

8th Grade Science Curriculum
Elevate Science Course 3 copyright 2019
Summer 2023

Topic 1 – Atoms and the Periodic Table

(MS-PS1-1,DCI PS1.A, CCC.3, SEP.2, RST.6-8.1,RST.6-8.2,MP2, 8.2.8.ED.2,8.2.8.ED.3,8.2.8.ED.4, SEL.PK-12.1.4, SEL.PK-12.4.1,SEL.PK-12.5.2)

Objectives

- Identify and describe the properties of electron, protons and neutrons
- Describe the development of atomic theory including historical models of Dalton, Thomson, Rutherford and Bohr
- Describe how data from experiments caused the theory to change
- Describe the basics of modern atomic theory
- Cite evidence that supports the modern model of the atom including Rutherford’s gold-foil experiment and Chadwick discovery of the neutron.
- Interpret and use the periodic table for locating important information pertaining to elements
- Describe the elements
- Explain the role of valence electrons in the bonding of atoms
- Describe how the properties of atoms are affected when atoms bond together
- Compare the properties of metals and nonmetals
- Describe and compare the properties of atoms
- Explain the role of valence electrons in the structure and function of atoms
- Recognize a finite number of elements exist
- Recognize that atoms combine to produce compounds that make up all living and nonliving things
- Identify basic examples of atoms
- Compare and classify properties of various compounds, including acids, bases, and salts
- Use evidence to list and describe properties of acids and bases
- Analyze and interpret data to explain what happens when acids and bases interact

Extended

Provide each group of students with colored pencils that roughly match the colors of the sticky notes. Each sticky note represents a single atom of a particular element, based on color. Students should use their color keys and the formulas provided to stick together the correct combination of sticky notes to make models of four kinds of matter.

Quest

Students will watch NBC Learn Video to solve – How can you use chemistry to solve a culinary mystery? Throughout the Quest, students will complete various activities to identify an unknown substance and to solve the mystery of the dessert disaster. When possible, have students make a microwave cake to conclude the activity.

Support Struggling Students

Have students write about each model of the atom, being as descriptive as possible but without identifying which model they are writing about. Have them exchange descriptions with a partner and have them try to identify the models from their partner's descriptions.

Gifted and Talented

Tell students that the elements carbon, oxygen, and sulfur have allotropic forms. Have students do research to find out what an allotrope is and to learn the difference between the allotropic forms of these three nonmetals.

Topic 2 – Chemical Reactions

(MS-PS1-2, MS PS1-3, MS-PS1-5, MS-PS1-6, DCI-PS1.A, DCI.PS.1.B, CCC.1, CCC.5, CCC.6, SEP.4, SEP.8, RST.6-8.1, RST.6-8.2, MP2, 8.2.8, ED.2, 8.2.8, ED.3, 8.2.8, ED.4, SEL.PK-12.1.4, SEL.PK-12.4.1, SEL.PK-12.5.2)

Objective:

- Identify properties to differentiate between mixtures and solutions
- Analyze data to describe the molecular and atomic properties of mixtures
- Investigations to identify and describe kinds of mixtures
- Identify tools needed to separate mixtures
- Analyze and interpret data about properties of substances to determine a change in matter is physical or chemical
- Identify and describe the factors that affect the rate at which a chemical reaction occurs
- Interprets and develop models to identify components of a chemical reaction including products, reactant and number of atoms and molecules
- Use chemical equations to model mass conservation during a chemical change

Extended Activity

Students will initiate a chemical reaction and identify the changes that accompany the reaction. Have students observe and then record their observations of baking soda, vinegar and the changes that occur when they are mixed.

Support Struggling Students

Review endothermic and exothermic graphs with students. Have them match the start, end and high point of the graph to images that show the process of an endothermic and exothermic reaction.

Gifted and Talented

Have students summarize what they know about efforts to recycle plastics in their neighborhoods. Are there dedicated waste receptacles in public places? Are plastic and other recyclable materials picked ups curbside. Review endothermic and exothermic graphs with

students. Have them match the start, end and high point of the graph to images that show the process of an endothermic and exothermic reaction.

