

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

**The Nature of Science****Introduction to Physical Science****What Is Science?**

- Compare and contrast theories and laws.
- Define science and identify questions that science cannot answer.
- Identify a system and its components.
- Identify the three branches of science.

**Science in Action**

- Define hypothesis.
- Identify some skills scientists use.
- Recognize the difference between observation and inference.

**Models in Science**

- Describe various types of models.
- Discuss limitations of models.

**Evaluating Scientific Explanation**

- Evaluate promotional claims.
- Evaluate scientific explanations.

**What Is Technology?**

- Describe the parts of a technological system.
- Explain how society and technology affect each other.
- Identify the steps in the technology design process, and describe what is involved in each step.

**Measurement****Description and Measurement**

- Determine how reasonable a measurement is by estimating.
- Distinguish between precision and accuracy in measurement.
- Identify and use the rules for rounding a number.

**SI Units**

- Identify the purpose of SI.
- Identify the SI units of length, volume, mass, temperature, time and rate.

**Drawings, Tables, and Graphs**

- Describe how to use pictures and tables to give information.
- Distinguish the correct use of each type of graph.
- Identify and use three types of graphs.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

**Chemical Building Blocks****Matter****What Is Matter?**

- Categorize materials as pure substances or mixtures.
- Describe molecules, and explain how they are formed.
- Distinguish between elements and compounds.
- Explain the relationship between matter, atoms, and elements.
- Interpret and write some common chemical formulas.

**Properties of Matter**

- Describe characteristic properties, and give examples.
- Distinguish between the physical and chemical properties of matter, and give examples of each.
- Explain how materials are suited for different uses based on their physical and chemical properties and give examples.
- Perform calculations involving density.

**Changes of Matter**

- Compare and contrast physical and chemical changes.
- Describe how to detect whether a chemical change has occurred.
- Explain chemical change, and give examples of chemical changes.
- Explain physical change, and give examples of physical changes.

**Solids, Liquids, and Gases****States of Matter**

- Describe the characteristics of a gas.
- Describe the characteristics of a liquid.
- Describe the characteristics of a solid.

**Changes of State**

- Explain what happens to a substance during changes between liquid and gas.
- Explain what happens to a substance during changes between solid and gas.
- Explain what happens to a substance during changes between solid and liquid.

**Gas Behavior**

- Explain how the volume, temperature, and pressure of a gas are related.
- List the types of measurements used when working with gases.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

## Atoms, Elements, and the Periodic Table

### Atomic Structure

Compare and contrast Bohr's model with the modern model of the atom.

Explain Dalton's atomic theory, and describe why it was more successful than Democritus's theory.

State the charge, mass, and location of each part of an atom according to the modern model of the atom.

### A Guided Tour of the Periodic Table

Describe how the abundance of isotopes affect an element's average atomic mass.

Determine how many protons, neutrons, and electrons an atom has, given its symbol, atomic number, and mass number.

Explain why some atoms gain or lose electrons to form ions.

Relate the organization of the periodic table to the arrangement of electrons within an atom.

### Why Do Atoms Combine?

Compare how the arrangement of electrons in an atom is related to its place in the periodic table.

Compare the relative amounts of energy of electrons in an atom.

Identify how electrons are arranged in an atom.

### Metals

Explain how the elements that follow uranium are produced.

Explain how the reactivity of metals changes across the periodic table.

List the physical properties of metals.

### Nonmetals and Metalloids

Describe the properties of nonmetals.

Tell how metalloids are useful.

### Radioactive Elements

Describe how radioactive isotopes are useful.

Describe how radioactivity was discovered.

Identify the types of particles and energy that radioactive decay can produce.

## The Structure of Matter

### Compounds and Molecules

Describe how the chemical structure of a compound affects its properties.

Distinguish between compounds and mixtures.

Relate the chemical formula of a compound to the relative numbers of atoms or ions present in the compound.

