

Fundamentals: EARTH AND SPACE

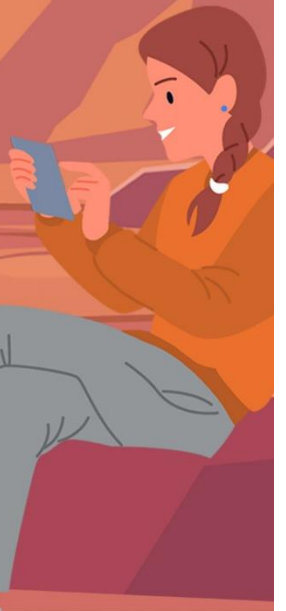
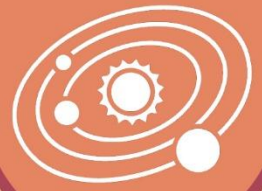




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Series Description

Introduction

The “Fundamentals” series was developed and updated based on the Puerto Rico Core Standards curricular designs and the Curriculum Framework created by the Department of Education.

This series presents course content in a dynamic, innovative, and recreational manner. It also gives students the opportunity to appreciate science as part of their daily life and not just as an academic subject that has nothing to do with them or their surroundings. This approach encourages the study of this discipline by placing scientific research, skills and processes within reach.

Philosophy of the Series

The “Fundamentals” series is created with the purpose of building on the scientific knowledge expected to be covered at each level while integrating new knowledge into the classroom in an accessible way. The new scientific discoveries, analyses, and theories used in this series reflect this new wave of knowledge that will be present in our future, without losing sight of the standards and expectations of the grade corresponding to the course.

The series is composed of worksheets that integrate different levels of thinking. For example, the “Comprehend” worksheet requires the student to review the content that was taught in order to answer the exercises it contains, while the “Apply” worksheet encourages students to analyze in depth what they have learned.

The “Let's Do Science” lab sheets constitute another area of education: learning by practicing. This implies that students, after having reviewed the lesson and having completed the “Comprehend” and “Apply” documents, can put their knowledge into practice through a scientific demonstration of an experiment or through the qualitative and quantitative analysis of different substances.

The “Fundamentals” series will serve as a bridge to convey the knowledge that students will need in upper-level courses.



Series Overview

The idea of science can be intimidating, so the series aims to provide knowledge in an accessible way through advanced terms and topics that fit the student's grade level. Thus, showing the link and correlation of science to everyday life. In addition, a better dynamic in the classroom is aspired and the negative expectations and preconceptions that students may have about science are transformed into positive experiences.

Through this series, we hope to expose students to new scientific trends, facilitate the exploration of the scientific method as a useful tool even outside of the laboratory, and develop essential skills such as critical thinking, interpreting data, analyzing results, making measurements, converting units, working in teams, and identifying and classifying properties or characteristics.

Thematic Focus

The content of the "Fundamentals" series was designed with a constructivist perspective, where the student will assess prior knowledge and build upon it by exploring new concepts. Each lesson has an exploration section that will allow the student to assess prior knowledge while expanding their learning through the lesson and applying it through the different worksheets. In order to establish a foundation for further building science knowledge, the first unit will review basic concepts common to the different disciplines, such as the scientific method, safety rules, and laboratory instruments. It is from there that we will move on to the exploration of scientific knowledge.

Puerto Rico Core Standards

- **Engineering and Technology.** Study and apply science and engineering practices in the design and construction of prototypes to solve problems based on scientific evidence.
- **Earth and Space Sciences.** Study and understand the set of disciplines related to the processes that occur on the planet Earth, and the interaction of it with the universe.



Course Structure: Curricular Components

Lesson Content

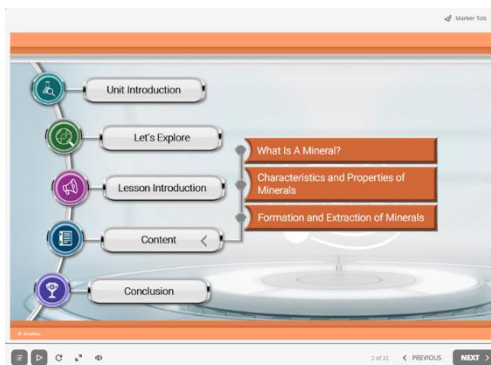
Cover



The cover page is the lesson presentation that includes the following components:

