7th Grade Science

Science

Grade(s) 7th, Duration 1 Year, 1 Credit
Required Course

Course Overview

The primary task of science education is to foster students' curiosity to investigate the natural phenomena of their world. Students will develop confidence in their ability to use scientific concepts and principles to understand and solve real-world problems. Students must understand the impact of science and technology on the individual, society, and culture.

Physical Science is an introduction into Chemistry and Physics. The students will learn how to observe, predict, study, and question. Emphasis will be placed on the development of lab skills. Students will be encouraged to “think like scientists” and investigate issues to determine a conclusion on their own. This course covers topics in Structure and Matter, Force and Motion, Chemical Reactions, Energy and Energy Transfer.

Scope And Sequence

Timeframe	Unit	Instructional Topics
1 Week(s)	Intro to 7th Grade Science	1. Lab Safety Lab
8 Week(s)	Natural vs. Synthetic Materials	1. Structure of Matter (PS1.A.1) 2. Characteristics of Chemical Reactions (PS1.A.2) 3. Modeling Conservation of Mass (PS1.B.1) 4. Tying it all together (PS1.A.3)
4 Week(s)	Thermal Energy	1. Changes in Energy on the Molecular Level (PS1.A.4) 2. Thermal Energy in Chemical Reaction (PS1.B.2)
5 Week(s)	Motion and Force	1. Newton's Third Law (PS2.A.2) 2. Gravitational Forces (PS2.B.2) 3. Changes in Force and Motion (PS2.A.1)
3 Week(s)	Electric and Magnetic Forces	1. Electric and Magnetic Forces (PS2.B.3 & PS2.B.1)
4 Week(s)	Energy	1. Thermal Energy Transfer (PS3.A.3) 2. Energy Transfer and Temperature (PS3.A.4)
5 Week(s)	Kinetic and Potential Energy	1. Potential Energy (PS3.A.2) 2. Kinetic Energy (PS3.A.1) 3. Tying it together(PS3.B.1)
4 Week(s)	Waves	1. Introduction to Properties of Waves (PS4.A.1) 2. Light Waves (PS4.A.2)
Ongoing	Science Fair	1. Science Fair Project

Materials and Resources

Stemscopes
Vocab Sheets
Graphic Organizers
K-W-L Charts

Course Details

Unit: Intro to 7th Grade Science

Duration: 1 Week(s)

Topic: Lab Safety Lab

Duration: 1 Week(s)

Topic Description (short)

Students will be able to identify where lab safety equipment is and how to use it.

Unit: Natural vs. Synthetic Materials

Duration: 8 Week(s)

Unit Description

How do natural resources go through a chemical process to form synthetic materials that impact society?

Enduring Understandings (Knowledge & Skills)

Knowledge:
How atoms make up all matter.
The role of neutrons, electrons, protons in an atom.
Law of conservation of matter.
All natural resources exist on the periodic table.
Elements go through chemical reactions to create new substances (synthetic.)

Atoms are non-living.
Skills:
Organize and categorize the classification of matter (pure substance vs mixture)
Develop a model an atom and compound molecule
Identify physical and chemical changes
Design experiments that create chemical changes.
Develop an argument that supports the Law of Conservation of Matter.

Academic Vocabulary

synthetic resources
natural resources
proton
neutron
electron
law of conservation of mass
atom
compound molecule
physical change
chemical change
reactants
products
Chemical Equation
decomposition
ionic bonds
covalent bonds

Topic: Structure of Matter (PS1.A.1)

Duration: 2 Week(s)

Topic Description (short)

The atomic composition of simple molecules and extended structures.

Formative Assessment

Pre-Assessment: Water wipes
Formative 1: build atoms, compounds, molecules, and mixtures

Materials and Resources

Stemscopes:
Structure of Matter

Teacher's Resources:
Classifying matter notes
Classifying Elements, Compounds and Mixtures
Atom model project

Learning Targets

SC.6-8.PS1.A.1 -- Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.