Use models to visualize a compound's chemical structure.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

**Ionic Bonds**

- Describe ions, and explain how they form bonds.
- Explain how the formulas and names of ionic compounds are written.
- Identify the properties of ionic compounds.

**Covalent Bonds**

- Explain how unequal sharing of electrons occurs and how it affects molecules.
- Identify the properties of molecular compounds.
- State what holds covalently bonded atoms together.

**Compound Names and Formulas**

- Distinguish a covalent compound's empirical formula from its molecular formula.
- Name simple ionic and covalent compounds.
- Predict the charge of a transition metal cation in an ionic compound.
- Write chemical formulas for simple ionic compounds.

**Organic and Biochemical Compounds**

- Describe how carbon atoms bond covalently to form organic compounds.
- Identify the names and structures of groups of simple organic compounds and polymers.
- Identify what makes up the polymers that are essential to life.

**Chemical Reactions****The Nature of Chemical Reactions**

- Describe the differences between endothermic and exothermic reactions.
- Explain chemical changes in terms of the structure and motion of atom and molecules.
- Identify situations involving chemical energy.
- Recognize some signs that a chemical reaction may be taking place.

**Reaction Types**

- Describe reactions that transfer or share electrons between molecules, atoms, or ions.
- Distinguish among the five general types of chemical reactions.
- Predict the products of some reactions based on the reaction type.

**Balancing Chemical Equations**

- Calculate the relative masses of reactants and products from a chemical equation.
- Demonstrate how to balance chemical equations.
- Explain how the law of definite proportions allows for predictions about reaction amounts.
- Identify mole ratios in a balanced chemical equation.
- Interpret chemical equations to determine the relative number of moles of reactants needed and moles of products formed.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

**Rates of Change**

- Apply Le Chatelier's principle to predict the effect of changes in concentration, temperature, and pressure in an equilibrium process.
- Describe the factors affecting reaction rates.
- Explain chemical equilibrium in terms of equal forward and reverse reaction rates.
- Explain the effect a catalyst has on a chemical reaction.

**Acids, Bases, and Solutions****Understanding Solutions**

- Explain how solutes affect the freezing point and boiling point of a solvent.
- Describe what happens to the particles of a solute when a solution forms.
- State the characteristics of solutions, colloids, and suspensions.

**Concentration and Solubility**

- Describe how concentration is measured.
- Explain why solubility is useful in identifying substances.
- Identify factors that affect the solubility of a substance.

**Describing Acids and Bases**

- Identify where acids and bases are commonly used.
- Names the properties of acids and bases.

**Acids and Bases in Solution**

- Describe what happens in a neutralization reaction.
- Explain what pH tells you about a solution.
- State what kinds of ions acids and bases form in water.

**Digestion and pH**

- Describe how pH affects digestion.
- Explain why the body must digest food.

**Carbon Chemistry****Simple Organic Compounds**

- Describe how saturated and unsaturated hydrocarbons differ.
- Explain why carbon is able to form many compounds.
- Identify isomers of organic compounds.

**Other Organic Compounds**

- Describe how new compounds are formed by substituting hydrogens in hydrocarbons.
- Identify the classes of compounds that result from substitution.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

**Biological Compounds**

- Describe how large organic molecules are made.
- Explain the roles of organic molecules in the body.
- Explain why eating a balanced diet is important for good health.

**Motion, Forces, and Energy****Motion****Measuring Motion**

- Distinguish between speed and velocity.
- Explain the relationship between motion and a frame of reference.
- Relate speed to distance and time.
- Solve problems related to time, distance, displacement, speed, and velocity.

**Acceleration**

- Define acceleration.
- Predict what effect acceleration will have on motion.

**Momentum**

- Define momentum.
- Explain the relationship between mass and inertia.
- Predict motion using the law of conservation of momentum.

**Force and Newton****Newton's First Law**

- Describe Newton's First law of motion.
- Distinguish between balanced and net forces.
- Explain how friction affects motion.