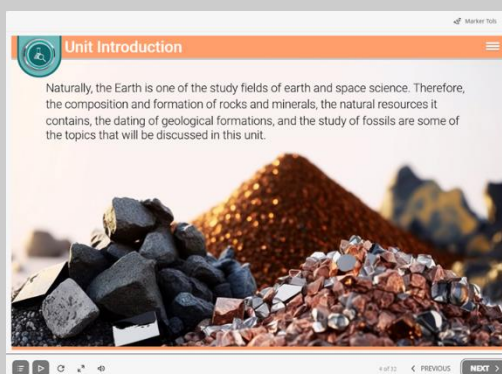
- "Fundamentals: Earth and Space" (course title);
- "The Earth" (Unit title);
- "Minerals" (Lesson title);
- course design;
- credits.

Table of Contents



The table of contents presents the sections contained in each lesson. Each button here directs you to the section you clicked; this way you can navigate the lesson more efficiently and smoothly.

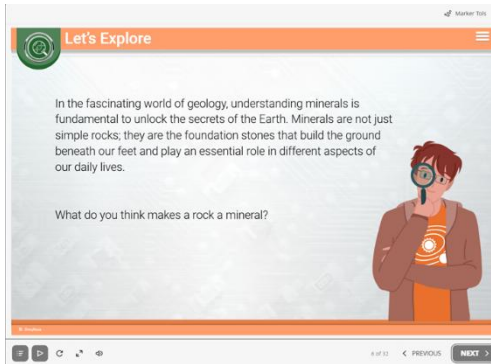
Unit Introduction



The unit introduction is a section that summarizes the most important topics or concepts of each unit and briefly describes them. This section will only be found in the first lesson of each unit.

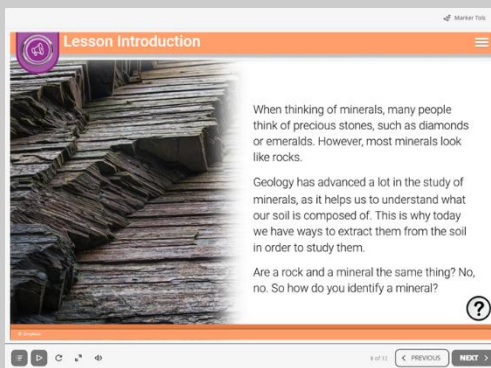


Let's Explore



“Let's Explore” is an exploratory exercise that exposes the student to a first impression of the topics to be discussed in the lesson.

Lesson Introduction



The lesson introduction presents the topics to be covered in the lesson, either by means of an example from everyday life or a historical event.

Lesson Topics



Lesson topics follow the order of introduction, development and conclusion. In addition, they are composed of vocabulary words, key terms, explanations of the topic, examples and, when applicable, practice exercises.



Did You Know?

The “Did You Know?” section shows students an example of the material studied in the lesson applied in the real world. This can be seen in examples of professions, historical data, or other.

Conclusion

The conclusion section introduces the most important points presented in the lesson. This way, the student can examine and review the content of the lesson.

Windows

Review

The “Review” section is a window that helps the student to revisit the points seen in the lesson. This review is usually presented in the form of short questions.



Worksheets

Explore

Name _____ Date _____
Unit: The Earth
Lesson: Minerals

Explore
Mineral Exploration and Identification

In the fascinating world of geology, understanding minerals is fundamental to unlocking the secrets of the Earth. Minerals are not just simple rocks, they are the foundation stones that build the ground beneath our feet and play an essential role in many aspects of our daily lives.

Materials:

- different objects (rocks, minerals, metals, glass, etc.)
- printed sheets of the "Minerals Identification Table";
- research resources (books, internet, encyclopedias);
- blackboard or Flipchart;
- pens and pencils.

Process:

Have you ever wondered what makes a rock a mineral? Today we will find out!

1. Observe the different objects presented by your teacher. Are they minerals or not?
2. Complete the table of data.

The "Explore" worksheet presents a task that has the function of introducing the student to the topic of the lesson. This is intended to determine how much the student knows about the topic before beginning the lesson.

Check Your Knowledge

Name _____ Date _____
Unit: The Earth
Lesson: Minerals

Check Your Knowledge

1. **Multiple Choice.** Choose the correct option for each item.