Topic 3 - Force and Motion

(MS.PS.2-1, MS.PS2.2, MS.PS2-4, MS-PS3-1, MS-PS3-2, DCI PS2.A, CCC.7, SEP.3, RST.6-8.1, RST.6-8.7, RST.6-8.2, RST.6-8.4, WHST.6-8.7, WHST.6-8.2.D, RI.8.1, 6.EE9C, 6.RP.2A, 7.EE.3B, 7.EE.4B, 8.F.3A, 8.2.8.ED.2, 8.2.8.ED.3, 8.2.8.ED.4, SEL.PK-12.1.4, SEL.PK-12.4.1, SEL.PK-12.5.2)

Objectives:

- Construct an explanation using reasoning that motion is a change in position relative to a reference point
- Describe how balanced and unbalanced forces affect the motion of an object
- Determine the average speed of an object from calculations, using distance-versus-time graphs
- Use text evidence to compare velocity, speed and acceleration
- Interpret graphs to determine acceleration
- Identify and describe evidence that object's motion remains same if forces on it are balanced; if object's motion changes if forces on it are unbalanced
- Model how factors affect an object's motion to predict the relationship between force, mass and acceleration
- Construct explanations using reasoning to describe the effect of action and reactions forces on an object's motion
- Analyze and interpret data to predict to push surfaces together affect the amount of friction
- Interpret data to predict how the mass and distance between two objects affect the gravitational force they exert on each other
- Develop a model to demonstrate the relationship between gravitational potential energy and kinetic energy

Extended Activity

Watch a video Build a Better Bumper Car. Have students think about the forces at work as well as safety consideration on amusement park rides.

Support Struggling Students

Review what is meant by criteria and constraints. As a group, have students list the criteria that are necessary for a successful bumper. (It must reduce the force of impact; it must hold up; it must not hinder the rider's view from the car). Also list constraints for the bumper (Availability and cost of material, etc.). Discuss how these criteria and constraints must be considered during the design of the new bumper.

Gifted and Talented

Have students start thinking about the forces at work on a bumper car ride. They should draw the car with its bumper and arrows to show where forces come from and where they go to. They should also label variables that affect the forces, such as acceleration, mass, gravity, etc. As they continue to learn about Newton's law, they can add to their diagrams and refer to them when designing their bumper cars.

Topic 4 – Genes and Heredity

(MS-LS3-1, MS-LS3-2, MS-LS4-4, MS-LS4-5, DCI LS1.B, DCI LS 3.A, DCI LS3.B, DCI CCC.6, CCC.2, CCC.6, SEP.2, RST.6-8.1, RST. 6-8.2, RST.6-8.4, RST.6-8.7, SL.8.5, RH.6-8.5, WHST.6-8.10, 7.SP. 5C, 7.SP. 7C, 7.SP.4B, MP.4, 8.2.8.ED.2,8.2.8.ED.3, 8.2.8.ED.4SEL.PK-12.1.4, SEL.PK-12.4.1,SEL.PK-12.5.2)

Objectives:

- Identify Gregor Mendel's contributions to the fields of genetics and inheritance
- Model to describe how variations of traits between parents and offspring arise from variations between genes (and therefore alleles) from each parent
- Develop the probability of inheritance of specific genetic variations
- Differentiate between genes, alleles and chromosomes
- Determine how they are related to inheritance
- Demonstrate and describe the cause and effect of the influence of pedigree on variations in inherited traits across generations
- Compare and contrast the formation of sex cells during meiosis and the process of cell divisions
- Construct explanations by describing why cells undergo DNA replication
- Develop models to explain how cells make protein
- Use models to explain why cells undergo proteins synthesis
- Determine sex-linked inheritance using a Punnett Square
- Analyze sex-linked chromosomal indicators of disease
- Construct a model to show how a genetic mutation occurs
- Relate environmental factors to genetic mutations
- Explain how humans use artificial selection to produce organisms with desired traits
- Explain how scientist engineer new genes
- Support how genetic information can be used

Extent Activity

Use a Probability Model

Although the capital letter G has been used throughout the lesson to represent yellow pea pod color, which is the dominant allele, students may use any letter they choose as long as they label the square with the correct letters on each side. How would you represent a purebred? (either two capital letters or two lowercase letters) Remind students that each box in the Punnett square represents a 1 in 4 chance (or $\frac{1}{4}$ chance) of an offspring inheriting a certain trait. Create a Punnett square using a purebred for dominant and recessive parents and predict the percentage of a dominant offspring and recessive offspring.