**Newton's Second Law**

- Describe Newton's second law of motion.
- Explain why objects accelerate during free fall.
- Explain why the direction of force is important.
- Identify the factors that affect the gravitational force between two objects.

**Newton's Third Law**

- Identify the relationship between the forces that objects exert on each other.

**Rockets and Satellites**

- Describe the forces that keep a satellite in orbit.
- Explain how a rocket lifts off the ground.

Unit	Topic	Lesson	Lesson Objectives
<b>Forces in Fluids</b>			
<b>Pressure</b>			
Describe how fluid pressure changes with elevation and depth.			
Explain how fluids exert pressure.			
Explain what pressure depends on.			
<b>Why Do Objects Float?</b>			
Define density.			
Explain floating and sinking using Archimedes' principle.			
Explain how the pressure in a fluid produces a buoyant force.			
<b>Doing Work with Fluids</b>			
Describe Bernoulli's principle.			
Describe how a hydraulic system increases force.			
Explain how forces are transmitted through fluids.			
<b>Work and Simple Machines</b>			
<b>Work and Power</b>			
Calculate how much work is done.			
Explain the relationship between work and power.			
Recognize when work is done.			
<b>Using Machines</b>			
Calculate the mechanical advantages and efficiency of a machine.			
Explain how a machine makes work easier.			
Explain how friction reduces efficiency.			
<b>Simple Machines</b>			
Describe how to find the mechanical advantage of each simple machine.			
Distinguish among the different simple machines.			
<b>Energy</b>			
<b>What Is Energy?</b>			
Describe how energy, work, and power are related.			
Name and describe the two basic kinds of energy.			
<b>Forms of Energy</b>			
Explain how an object's mechanical energy is determined.			
Name some forms of energy associated with the particles that make up objects.			

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

### Energy Transformations and Conservation

- Describe how different forms of energy are related.
- Name common energy transformations.
- State the law of conservation of energy.

### Energy and Fossil Fuels

- Describe how energy is transformed when fossil fuels are used.
- Identify the source of the energy stored in fossil fuels.

## Thermal Energy and Heat

### Temperature, Thermal Energy, and Heat

- Describe how thermal energy is related to temperature and heat.
- Explain the significance of a high specific heat.
- Name the three common temperature scales.

### Heat

- Describe three ways heat is transferred.
- Explain the difference between thermal energy and heat.
- Identify materials that are insulators or conductors.

### Uses of Heat

- Describe how heat engines use thermal energy.
- Describe how refrigerators keep things cold.

## Waves, Sound, and Light

### Waves

#### What Are Waves?

- Describe two types of waves and how they can be represented.
- Explain what causes mechanical waves.

#### Characteristics of Waves

- Define the terms frequency and period.
- Describe the Doppler effect.
- Identify the crest, trough, amplitude, and wavelength of a wave.
- Solve problems involving wave speed, frequency, and wavelength.

#### Interactions of Waves

- Describe how reflection, refraction, and diffraction change a wave's direction.
- Explain how standing waves form.
- State the different types of interference.

Unit	Topic	Lesson	Lesson Objectives
		<b>Seismic Waves</b>	<p>Explain how a seismograph works.</p> <p>Identify the types of seismic waves.</p>
		<b>Sound</b>	
		<b>Sound</b>	<p>Describe the function of the ear.</p> <p>Explain how harmonics and resonance affect the sound from musical instruments.</p> <p>Explain how sonar and ultrasound imaging work.</p> <p>Recognize what factors affect the speed of sound.</p> <p>Relate loudness and pitch to properties of sound waves.</p>
		<b>Music</b>	<p>Describe how different instruments produce music.</p> <p>Explain how you hear.</p> <p>Explain the difference between music and noise.</p>
		<b>How You Hear Sound</b>	<p>Describe the function of each section of the ear.</p> <p>Identify what causes hearing loss.</p>
		<b>Electromagnetic Waves</b>	
		<b>The Nature of Electromagnetic Waves</b>	<p>Identify models that explain the behavior of electromagnetic waves.</p> <p>State what an electromagnetic wave consists of.</p>
		<b>Waves of the Electromagnetic Spectrum</b>	<p>Explain how electromagnetic waves are alike and how they are different.</p> <p>Name the waves that make up the electromagnetic spectrum.</p>
		<b>Using Electromagnetic Waves</b>	<p>Compare and contrast AM and FM radio signals.</p> <p>Describe different ways of using electromagnetic waves to communicate.</p>
		<b>Light</b>	
		<b>Properties of Light</b>	<p>Describe the wave nature of light.</p> <p>Determine why objects appear to have color.</p> <p>Explain how light interacts with materials.</p>