1. What is the main difference between a rock and a mineral?
 - a. Rocks are organic, minerals are inorganic.
 - b. Rocks are liquid, minerals are solid.
 - c. Rocks are a mixture of minerals, minerals are pure chemical substances.
2. Which of these statements describes the crystalline structure of minerals?
 - a. Minerals have no defined structure.
 - b. Minerals are liquid and have no fixed structure.
 - c. Minerals have atoms, molecules, or ions arranged in a uniform manner.
3. What type of luster do minerals with a metallic appearance have?
 - a. Adamantine.
 - b. Vitreous.
 - c. Metallic.
4. Which of the following minerals is a silicate?
 - a. Calcite.
 - b. Quartz.
 - c. Gold.
5. Which of the following is the most distinctive and recognizable property of a mineral?
 - a. Color.
 - b. Luster.
 - c. Hardness.

The worksheet "Check Your Knowledge" presents the topics discussed in the lesson. This document serves as study material for the student once the lesson is over. It is also useful for the student to identify any topic that they have not mastered and need to re-study.

Apply

Name _____ Date _____
Unit: The Earth
Lesson: Minerals

Applying Knowledge

1. **Answer.** Answer each exercise in complete sentences.

1. Briefly describe the following properties of minerals:
 - a. Hardness:

 - b. Luster:

 - c. Color:

2. Explain how these properties are useful in identifying and classifying minerals:

The "Applying Knowledge" worksheet presents a work that has the function of assessing what the student has learned in the lesson. In this document the student must use what was learned in the lesson to solve a problem of daily life. This should be done at the end of the lesson study.



Let's Do Science

Name _____ Date _____

Unit: The Earth
Lesson: Minerals

Let's Do Science
Exploration of Minerals and their Crystalline Structure

Minerals are the building blocks of the Earth. By understanding their crystalline structure, they provide us with important information about geological formations.

In this activity, we will explore the identification of minerals and their crystalline structure.

Materials:

- samples of different minerals;
- magnifying glass or microscope;
- paper and pens;
- mineral identification worksheets;
- safety equipment (goggles);
- books and research resources.

Process:

1. The teacher will distribute mineral samples.
2. Observe the physical and chemical properties of each mineral using a magnifying glass or microscope.
3. Examine each assigned mineral sample and its properties:
 - **Color:** Write down the main color of the mineral.
 - **Luster:** Observe if the mineral has metallic, vitreous, resinous, pearly, greasy, or adamantine luster. Write it down on the table.
 - **Hardness:** Try to scratch the mineral with common objects (fingernail, coin, etc.) and identify its hardness on a scale from 1 to 10.
 - **Crystalline Structure:** Use the magnifying glass or microscope to examine the crystalline structure of the mineral and indicate if it is granular, lamellar, fibrous, etc. Write it down in the table.

The "Let's Do Science" worksheet presents an activity or laboratory in which the student will apply the scientific method to arrive at a conclusion.

Study Guide

Name _____ Date _____

Unit: The Earth
Lesson: Minerals

Study Guide

Main Ideas:

- Minerals are naturally occurring inorganic solids with a crystalline structure and can be either elements or compounds.
- Minerals are classified as either silicates or non-silicates, depending on their components.
- Minerals can be identified according to properties: luster, cleavage and fracture, color, grain, and hardness.
- The formation of minerals depends on their location.
- The two types of mining are surface mining and underground mining.
- Land restoration and recycling of mineral products are two ways to reduce the effects of mining.
- Minerals have many important applications in industry and in the economy.

Vocabulary

abrasion: type of wear that occurs on the surface of a rock due to friction from erosive agents such as sand, wind, sea waves, or ice.

allochromatic: mineral that has colors that vary greatly.

compound: substance consisting of two or more elements chemically bonded together.

crystal: solid whose atoms, molecules, or ions are arranged in a uniform manner.

element: simple substance that cannot be broken down into smaller parts or transformed into another substance.

The "Study Guide" is a breakdown of the important points of the lesson and the vocabulary words that appear in the lesson.



Unit Breakdown

Below is the breakdown of each unit into lessons, including the titles of each unit and the titles, codes, objectives, topics and keywords of each lesson.

Unit 1: Introduction to Earth Science

Earth science is a set of methods, techniques and knowledge obtained from several areas of science, such as geology, meteorology and oceanography. Although each of these sciences has a particular specialty, there are some elements that are constant in these branches. The use of the scientific method, the International System of Units and the laboratory are some of these elements and are what we will be learning or reviewing in this unit.

At the end of this Unit, the student will have completed the objectives found in the following lessons.

