. Some stars seem to rise and set, like the sun.

Activity 7

Investigate Like a Scientist

Hands-On Investigation: What Can Shadows Tell Us?

In this investigation, you will construct a sundial that will be used to collect data about shadows over time. Shadows teach us that as the sun appears to move throughout the day, so does the shadow it casts. You will use the data to construct a graph. You can use the graph to analyze trends in the light and shadow movement throughout the day.

Make a Prediction

Record some predictions. Think about these questions:

What will happen to the shadow length over the course of the day?

_____

What will happen to the shadow angle over the course of the day?

What materials do you need? (per group)

- Cardstock
- Plastic straw
- Clay
- Graph paper
- Pencils
- Colored pencils
- Compass
- Protractor
- Metric ruler

HANDS-ON INVESTIGATION

What Will You Do?

1. Find a good location to track shadows, away from any structures that might block the sun.
2. Work with your partner to create a sundial. Cut a large rectangle out of the cardstock.
3. Locate the center of the cardstock. Draw reference lines that split the cardstock vertically and horizontally. The intersection of these two lines is the center of the cardstock.
4. Attach the clay to the center of the cardstock.

Life Skills **I can predict possible outcomes of an event.**

5. Stick the straw into the clay to provide an object to cast a measurable shadow.
6. Use your compass to face your sundial north.
7. Collect data on the shadow's length and angle every hour by tracing the shadow on the cardstock.
8. Use a metric ruler to measure length. Use a protractor to measure angle using the horizonal reference line.
9. Use a different color pencil for each hour.
10. Measure the lengths and angles and record them on the data table.
11. Graph the data from the data table.

Look for patterns in these data. Then, graph the data.

Day	Time	Angle	Length

Think About the Activity

What happened to the shadow length over the course of the day?

What happened to the shadow angle over the course of the day?

Why did the shadow length and angle change (or remain the same) over the course of a day?

Why was it important to keep the orientation and location of the sundial the same each day?

What are two factors that affect the length and angle of a shadow?

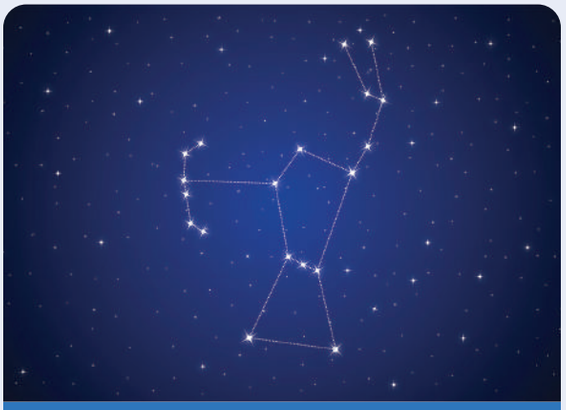
Activity 8

Investigate Like a Scientist

Constellations Visible during Different Seasons

On a really dark night, you may be able to see thousands of stars. Some stars even form shapes in the sky called constellations. Read the text and highlight evidence that supports the idea that different constellations are visible at different times of the year.

Stars in the sky can be grouped together in shapes called constellations. They appear to form patterns in the sky. Some look like people, animals, and other objects. The appearance of star patterns and constellations are associated with specific seasons. As Earth revolves around the sun, different parts of the sky are visible. The constellations shift gradually to the west. In the summer, you are looking in a different direction in space at night than during the winter.



The Constellation Orion

A **constellation** is a group of stars that looks like a certain shape in the sky. These stars are far away from Earth. They are not connected to each other at all. If you were to draw lines in the sky between the stars like a dot-to-dot puzzle, and use lots of imagination, the picture would look like an object, animal, or person. You may have heard of the constellation Orion, who the ancient Greeks named after a mythical hunter.

Constellations on the Move

You may have noticed that the stars seem to move across the night sky. In fact, the positions of the stars do not change. Earth's rotation around its axis makes it seem like they do. You also may have noticed that you can see different constellations in winter than in summer. The other constellations still exist even though you cannot see them. They are just not visible from where you are located on Earth. These changes result from Earth's path around the sun.