Support Struggling Students

For students who are having difficulty relating probability to heredity, have them flip a coin 20 times and then record the results. Explain that even though the law of probability states that it is likely that 10 of the losses should land heads-up, it cannot be predicted with certainty (which their data most likely show). Point out that every trait contains two alleles, so when parents produce an offspring, each allele has an equal chance to be passed on.

Gifted and Talents

Challenge students to write their own genetics problems, using fictional plants and animals. Students can work in pairs to solve each other's problems. Students should ensure that their problems can be solved based on the information that is provided.

Topic 5 – Natural Selection and Change Over Time

(MS-LS4-1, MS-LS4-2, MS-LS4-3, MS-LS4-4, MS-LS4-5, MS-LS4-6, DCI LS4.A, DCI LS4.B, DCI LS4.C, CCC.1, CCC.2, SEP.5, SEP.6, SEP.8, RST.6-8.1, RST.6-8.2, WHST.6-8.9, RH.6-8.1, RH.6-8.2, 6.RP.1, 7.RP. 2c, 7.EE.1A, 8.2.8.ED.2,8.2.8.ED.3,8.2.8.ED.4, SEL.PK-12.1.4, SEL.PK-12.4.1,SEL.PK-12.5.2)

Objectives:

- Explain how organisms can change over time
- describe the theory of evolution
- describe how natural selection leads to change over time in organisms
- explain the roles of genes, mutations, and the environment in the natural selection.
- Use mathematical representation to support explanation of how natural selection and inherited variations influence a population
- Construct evidence to describe influence sexual selection has on a population's genetic variation
- Investigate the cause-and-effect relationship between species interaction and its influence on evolution
- Support evidence for the scientific theory of evolution
- Explain how fossils show change over time
- Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species
- Describe how failure to adapt to environmental changes can lead to species extinction
- Explain how modern technology provides evidence that all organisms have a common ancestor
- Use technology to make new discoveries about evolution possible

Extended Activity - Mystery on the Galapagos Islands

Students will examine observations from Darwin's travels to the Galapagos Islands and answer questions about the differences in traits among the various animals. Have students write a brief description of the location of the Galapagos Islands relative to South America, and to hypothesize themselves as to how some species may have come to the island.

Support Struggling Students

Have students look at the images for the Theory of Transformation. Using Lamarck's theory, have them describe what is happening in each image of the moles (textbook page 241)

Gifted and Talented

Have students create their own journal depicting their observations of living things in their neighborhood. Their journal should include at least three separate entries with a written description and drawing of their discoveries.

Topic 6 – History of Earth

(MS-ESS1-4, DCI ESS.1, DCI ESS.1c, CCC.3, SEP.6, RST.6-8.1, WHST.6-8.2, 6.EE.6B, 7 RP. 3a, 8.2.8.ED.2,8.2.8.ED.3,8.2.8.ED.4, SEL.PK-12.1.4, SEL.PK-12.4.1,SEL.PK-12.5.2)

Objectives:

- Describe the ages of rocks
- Determine the relative ages of rocks
- Determine the absolute ages of rocks
- Provide physical evidence to show that Earth has changes over time due to natural processes
- Define and divide geologic time
- Analyze evidence that Earth evolved due to natural processes
- Use evidence to explain Earth change in the Paleozoic era, Mesozoic era and Cenozoic era

Extended Activity – A Very Grand Canyon

Students will learn how the Grand Canyon formed and respond to scenario-based prompts about rock formation, superposition, and unconformities.

Supporting Struggling Students

Print up images of plants and animals from different periods in Earth's history. With each image, tell how many years ago the plant or animal lived. Identify the period to which the plant or animal belongs.