Learning Targets linked to Priority Standard = ✣

Topic: Characteristics of Chemical Reactions (PS1.A.2)

Duration: 2 Week(s)

Topic Description (short)

The properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Formative Assessment

Formative 2: Chemical and Physical Changes

Materials and Resources

Stemscopes:
Characteristics of Chemical Reactions
Physical and Chemical Properties

Teacher's Resources:
Chemical and Physical Changes Lab

Learning Targets

PS1.A.2
Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.]

Learning Targets linked to Priority Standard = ✙

Topic: Modeling Conservation of Mass (PS1.B.1) **Duration:** 2 Week(s)

Topic Description (short)
Describe how the total number of atoms remains the same during a chemical reaction and thus mass is conserved.

Formative Assessment
Formative 3:

Materials and Resources
Stemscopes:
Modeling Conservation of Mass

Teacher's Resources:
Chemical Reaction Video

Learning Targets
PS1.B.1
Develop and use a model to describe how the total number of atoms remains the same during a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.]

Learning Targets linked to Priority Standard = ✙

Topic: Tying it all together (PS1.A.3) **Duration:** 2 Week(s)

Topic Description (short)
Describe that synthetic materials come from natural resources and how they impact society.

Formative Assessment
Post-Assessment: Monster Energy Drink Questions

Materials and Resources
Stemscopes:

Teacher's Resources:
Synthetic Materials Fillable slides
YouTube Video, “Professor Dave Explains: Will Synthetic Vitamins Make Me Explode?”
Natural Resources & Synthetic Materials Lab

Learning Targets
PS1.A.3
Gather and make sense of information to describe that synthetic materials come from natural resources and how they impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.]

Learning Targets linked to Priority Standard = ✙

Unit: Thermal Energy **Duration:** 4 Week(s)

Unit Description
How does thermal energy impact the states of matter

Enduring Understandings (Knowledge & Skills)
How does heat transfer?
How does temperature impact particle movement in matter?
Does the concentration of a solute impact thermal energy?

Academic Vocabulary
insulators
solids
conductors
liquids
thermal energy
gases
temperature
conduction
kinetic energy

convection
endothermic
absorption
exothermic
reflection
chemical reaction
catalyst

Topic: Changes in Energy on the Molecular Level (PS1.A.4) **Duration:** 2 Week(s)

Topic Description (short)
Describe changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Formative Assessment
Pre-test: Elephant tooth paste lab
Formative 1: Worksheet
Formative 2: Principles of conduction and convection worksheet

Materials and Resources
Stemscopes:
Changes in Energy on the Molecular Level
Heat and Matter

Teacher's Resources:
Elephant tooth paste lab
phet simulation
Insulator Investigation Lab
Convection Lab
Endothermic or Exothermic Reactions Lab

Learning Targets
PS1.A.4
Develop a model that describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]

Learning Targets linked to Priority Standard = ✣

Topic: Thermal Energy in Chemical Reaction (PS1.B.2) **Duration:** 2 Week(s)

Topic Description (short)
Release and absorption of thermal energy by chemical processes.

Formative Assessment
Formative 3: Design: A device that releases or absorbs energy
Post-test: Elephant Toothpaste questions

Materials and Resources
Stemscopes:
Thermal Energy in Chemical Reaction

Teacher's Resources:
Sugar Snake Lab
Design: A device that releases or absorbs energy Lab

Learning Targets
PS1.B.2
Construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.]

Learning Targets linked to Priority Standard = ✣

Unit: Motion and Force **Duration:** 5 Week(s)

Unit Description
How do you apply physics principles to solve problems
What happens when objects touch or collide

Enduring Understandings (Knowledge & Skills)

Differentiate between Newton's laws
Gravity's role in the solar system
Hypothesize what can happen knowing Newton's laws of motion
Investigate changes in lab designs
apply scientific laws and theories to analyze data patterns and make predictions
analyze/evaluate solution designs

Academic Vocabulary

force
qualitative
motion
quantitative
balanced/unbalanced force
mass
net force
matter
friction
weight
gravity
inertia

Topic: Newton's Third Law (PS2.A.2)

Duration: 2 Week(s)

Topic Description (short)

The change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Formative Assessment

Pre-test:
Formative 1: Newton's First Law Choice Board
Formative 2: Tug of War

Materials and Resources

Stemscopes:
Newton's Third Law

Teacher's Resources:
Forces Phenomena video
Walker Lab
Newton's Laws Slides
NFL Newton's Laws Videos
Helicopter Lab

Learning Targets

PS2.A.2
Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.]