Every night, new stars appear from the east because the direction that the night sky faces shifts a little bit. After one **revolution** around the sun, or one year, the night sky is facing the same direction again, and the cycle starts over.

Activity 9

Observe Like a Scientist

Constellations

In this exploration, you will observe constellations and explore differences in the night sky through the year. Read the text, and then answer the questions.

Starlight

Stars make their own light. Stars are made of hot gases, which makes them shine bright. Some stars are larger than our sun, while others are smaller. Planets and moons do not make their own light. Earth's moon reflects the light of the sun.

The Pole Stars

Some constellations are always visible, and others can be seen only during specific seasons. Stars close to the poles, the imaginary points where Earth's north and south axes point in space, have a very small circle of spin. The placement of these constellation varies little throughout the year.

What makes the moon look bright in the sky?

Why does the appearance of the night sky change in different seasons?

How might knowledge of the constellations' locations in the night sky help someone who is lost?

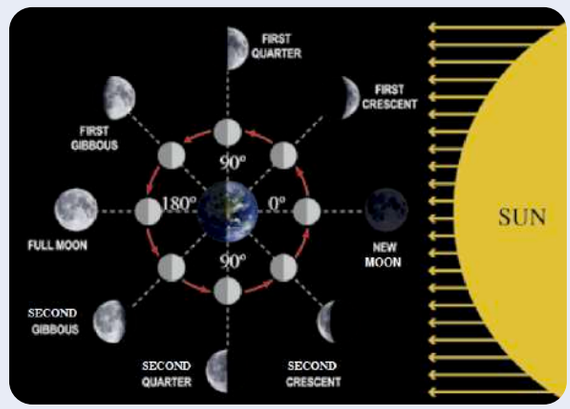
Activity 10

Investigate Like a Scientist

Hands-On Investigation: Phases of the Moon

Have you ever noticed the different shapes of the moon? For example,

Moon passes through a number of phases through its revolution around Earth Where its apparent face changes in shape and in its lightened part size. The difference in Moon`s phases in one full lunar month (Hijri month) happens due to its revolution around Earth in an elliptical orbit. And so, its shape changes from first crescent to first quarter to first gibbous to full Moon, and then to a second gibbous, second quarter, second crescent and finally to new Moon, Where the face of moon facing Earth becomes completely dark and then a new cycle starts again at the beginning of a new lunar month (Hijri month) you will model the Earth-moon-sun system to identify patterns in how we see the moon.



Make a Prediction

Why does the moon have a different appearance on different nights?
Think-pair-share your ideas with a partner.

Think of a time when you have seen different phases when observing the moon. What are some shapes you have seen?

Why would the moon appear to change shape?

Life Skills **I can predict possible outcomes of an event.**

What materials do you need? (per group)

- Lamp with shade removed
- Sharpened pencil
- White foam ball, 5 cm diameter or larger

What Will You Do?

1. Place the lamp on a nearby table and stand next to it.
2. Carefully, push the pencil into the middle of the foam ball. The foam ball will represent the moon in this activity.
3. Turn on the lamp, which represents the sun. Turn off the room lights.
4. Face the lamp and hold the pencil with the ball out at arm's length.
5. Draw what you see.
6. With your arm held out straight, turn your whole body slowly to the left about 45 degrees.
7. Continue turning around to the left. Follow your teacher's directions and record your observations.

Think About the Activity

Where does the light we see when observing the moon come from?

What are some of the shapes we see when observing the moon? What do we call these phases?

Explain what causes the moon to appear to have different shapes or phases.

Would you notice the following lunar shapes?