Gifted and Talented

Have students create a table showing each era, each period in that era, and some of the animals that lived in that era. Next, identify which animals in which era are still alive today.

Topic 7 – Energy in the Atmosphere and Ocean

(MS-ESS2-1, MS-ESS2-4, MS ESS2-6, DCI ESS2.C, DCI ESS2.D, CCC.4, SEP.2, RST.6-8.2, RST.6-8.7, WHST.6-8.1.B, 6.EE2c, 6.EE.7b, 8.2.8.ED.2,8.2.8.ED.3,8.2.8.ED.4, SEL.PK-12.1.4, SEL.PK-12.4.1,SEL.PK-12.5.2)

Objectives:

- Identify and describe evidence that energy moves through Earth’s atmosphere by radiation, conduction, and convection
- Cite textual evidence to support how energy from the sun is either absorbed or reflected by the different levels of the atmosphere
- Analyze relationships to describe the greenhouse effect traps and absorbs gases in the atmosphere
- Identify and explain how wind results from differences in air pressure from unequal heating of the atmosphere and how stream and ocean currents
- Describe how winds that blow over short distances and affect local weather are called local winds
- Describe how global convection currents and the Coriolis effect interact to make the wind pattern of calm areas and global wind belts around Earth.
- Describe how global winds drive surface currents
- Identify and describe how unequal heating and the rotation of Earth combine to produce the patterns of ocean circulation
- Find evidence to support how ocean currents redistribute Earth’s energy by the motion of the Gulf stream

Extended Activity

Have students create a list of different types of breezes. Have them compare and contrast a chart to summarize the differences between land breezes and sea breezes. Have students include a description and a model of the air pressure and wind direction associated with each breeze type.

Support Struggling Students

Model how uneven heating of air causes wind. Hold a pinwheel over an unlit incandescent light bulb and then over the same bulb while it is lit. The pinwheel will remain stationary when the bulb is off and will spin when the bulb is lit. Discuss what causes the pinwheel to spin.

Gifted and Talented

Have students determine why airlines companies would have a special interest in knowing about global winds. Challenge students to research flight times on long distance flights to see if east-to-west flights have different times than west-to-east flights.

Topic 8 – Climate

(MS-ESS2-6, MS ESS3-5, MS ESS3-5-D, MS LS2-5,DCI ESS2.D, DCI ESS3.DCCC.4, CCC.7, SEP.1, SEP.2, RH.6-8.1, RH.6-8.6, RH.6-8.7, RST.6-8.1, RST.6-8.7, RST.6-8.8, WHST.6-8.1.b, 6.RP. 1a, MP.2, 8.2.8.ED.2,8.2.8.ED.3,8.2.8.ED.4, 8.2.8.ITH.4,SEL.PK-12.1.4, SEL.PK-12.4.1,SEL.PK-12.5.2)

Objectives:

- Identify weather as a description of short-term atmospheric conditions
- Recognize climate as long-term patterns in atmospheric conditions
- Interpret data to provide how latitude, altitude, distance from large bodies of water, and ocean currents affect patterns of circulation in the atmosphere and ocean
- Explain how patterns of circulation determine regional climates
- Provide quantitative reasoning to support patterns of change in global temperature
- Identify the effect of greenhouse gases on global temperatures
- Explain how both natural processes and human activities affect global temperatures
- Explain how changes in global temperatures impact sea levels
- Explain the effects of sea levels are rising
- Explain how global temperatures and organisms' adaption as are connect
- Identify human actions impact climate change

Extended Activity

Use a pinwheel to model how as air is heated it rises, allowing for cooler air to move in, which in turn causes wind. Hold a pinwheel above an unlit incandescent light bulb or other heat source to demonstrate there is no movement. Then hold the pinwheel above the bulb while it is turned on. As the air above the illuminated bulb is heated and cooler air rushes in, the pinwheel will start to rotate. Encourage students to apply the demonstration by creating a model incorporating the movement of warm air masses and cool air masses and the resulting wind movement.

Support Struggling Students

Use a cause-and-effect graphic organizer to help students understand why land heat cools more quickly than water.