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

### Reflection and Mirrors

- Describe how concave and convex mirrors form an image.
- Determine how mirrors form an image.
- Explain how light is reflected from rough and smooth surfaces.

### Refraction and Lenses

- Determine why light rays refract.
- Explain how convex and concave lenses form images.

### Using Mirrors and Lenses

- Describe how a camera works.
- Explain how microscopes magnify objects.
- Explain how telescopes make distant objects visible.

## Electricity and Magnetism

### Electricity

#### Electric Charge and Static Electricity

- Describe how static electricity builds up and transfers.
- Explain how electric charges interact.
- Explain what an electric field is.

#### Electric Current

- Describe what causes electric charges to flow in a circuit.
- Explain how an electric current is produced.
- Explain how conductors are different from insulators.
- Explain how resistance affects current.

#### Batteries

- Describe what the first battery was made of.
- Explain how an electrochemical cell works.

#### Electric Circuits and Power

- Describe the basic features of an electric circuit.
- Explain how to calculate electric power and the energy used by an appliance.
- Explain what Ohm's law is.
- Identify how many paths currents can take in series and parallel circuits.

#### Electrical Safety

- Describe measures that help protect people from electrical shocks and short circuits.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

## Magnetism

### What Is Magnetism?

- Describe the shape of a magnetic field.
- Explain how magnetic poles interact.
- Explain what the properties of a magnet are.

### Inside a Magnet

- Describe how magnetic domains are arranged in a magnetic material.
- Explain how an atom can behave like a magnet.
- Explain how magnets can be changed.

### Magnetic Earth

- Describe the effects of Earth's magnetic field.
- Explain how Earth is like a bar magnet.

## Using Electricity and Magnetism

### What Is Electromagnetism?

- Describe the characteristics of an electromagnet.
- Explain how an electric current is related to a magnetic field.
- Identify some characteristics of a magnetic field.

### Electricity, Magnetism, and Motion

- Describe how a galvanometer works.
- Describe what an electric motor does.
- Explain how electrical energy can be transformed into mechanical energy.

### Electricity from Magnetism

- Describe how a generator works.
- Describe the function of a transformer.
- Explain how an electric current can be produced in a conductor.

## Electronics

### Electronic Signals and Semiconductors

- Describe two types of electronic signals.
- Explain how semiconductors are used to make electronic components.

### Electronic Communication

- Describe how sound is transmitted by telephone.
- Describe two ways that sound can be reproduced.
- Explain how electromagnetic waves are involved in the transmission of radio and television signals.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

### Computers

- Describe the function of computer hardware and software.
- Describe the purpose of a computer network.
- Explain how information is sorted and processed in a computer.

## Our Universe, Our Galaxy, Our Earth

### The Universe

#### The Life and Death of Stars

- Describe the basic structure and properties of stars.
- Explain how the surface temperature of a star is measured.
- Identify the stages in the evolution of stars.
- Recognize that all normal stars are powered by fusion reactions that form elements.

#### The Milky Way and Other Galaxies

- Define galaxy, and identify Earth's home galaxy.
- Describe two aspects of a quasar, and identify the tools scientists use to study quasars.
- Describe two characteristics of a spiral galaxy.
- Distinguish between the three types of galaxies.