Lesson 1: Earth Science

Code: C469G0SU01L01

Objectives:

At the end of the lesson, the student will:

- explain the importance of knowledge about Earth and Space Science to understand the dynamics of planet Earth;
- describe the main branches of earth science;
- identify the relationship between different branches of science with earth science;
- explain how the scientific method is used in the earth science;
- describe different scientific models.

Topics

- Earth Science
- Applying the Scientific Method in Earth Science
- Scientific Models

Keywords

astronomy, climate, meteorology, radio waves, paleontologist, vulcanology



Lesson 2: Mathematics: The Language of Science

Code: C469G0SU01L02

Objectives:

At the end of the lesson, the student will:

- explain the importance of SI;
- identify the correct unit of measure for each measurement;
- convert SI units of measurement to climate data.

Topics

- International System of Units (SI)
- SI Prefixes
- Significant Figures and Scientific Notation

Keywords

significant figures, accuracy, conversion factor, mass, meter, scientific notation, paleontologist, precision, graduated cylinder, rounding, International System of Units (SI), metric system, temperature, thermometer, volume

Lesson 3: Getting to Know the Science Lab

Code: C469G0SU01L03

Objectives:

At the end of the lesson, the student will:

- identify safety symbols and determine their meaning.

Topics

- Safety in the Lab
- Lab Instruments and their Uses

Keywords

Burette, graduated cylinder, crucibles, watch glass, funnels, Florence flasks, droppers, Erlenmeyer flasks, Büchner flasks, volumetric flasks, microscope, pipettes, hot plate, Petri dishes, test tubes



Unit 2: Maps

The perception we have of the Earth today is radically different from that of ancient civilizations, and in this Unit we will learn how this perception changed and how maps help us to understand the different physical characteristics of the Earth and the limits of its territories.

At the end of this unit, the student will have completed the objectives found in the following lessons.

Lesson 1: Models and Maps

Code: C469G0SU02L01

Objectives:

At the end of the lesson, the student will:

- explain how directions can be found on Earth using a compass;
- explain the differences between magnetic north and geographic north;
- explain how directions on Earth can be found using latitude and longitude;
- distinguish between latitude and longitude;
- explain the distortion of terrestrial maps;
- describe the types of cartographic projections;
- identify the main components of a map;
- explaining modern cartography.

Topics

- How do We Locate Ourselves on Earth?
- Maps of the Earth's Surface
- Modern Cartography

Keywords

compass, cartographer, zenith, magnetic declination, distortion, equator, axis, time zone, latitude, map, meridians, true north, map projection, reference point, cardinal points, summer solstice, remote sensing



Lesson 2: Topographic Maps

Code: C469G0SU02L02

Objectives:

At the end of the lesson, the student will:

- explain what contour lines are;
- describe how the relief of an area relates to contour lines;
- mention the rules of contour lines.

Topics

- What is a Topographic Map?
- Contour Lines
- How to Read a Topographic Map

Keywords

contour lines, elevation, equidistance, contour index, relief, United States Geological Survey (USGS)



Unit 3: The Earth

Naturally, the earth is one of the fields of study of earth and space science. Therefore, the composition and formation of rocks and minerals, the natural resources it contains, the dating of geological formations, and the study of fossils are some of the topics that will be discussed in this unit.

At the end of this unit, the student will have completed the objectives found in the following lessons.

Lesson 1: Minerals

Code: C469G0SU03L01

Objectives:

At the end of the lesson, the student will:

- describe the structure of minerals;
- describe the characteristics and properties of the main groups of minerals;
- identify ways to determine the identity of minerals;
- describe the formation and extraction of minerals.

Topics

- What is a Mineral?
- Characteristics and Properties of Minerals
- Formation and Extraction of Minerals

Keywords

abrasion, luster, composite, crystal, hardness, element, cleavage, fracture, mine, mineral, streak, restoration

Lesson 2: Rocks

Code: C469G0SU03L02

Objectives:

At the end of the lesson, the student will:

- describe the four processes that shape the earth;
- describe the formation of each type of rock: igneous, metamorphic, and sedimentary;
- describe the characteristics of each type of rock.