No	Lunar phases	Moon's shape	Description
1	First crescent		The first phase of lunar phases, where the moon shape is a small shiny crescent , its size increases gradually with time
2	First quarter		In this phase, half of the moon's face is illuminated, and the other half is darkened.
3	First Gibbous		In this phase, the brighten part of the moon's face increases gradually and the line separating the lighted part and the darkened part appears curved
4	Full moon		This phase appears in the middle of the lunar month, where the apparent face of the moon to us is fully illuminated.
5	Second Gibbous		In this phase, the brighten part of the moon's face decreases gradually and the line separating the darkened part and the lighted part appears curved.
6	Second quarter		In this phase, half of the moon's face is darkened, and the other half is illuminated.
7	Second crescent		This phase appears after the second quarter, in which only a small part of its face is lighten
8	New moon		Appears in the last day of the lunar month (Hijiri month), Where the Moon's face that facing Earth becomes cempletely dark

What causes the cycle of day and night, and why do the sun, planets, and stars appear to move across the sky?

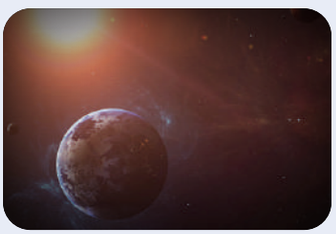
Activity 11

Observe Like a Scientist

What Are Stars?

Studying stars can help us understand more about our **universe**. Read the text. As you do, consider the answer to the following question: What are stars? Work with your classmates to create a summary statement to answer this question.

In 16th century, a scientist named Copernicus proved that the sun was the center of our solar system.You may think the sun is much bigger than other stars. In fact, the sun seems much larger because it is much nearer to Earth. The sun is a medium-sized star and is the only star located in our solar system. Other stars are farther away. The sun, like all stars, uses energy from reactions of gases to give off heat energy and light energy. Stars are giant spheres of highly explosive gas made of mostly **hydrogen** and **helium**. As stars burn gas that reduces huge light energy and heat energy , and leades to bright stars, in the sky. however, debate still continued about how the sun could give off so much heat and light. because the sun size is so large, the sun has opowerfull gravitational pull, This force Keeps 8 plants and more than 200 moons in orbit around it, including Earth. Some scientists say there are many more stars than all the grains of sand on Earth's beaches.



Life Skills I can respect different opinions.

Activity 12

Analyze Like a Scientist

How Do We Study the Stars?

Stars can help us understand how our **galaxy** and other galaxies formed. Read and highlight any text that describes how we use technology to study stars.

You can see many objects in space with just your eyes. Sometimes, you can see comets, meteors, and even human-made satellites like the International Space Station move across the sky. However, most of these objects probably look like small pinpricks of light. It is hard to tell them apart. The universe is so big that many objects are too far away to be seen without help. Many of the objects that we see, such as stars, are too far away to send astronauts to study. Therefore, we must rely on tools that help us see into space. To see more distant objects in greater detail, we need to use technology.

Hubble Space Telescope

Galileo binoculars

Tools like **binoculars** as Galileo binoculars and **telescopes** as Hubble Space Telescope help us take a closer look at the surface of the moon, passing objects like asteroids, our neighboring planets, and stars within and beyond our galaxy.

These tools have limitations though. Our **atmosphere** acts like a protective blanket around Earth. It lets some light waves through,yet it blocks others.

Activity 13

Record Evidence Like a Scientist

Day and Night

Now that you have learned about patterns of motion in the sky.

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?

What causes the cycle of day and night, and why do the sun, planets, and stars appear to move across the sky?

Now you will use your new ideas about day and night to write a scientific explanation that answers the Can You Explain? question. To plan your scientific explanation, 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 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:

Now, write your scientific explanation and include your reasoning. Scientific explanation with reasoning:

Life Skills **I can be reflective.**

STEM in Action

Activity 14

Analyze Like a Scientist

Planetarium Director and the Stars

Read the text and answer the questions that follow.

Let's Visit a Planetarium

Night Sky in the Day

Think about the stars, planets, and constellations in the sky. Did you know you could see all of them in one place? This special kind of place is a space theater. People also call this a planetarium. When stepping foot into this building, you walk into the world of astronomy. You also feel a little bit closer to outer space. Imagine seeing what the night sky looks like, even when it is daylight outside. Plan a visit to your local planetarium and you will experience this.