#### Origin of the Universe

- Describe red shift, and explain what it tells scientists about our universe.
- Describe the basic structure of the universe.
- Explain how scientists are using tools and models to hypothesize what may happen to the universe in the future.
- State the main features of the big bang theory, and explain the evidence supporting the expansion of the universe.

### The Solar System

#### Sun, Earth, and Moon

- Describe eclipses and phases of the moon.
- Explain how gravity works within the solar system.
- List two characteristics of the moon, and show how the moon affects Earth's tides.
- Recognize Earth as one of many planets that orbit the sun.

#### The Inner and Outer Planets

- Describe two characteristics of a gas giant.
- Distinguish between the inner and outer planets and their relative distances from the sun.
- Identify the planets of the solar system and their features.
- State two characteristics that allow Earth to sustain life.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

### Formation of the Solar System

- Contrast ancient models of the solar system with the current model.
- Estimate the age of our solar system.
- Explain how scientists think the moon was formed.
- Summarize two points of the nebular model, and describe how it can explain astronomical observations.

## Planet Earth

### Earth's Interior and Plate Tectonics

- Describe the movement of Earth's lithosphere using the theory of plate tectonics.
- Explain how the presence of magnetic bands on the ocean floor supports the theory of plate tectonics.
- Identify Earth's different geologic layers.
- Identify the three types of plate boundaries and the principal structures that form at each of these boundaries.

### Earthquakes and Volcanoes

- Describe how earthquakes are measured and rated.
- Describe the different types of volcanoes.
- Distinguish between primary, secondary, and surface waves in earthquakes.
- Explain how and where volcanoes occur.
- Identify the causes of earthquakes.

### Minerals and Rocks

- Describe the rock cycle and how rocks change form.
- Explain how the relative and absolute ages of rocks are determined.
- Explain the properties of each type of rock based on physical and chemical conditions under which the rock formed.
- Identify the three types of rock.

### Weathering and Erosion

- Describe the importance of water to chemical weathering.
- Distinguish between chemical and physical weathering.
- Explain how chemical weathering can form underground caves in limestone.
- Identify three different physical elements that can cause erosion.

## The Atmosphere

### Characteristics of the Atmosphere

- Describe how the atmosphere has evolved over time.
- Describe how the oxygen-carbon dioxide cycle works, and explain its importance to living organisms.
- Discuss the recent changes in Earth's atmosphere.
- Identify the primary layers of the atmosphere.

Unit	Topic	Lesson	Lesson Objectives
------	-------	--------	-------------------

**Water and Wind**

- Describe the three phases of the water cycle.
- Explain how temperature and humidity are related.
- Identify various cloud types by their appearance and the altitudes at which they typically occur.
- Use the concept of pressure gradients to explain how winds are created, and explain how Earth's rotation affects their direction.

**Weather and Climate**

- Describe the formation of cold fronts and warm fronts.
- Describe various severe weather situations, including thunderstorms, tornadoes, and hurricanes.
- Distinguish between climate and weather.
- Identify factors that affect Earth's climate.

**Using Natural Resources****Organisms and Their Environment**

- Describe the effects one species can have on an ecosystem.
- Discuss to ways natural forces can change ecosystems.
- Discuss two ways humans can change ecosystems.
- Explain the structure of an ecosystem.

**Energy and Resources**

- Describe the advantages and disadvantages of several energy sources.
- Describe the types of conversion processes necessary for different energy sources to produce electricity.
- Identify different sources of energy used by living things, and trace each source back to the sun.
- Identify how efficient different conversion processes are.

**Pollution and Recycling**

- Compare the economic and environmental impacts of using various energy sources.
- Describe types of pollution in air, in water, and on land.
- Identify several pollutants caused by fossil fuel use.
- Identify ways to reduce, reuse, and recycle.