Topics

- Cycle of Rocks
- Igneous Rocks
- Metamorphic Rocks
- Sedimentary Rocks

Keywords

rock cycle, deposition, endogenous, erosion, stratification, exogenous, foliated, magma, metamorphism, contact metamorphism, regional metamorphism, tectonic movements, non-foliated, recrystallization, rock, igneous rock, metamorphic rock, sedimentary rock, sedimentation, texture

Lesson 3: Energy Resources

Code: C469G0SU03L03

Objectives:

At the end of the lesson, the student will:

- compare renewable and nonrenewable resources;
- describe the uses of natural resources;
- explain how natural resources can be conserved;
- describe the energy resources and their uses;
- identify the three types of fossil fuels;
- identify some of the problems related to the use of fossil fuels;
- describe alternatives to the use of fossil fuels;
- mention the advantages and disadvantages of the use of alternative energy.

Topics

- Natural Resources
- Fossil Fuels
- Alternative Energy

Keywords

biomass, coal, photovoltaic cells, fossil fuel, kinetic energy, biomass energy, wind energy, geothermal energy, hydropower, solar energy, natural gas, petroleum, natural resource, nonrenewable resource, renewable resource, Industrial Revolution



Lesson 4: Rock and Fossil Record

Code: C469G0SU03L04

Objectives:

At the end of the lesson, the student will:

- compare uniformitarianism with catastrophism;
- describe how geology has changed;
- explain the importance of paleontology in the study of the earth;
- explain the concepts of relative dating and absolute dating;
- identify the processes that produce rupture in the rock layers;
- explain how age is determined in rocks;
- describe how radioactive decay occurs;
- determine the appropriate type of dating for an object;
- describe how fossils are formed;
- explain how fossils help determine the history of changes in the environment and in organisms;
- explain how geological time is recorded in rock layers;
- identify important events on the geologic time scale.

Topics

- Uniformitarianism vs Catastrophism
- Relative Dating
- Absolute Dating
- Fossils
- Geological Time

Keywords

amber, catastrophism, absolute dating, radiometric dating, relative dating, radioactive decay, discordance, eon, era, geologic time scale, fossil, compressive force, geologist, slope, isotope, paleontology, folding, superposition principle, geologic process, fossil record, geologic time, uniformitarianism, half-life, convergence zones



Unit 4: A Planet in Motion

The most obvious movement of the Earth is the earthquake, but, in addition to earthquakes, the Earth has other ways of moving. There are other movements that are slower and less obvious, but which have been responsible for the way each continent on this planet is formed.

At the end of this unit, the student will have completed the objectives found in the following lessons.

Lesson 1: Composition of Earth

Code: C469G0SU04L01

Objectives:

At the end of the lesson, the student will:

- describe the earth's layers according to their composition and physical properties;
- describe a tectonic plate;
- explain how scientists know the interior of the earth;
- explain Wegener's continental drift hypothesis;
- explain how the expansion of the sea floor allows the movement of continents;
- describe the forces that drive the movement of tectonic plates;
- describe the types of boundaries;
- describe the types of stresses that deform rocks;
- compare the types of faults.

Topics

- Earth Layers
- Tectonic Plates
- Plate Tectonics
- Global Positioning System (GPS)
- Deformation of the Earth's Crust

Keywords

asthenosphere, crust, convection currents, continental drift, seafloor spreading, boundary, convergent boundary, transform boundary, divergent boundary, lithosphere, mantle, core, orogenesis, Pangaea, plate tectonics, Global Positioning System (GPS), tectonic plates



Lesson 2: Earthquakes

Code: C469G0SU04L02

Objectives:

At the end of the lesson, the student will:

- explain what an earthquake is and where they occur;
- identify the types of faults occurring at fault boundaries;
- describe how seismic waves travel;
- explain how earthquakes are detected and how their intensity is measured;
- summarize the safety procedures to be followed during and after an earthquake.

Topics

- What is an Earthquake?
- How do Seismic Waves Travel?
- Measurement of Earthquakes
- Effects of Earthquakes

Keywords

epicenter, Richter Scale, Modified Mercalli Scale, P-waves, S-waves, seismic waves, seismograph, seismometer, earthquake

Lesson 3: Volcanoes

Code: C469G0SU04L03

Objectives:

At the end of the lesson, the student will:

- establish the differences between explosive and non-explosive volcanic eruptions;
- identify the characteristics of a volcano;
- describe the types of lava and pyroclastic material;
- compare types of volcanoes;
- explain how volcanic eruptions can affect the climate;
- describe the formation and flow of magma;
- explain the relationship between plate tectonics and volcanoes.