Planetarium in Alexandria, Egypt

Under the Dome

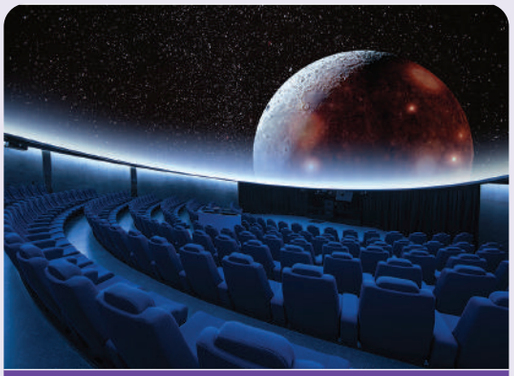
In the space theater, there is a projector. It displays images on the ceiling. This ceiling is shaped like a dome. There are different images you can see.

Some pictures may be of stars, planets, constellations, and other celestial bodies in the universe. There are even special computer programs used at the planetarium.

They allow you to see what the sky looks like during certain times of the month or year. You may even see what the sky looked like many, many years ago.

Planetarium Directors

Different scientists operate planetariums. Typically, they are astronomers, and often they are called planetarium directors. Planetarium directors are scientists who study the properties and behavior of celestial bodies in outer space. They are responsible for bringing outer space to Earth. This can be done through daytime activities or even an amazing nighttime show. At planetariums, people can learn as much as possible about space and the objects within it.



Planetarium Space Theater

Planetarium Director and the Stars

Why is it important for planetarium directors to know about stars, constellations, and other bodies in the universe?

How could you create your own star projector similar to one in a planetarium? What equipment and materials would you need? Describe your design and how you plan to test your projector.

Suppose you are working with a planetarium director. The planetarium director asks you to plan a presentation that introduces students to stars and constellations. How would you use your star projector and other technology to teach the students?

Solve Problems Like a Scientist

Unit Project: Sundial

You have learned a lot about patterns of motion in the sky. In this project, you will use what you know to predict the movement of the sun across the sky. You will then use this knowledge to design and test a human sundial. After you have tested your model, reflect on what worked and what did not work. Then, consider how you could make improvements in the future.

Sundials

Sundials have been used to tell time for thousands of years. Sundials are usually flat disks with a rod at the center, called a **gnomon**. The gnomon casts a shadow onto the disk, and this shadow changes as the sun appears to move across the sky from east to west. You know that the phenomenon of Earth rotating on its axis makes the sun appear to move this way.

Arabic Sundial Model

How a Sundial Works

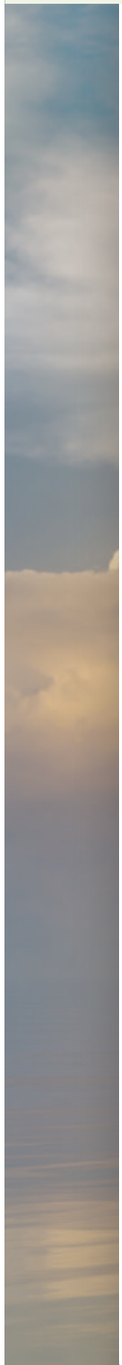
Earth's rotation causes the shadow from the gnomon to move across the disk throughout the day. By making careful observations, people have learned how to mark the disk with the hours of the day. For example, at 10 a.m., the shadow falls on the 10 marker, and at 2 p.m., the shadow falls on the 2 marker. Once the markers are correctly positioned, the sundial can be used to tell time. Of course, the sundial must always stay in the same place. If it is turned, the shadow will tell the wrong time.Types of Sundials

Sundials vary in size, although often they are about a half meter wide and about the right size for a garden. However, some sundials are many meters wide in size. These structures have tall gnomons that can cast very long shadows. Large sundials are

Life Skills **I can choose the best solution to a problem.**

Unit Project

sometimes found in public parks. Some of these larger sundials have no permanent gnomon. How can they work? A person must act as the gnomon in such a sundial. The person stands in the center where the gnomon would ordinarily be and observes where their shadow falls. They can read the time based on which mark is darkened by their shadow. This type of sundial is called a human sundial.