Gifted and Talented

Create a climate poster for the United States. Research and list each of the climates found within the United States. Have students apply this information to group each state according to its climate. Next, make generalizations about weather patterns based on their state grouping.

Topic 9 – Earth-Sun-Moon Systems

(MS-ESS1-1, DCI ESS1.A, DCI ESS1.B, CCC.1, SEP.2, SL.8.5, RST.6-8.1, RST.6-8.6, 7 RP 2C, WHST.6-8.2.a, RH.6-8.5, RH.6-8.7, 8.2.8.ED.2,8.2.8.ED.3,8.2.8.ED.4, SEL.PK-12.1.4, SEL.PK-12.4.1,SEL.PK-12.5.2)

Objectives:

- Identify objects and constellations visible without a telescope in the night sky
- Explain the apparent motions of stars and planets throughout the year
- Use models to explain the motion of Earth, other planets, and the sun through space
- Explain what causes the cycle of season on Earth
- Describe how the moon affects the amount of daylight
- Describe factors that keep the moon and Earth in orbit
- Explain why the moon appears to change shape
- Describe what causes solar and lunar eclipses
- Predict the position of the Earth, sun, and the moon during a given type of eclipse
- Describe how the sun and moon affect tides

Extended Activity

Break students up into small groups. Have each group discuss the following to help them develop their heliocentric model of the universe. What is at the center of the model? What components are important to include in the model? What evidence did Galileo use to support his model? Draw Galileo's heliocentric system. Show and label the evidence he produced to support his model.

Support Struggling Students

Have students draw and label a solar and lunar eclipse. Explain that an eclipse occurs when one object in space comes between the sun and a third object, and it casts a shadow on that object.

Gifted and Talented

Have students design an investigation to demonstrate inertia using simple materials, such as a toy car and marbles or a wagon and tennis balls.

Topic 10 Solar System and the Universe

(MS. ESS1-2, MS ESS1-3, DCI ESS1.A, DCI ESS1.B, CCC.3, CCC.4, SEP.2, SEP.4, RST.6-8.1, RST.6-8.2, RST.6-8.7, RST.6-8.10, WHST.6-8.4, 6 RP. 1a, 6.EE.9c. MP.4, 8.2.8.ED.2,8.2.8.ED.3,8.2.8.ED.4, SEL.PK-12.1.4, SEL.PK-12.4.1,SEL.PK-12.5.2)

Objectives

- Compare and contrast solar system objects based on their characteristics (color, size, motion, ability to sustain life, geographical features, etc.)
- Describe the role of gravity in the motion of the planets and other objects in the solar system
- Describe the role of gravity in the sun's function
- Describe the relationships between solar system objects
- Identify and describe the characteristics of the electromagnetic spectrum
- Describe how scientists use the electromagnetic spectrum to learn about the universe
- Evaluate and describe the role of technology in accessing outer space and collecting, analyzing, and communicating data
- Describe the physical properties of stars
- Explain how stars are classified
- Describe the role gravity plays in the formation of stars
- Analyze the distances between objects in the universe and the method used to measure those distances
- Explain the hierarchical relationships between the various bodies in the universe

Extended Activity

1. Students will create a rocket using a water bottle and paper towel tube.
2. Model the sun's atmosphere. Label the photosphere and corona. Shade in and label the area of the chromosphere.

Gifted and Talented

1. Have students work in pairs to develop a plan for a mission to Mars that will establish a permanent habitat for carrying out scientific investigations.
2. Students will describe the two-phase plan in detail and determine the mission budget.

Other Resources

Brainpop, Newsela

New Jersey Legislative Statutes and Administrative Code (place an "X" before each law/statute if/when present within the curriculum map)									
	Amistad Law: <i>N.J.S.A. 18A 52:16A-88</i>		Holocaust Law: <i>N.J.S.A. 18A:35-28</i>	x	LGBT and Disabilities Law: <i>N.J.S.A. 18A:35-4.35</i>		Diversity & Inclusion: <i>N.J.S.A. 18A:35-4.36a</i>	x	Standards in Action: <i>Climate Change</i>