Topics

- Volcanic Eruptions and their Causes
- Types of Volcanoes

Keywords

crater, volcanic eruption, stratosphere, pyroclastic material, volcano



Unit 5: Soil

A rock formation located east of Hyden, Australia looks like a wave and was formed over 2 million years ago. This is not the only rock formation with a peculiar shape. In this unit, we will learn about this and other phenomena that affect the size and shape of rocks.

At the end of this unit, the student will have completed the objectives found in the following lessons.

Lesson 1: Weathering

Code: C469G0SU05L01

Objectives:

At the end of the lesson, the student will:

- describe the agents that cause mechanical wear of the soil;
- describe the agents that cause chemical weathering of the soil;
- describe how the composition of the rock influences the rate of weathering;
- describe how differences in elevation and climate influence the rate of weathering;
- describe the origin of the soil;
- explain how soil characteristics affect plant growth;
- analyze how different climates can affect soil formation;
- describe methods to prevent soil erosion.

Topics

- What is Weathering?
- Types of Weathering
- Weathering Rates
- From the Rocks to the Soil
- Soil Preservation

Keywords

abrasion, boulders, differential weathering, chemical weathering, wind erosion, fragmentation, hydrolysis, horizon, humus, infiltration, bedrock, biological weathering, physical or mechanical weathering, weathering, oxidation, acid precipitation, parent rock, soil, soil texture



Lesson 2: Soil Erosion and Deposition

Code: C469G0SU05L02

Objectives:

At the end of the lesson, the student will:

- explain the effects of waves on the coasts;
- identify the characteristics of the shores created by the waves;
- identify geographic features produced by wind erosion and deposition;
- explain the displacement of the dunes;
- compare alpine glaciers with polar glaciers;
- describe the role of gravity as an agent of erosion and deposition;
- describe the types of rapid mass movements.

Topics

- Coastal Erosion and Deposition
- Wind Erosion and Deposition
- Glacial Erosion and Deposition
- Effects of Gravity on Erosion and Deposition

Keywords

glacial clay, creep, shore current, coastline, deflation, glacial drift, stratified drift, dune, coastal erosion, glacier, lahars, loess, mass movement, waves, beach, surf, saltation, wave trains



Unit 6: Meteorology

Sometimes, the plans we make are at the mercy of the weather or depend on climate. These are concepts that we sometimes confuse or think they mean the same thing. In this unit, we will not only learn to differentiate between climate and weather, but we will also see how the atmosphere of our planet influences them and how this affects us.

At the end of this unit, the student will have completed the objectives found in the following lessons.

Lesson 1: The Atmosphere

Code: C469G0SU06L01

Objectives:

At the end of the lesson, the student will:

- describe the layers of the earth's atmosphere and their function in relation to the earth;
- summarize heat transfer processes;
- describe global and local wind patterns;
- recognize and use the units of measurement in data collected in weather reports;
- identify sources of air pollution and their effect on the environment.

Topics

- Composition of the Atmosphere
- Warming of the Atmosphere
- Winds
- Air Pollution

Keywords

anthropogenic, atmosphere, global warming, heat, climate change, convection cells, pressure belts, conduction, air pollution, jet streams, equator, Coriolis effect, greenhouse effect, smog, stratosphere, exosphere, atmospheric phenomena, mesosphere, meteoroid, meteorology, atmospheric pressure, radiation, thermosphere, troposphere, wind, trade winds, westerly winds, global winds, local winds, polar winds



Lesson 2: Weather

Code: C469G0SU06L02

Objectives:

At the end of the lesson, the student will:

- explain how water moves in the atmosphere;
- describe how fronts change weather conditions;
- describe the formation of thunderstorms, tornadoes and hurricanes;
- describe the instruments used to predict weather conditions.

Topics

- Water in the Atmosphere
- Air Masses and Fronts
- Bad Weather: Storms, Tornadoes, and Hurricanes
- Weather Forecast

Keywords

anticyclone, cyclone, condensation, static electricity, front, humidity, relative humidity, hurricane, air mass, cloud, precipitation, psychrometer, dew point, lightning, supercell, thermometer, weather, thunderstorm, tornado, thunder

Lesson 3: Climate

Code: C469G0SU06L03

Objectives:

At the end of the lesson, the student will:

- identify the factors that determine the climate;
- establish the differences between weather and climate;
- describe the biomes of the tropical zone;
- locate and describe the temperate and polar zones;
- describe the biomes found in temperate and polar zones;
- compare the different climatic zones that exist on earth;
- describe changes in climate over time.