Imagine that your school has been given permission to install sundial. Your class has been asked to design this unique and fun sundial.

What Will You Do?

1. With your group, conduct research in the schoolyard. Choose a location for your human sundial. Both your sundial and the human gnomon should be oriented north. Your teacher will assist you in determining which direction is north.
2. Design your sundial. Sketch your plan in the space provided. Labels all the parts of your design.
3. Gather the materials you will use to build your model.
4. Build and test your design.

Safety note: Remember to never look directly at the sun. Doing so can permanently damage your eyes.

Sketch your plan for your human sundial.

Think About the Activity: Part 1

Write or draw your answers to the questions in the chart.

What Worked?	What Did Not Work?	What Could Work Better?

Think About the Activity: Part 2

How did you decide how large to make your sundial?

What materials did you choose to mark the hours, and why did you choose them?

How did you test the accuracy of your sundial?

Choose the correct answer for each of the following

1. The idea of sundial depends on ..... .
   a- formation of shadows
   b- rotation of object around its axis
   c- motion of the moon
   d- falling objects under the effect of gravity

2. If an object is projected vertically upwords, so the object .....
   a- returns again to Earth under effect of gravity
   b- floats in space because there is no gravity
   c- clings because its gravity equals that of Earth
   d- moves fast towards space

3. The force which is orginated between two touching surfaces and causes to slow the motion is called ..... force.
   a- pushing b- dragging
   c- friction d- pulling

4. The acting force on the moon to make it rotates around the Earth ..... .
   a- Earth's gravity b- Sun's gravity
   c- Moon's gravity d- Mars's gravity

5. Parachute helps in.....
   a- increasing the velocity of object falling to the ground.
   b- slowing down the velocity of object falling to the ground
   c- decreasing the air resistance against the falling object
   d- increasing the drag to object towards the gravity.

6. Moon orbiting the Earth, and the reflection of sunlight on it, leads to formation of .....
   a- constellation b- circular motion
   c- planets attraction d- Moon phases

7. Planets continue revolving around the sun in fixed orbits under the effect of .....
   a- Earth's gravity b- Sun's gravity
   c- Planets gravity d- Moon's gravity

8. From the materials which are attracted to the magnet ..... .
   a- iron and nickel b- aluminum and copper
   c- silver and gold d- aluminum and silver

Assess your learning

9. The sequence of day and night is due to .....
   a- revolution of the Moon around the Earth
   b- revolution of the Earth around the sun
   c- rotation of the Moon around its axis
   d- rotation of the Earth around its axis

10. The illuminated moon in the shape of circle is called.....
   a- full moon
   b- gibbous
   c- first quarter
   d- first crescent

11. One of the results of the revolution of theEarth in elliptical orbit around the sun and the inclination of its axis is .....
   a- differences in sunrise time and the sunset time, day after another
   b- differences in sunrise time, day after another
   c- differences in sunset time, day after another
   d- stability of sunrise time and sunset time, the year around

12. The appearance of Orion constellation in the sky is an evidence of .....
   a- rotation of Earth around its axis and around Earth
   b- constellation of stars in the sky in geometrical figures
   c- rotation of Moon around its axis facing the sun
   d- apparent motion of the sun due to the rotation of Earth around its axis

13. Moon seems to be lighted in the sky due to .....
   a- Reflection of Earth light on Moon's surface
   b- Reflection of stars light on Moon's surface
   c- Reflection of sun lights on Moon's surface
   d- Self-lighting of Moon at night

14. Heat and light energies of the sun result from..... .
   a- explosion of the extremely hot gases inside the sun
   b- the apparent of sun motion daily
   c- revolution of Earth in an elliptical orbit around the sun
   d- revolution of moon around Earth in front of the sun

15. The illumination and the shining of the stars in the sky is an evidence that .....
   a- they are composed of extremely hot gases
   b- they are under the effect of sun gravity
   c- they belong to our solar system
   d- they are from the followers of the sun.