Topics

- What is Climate?
- The Tropics
- Temperate and Polar Zones
- Why Does Climate Change?

Keywords

climate change, Milankovitch cycle, climate, monsoon, permafrost



Unit 7: Oceanography

Oceanography is a field of science that studies everything related to the oceans. Considering that most of the water on planet Earth belongs to the oceans, the knowledge that this science provides is very valuable. In this unit, we will learn about the ocean from its surface to its bottom, as well as its properties and the organisms that inhabit it.

At the end of this unit, the student will have completed the objectives found in the following lessons.

Lesson 1: Oceans

Code: C469G0SU07L01

Objectives:

At the end of the lesson, the student will:

- describe the formation of the oceans;
- identify the properties of ocean water;
- mention the main ones of the global ocean;
- explain the processes of melting, crystallization, erosion, deformation, and sedimentation occurring in the oceans.

Topics

- Ocean Formation
- Characteristics of the Ocean

Keywords

ocean, global ocean, salinity

Lesson 2: Ocean Floor

Code: C469G0SU07L02

Objectives:

At the end of the lesson, the student will:

- describe the technologies used to study the ocean;
- analyze and interpret data on the distribution of rocks and fossils on the seafloor that provide evidence for plate tectonic theory.

Topics

- Studying the Ocean Floor
- Characteristics of the Ocean Floor
- Ocean Floor

**Keywords**

mid-ocean ridge, echolocation, extremophile, foraminifera, oceanic trench, abyssal plain, convergent boundary, multibeam, paleomagnetism, continental shelf, side scan sonar, oceanographer, continental slope

Lesson 3: Life in the Ocean

Code: C469G0SU07L03

Objectives:

At the end of the lesson, the student will:

- identify the ecological zones of marine environments;
- describe the groups of marine organisms.

Topics

- Groups of Marine Organism
- Marine Environments

Keywords

benthos, detritus, epibenthos, phytoplankton, infauna , nekton, plankton, abyssal zone, bathyal zone, intertidal zone, neritic zone, sublittoral zone, zooplankton

Lesson 4: Ocean Resources

Code: C469G0SU07L04

Objectives:

At the end of the lesson, the student will:

- describe the groups of marine organisms.

Topics

- Biotic Resources
- Abiotic Resources

Keywords

aquaculture, fishing gear, desalination, artisanal fishing, sport fishing, industrial fishing, abiotic resources, biotic resources



Lesson 5: Ocean Pollution

Code: C469G0SU07L05

Objectives:

At the end of the lesson, the student will:

- explain the difference between point and nonpoint pollution;
- describe efforts being made to reduce ocean pollution.

Topics

- Ocean Pollution
- Ocean Preservation

Keywords

nonpoint pollution, point pollution, eutrophication, fertilizers, pesticide

Lesson 6: Ocean Water

Code: C469G0SU07L06

Objectives:

At the end of the lesson, the student will:

- describe surface currents and the factors that create them;
- describe the deep currents and the factors that create them;
- explain the influence of currents on climate;
- describe El Niño and La Niña phenomena;
- describe the types of waves;
- explain the relationship of the parts of a wave and wave motions;
- explain the relationship of the tides to the Sun and the Moon;
- describe the types of tides and analyze their relationship to coastal areas.

Topics

- Currents
- Relation Between Climate and Currents
- Waves and Tides

Keywords

amplitude, whitecaps, thermohaline circulation, deep current, surface current, ridge, Coriolis effect, El Niño, La Niña, Longitude, tide, high tide, low tide, spring tide, neap tide, orbital motion, Period, tidal range, sine, upwelling, seiche, tsunami



Unit 8: Space

Humans have always been fascinated by the question of what lies beyond our planet. Before technology allowed us to travel into space, many scientists had already formulated theories about the formation and movement of the planets. In this unit, we will learn about those scientists' findings about space, including how the universe and all the celestial bodies it contains are believed to have formed.

At the end of this unit, the student will have completed the objectives found in the following lessons.

Lesson 1: Astronomy

Code: C469G0SU08L01

Objectives:

At the end of the lesson, the student will:

- describe the first ideas about the structure of the universe;
- describe the contributions of Brahe, Kepler, Galileo, Newton and Hubble to modern astronomy;
- compare the different types of telescopes;
- mention the different types of electromagnetic radiation with which astronomers study objects in space;
- describe how celestial objects are located by means of a sphere;
- explain the organization of the night sky according to constellations;
- explaining size and scale in the universe;
- describe the evidence of the expanding universe.

Topics

- The Study of the First Science
- Telescopes
- Constellations

Keywords

astronomy, astronomer, year, light year, redshift, day, calendars, zenith, constellation, gravitational force, month, Hubble's law, geocentric theory, heliocentric theory, telescope, refracting telescope, reflecting telescope



Lesson 2: Stars and Galaxies

Code: C469G0SU08L02

Objectives:

At the end of the lesson, the student will:

- explain the classification of stars;
- identify how astronomers measure the distance between stars;
- describe the different types of stars;
- describe the H-R diagram;
- identify the different types of galaxies;
- describe the composition and characteristics of galaxies;
- explain the importance of observing galaxies.

Topics

- Stars
- The Life Cycle of Stars
- Galaxies

Keywords

biological science, science, scientific knowledge, empirical knowledge, properties, pseudoscience

Lesson 3: The Universe

Code: C469G0SU08L03

Objectives:

At the end of the lesson, the student will:

- describe the Big Bang theory and analyze the evidence supporting it;
- describe the structure of the universe;
- explain how the age of the universe is calculated.

Topics

- The Formation of the Universe – The Big Bang Theory
- An Expanding Universe

Keywords

astrophysics, redshift, cosmology, cluster, photon, elementary particles, Big Bang theory, universe



Lesson 4: The Solar System

Code: C469G0SU08L04

Objectives:

At the end of the lesson, the student will:

- describe how the solar system was formed;
- understanding the role of the force of gravity in the structure of the universe;
- describe the structure and formation of the Sun;
- explain the various roles of the Sun in the solar system and its importance for life on Earth;
- describe the formation and structure of the Earth;
- explain the difference between rotation and translation;
- describe the laws of planetary motion and gravitational attraction.

Topics

- Solar System Formation
- Our Star: The Sun
- The Shape of the Earth
- Planetary Motion and Kepler's Law
- Law of Universal Gravitation

Keywords

aphelion, convection, differentiation, photosynthesis, centrifugal force, nuclear fusion, orbit, perihelion, orbital period, plasma, protoplanet

Lesson 5: The Planets

Code: C469G0SU08L05

Objectives:

At the end of the lesson, the student will:

- name the planets according to the order in which they orbit the Sun;
- establish the differences between the inner and outer planets;
- explain how distances are measured in space;
- explain the difference between the periods of rotation and revolution of a planet;
- describe the differences between terrestrial planets and gas giants.
- explain the lunar phases;
- establish the differences between a lunar eclipse and a solar eclipse;
- explain the importance of the study of smaller celestial bodies.



Topics

- Inner Planets
- Outer Planets
- Moons
- Other Solar System Bodies

Keywords

asteroid, asteroid belt, comet, eclipse, orbital eccentricity, moon phase, Great Dark Spot, meteorite, dwarf planet, progressive rotation, retrograde rotation, satellite, sublimation



Unit 9: Space Exploration

Space vehicles have been the key to reach the universe. In this unit you will learn about everything from rockets to probes. Also how physics, engineering and technology are used to overcome the challenges of space and expand our knowledge of the universe.

At the end of this unit, the student will have completed the objectives found in the following lessons.

Lesson 1: Spacecraft

Code: C469G0SU09L01

Objectives:

At the end of the lesson, the student will:

- model the evolution of rockets;
- describe what space probes are and their function;
- explain the types of orbits.

Topics

- Rockets
- Space Probes

Keywords

rocket, centrifugal force, thrust force, gravity force, NASA, space probe, escape velocity, orbital velocity

Lesson 2: Satellites

Code: C469G0SU09L02

Objectives:

At the end of the lesson, the student will:

- explain the functions of artificial satellites.

Topics

- Natural Satellites
- Artificial Satellites

Keywords

artificial satellite, natural satellite, Global Positioning System (GPS)



Lesson 3: Humans in Space

Code: C469G0SU09L03

Objectives:

At the end of the lesson, the student will:

- explain the preparation that humans should have before space travel;
- summarize the history of human space flight;
- analyze the pros and cons of space exploration.

Topics

- Astronauts
- Humans Working in Space
- Benefits of Space Exploration

Keywords

moon landing, astronaut