Learning Targets linked to Priority Standard = ✣

Topic: Gravitational Forces (PS2.B.2)

Duration: 2 Week(s)

Topic Description (short)

Gravitational interactions depend on the mass of interacting objects.

Formative Assessment

Formative 3: Mass and Diameter of a Planet

Materials and Resources

Stemscopes:
Gravitational Forces

Teacher's Resources:
Exploratorium: Your Weight on other Planets
Newton's Laws Student Choice Project

Learning Targets

PS2.B.2
Create and analyze a graph to use as evidence to support the claim that gravitational interactions depend on the mass of interacting objects. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.]

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Topic: Changes in Force and Motion (PS2.A.1) **Duration:** 1 Week(s)

Topic Description (short)
The force of an object during a collision and develop an evaluation of the solution.

Formative Assessment
Post-test: Motion and Stability: Forces and Interactions

Materials and Resources
Stemscopes:
Changes in Force and Motion

Teacher's Resources:
Newton's hot wheels lab

Learning Targets
PS2.A.1
Apply physic principles to design a solution that minimizes the force of an object during a collision and develop an evaluation of the solution.

Learning Targets linked to Priority Standard = ✙

Unit: Electric and Magnetic Forces

Duration: 3 Week(s)

Unit Description
How do the strengths of electric and magnetic fields factor into the world around them

Enduring Understandings (Knowledge & Skills)
Why the strength of magnetic forces decrease with distance.
How magnetic poles interact (attract/repel)
How electricity generates magnetism and magnetism generates electricity
How magnetic domains explain magnetic behavior.
Compare different designs for an electromagnet
Draw magnetic field lines of a bar magnet
Describe how electric and magnetic forces can be attractive or repulsive.

Academic Vocabulary
magnetic domain
motor
electric field
generator
magnetic field
solenoid
electromagnet
current
magnetic pole
circuit
electromagnetic induction
voltage

Topic: Electric and Magnetic Forces (PS2.B.3 & PS2.B.1) **Duration:** 3 Week(s)

Topic Description (short)
Electric and magnetic fields exist between objects exerting forces on each other even though the objects are not in contact. Factors that affect the strength of electric and magnetic forces.

Formative Assessment
Pre-assessment: Accessing Prior knowledge
Formative 1: Student choice board
Formative 2: Phet Simulation: Balloons and Static Electricity
Formative 3: Student choice board
Post-test: Magnetic Force and Magnetic Field Inquiry Lab

Materials and Resources
Stemscopes:
Electric and Magnetic Forces

Teacher's Resources:
Magnets-Attract or Repel activity

Finding Magnetic Fields
Phet Simulation: Balloons and Static Electricity
Electric force videos
Light Bulb Lab
Magnetic Fields "Bending" Light Paths Video
Electric Field Visualised video
Magnetic Force and Magnetic Field Inquiry Lab

Learning Targets

SC.6-8.PS2.B.3 -- Conduct an investigation and evaluate the experimental design to provide evidence that electric and magnetic fields exist between objects exerting forces on each other even though the objects are not in contact. . [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.]
PS2.B.1
Analyze diagrams and collect data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.]

Learning Targets linked to Priority Standard = ✣

Unit: Energy

Duration: 4 Week(s)

Unit Description

How does matter, mass, and temperature affect the transfer of energy

Enduring Understandings (Knowledge & Skills)

How does the type of matter affect energy transfer?
How does temperature affect the states of matter?
How does temperature and energy relate to each other?
How does mass alter energy requirements?
Identify factors that affect transfer of energy
Compare and contrast the states of matter
Construct an argument that explains how mass affects energy transfer

Academic Vocabulary

thermal energy
sublimation
plasma
deposition
insulators
conductors
maximize
minimize

Topic: Thermal Energy Transfer (PS3.A.3)

Duration: 2 Week(s)

Topic Description (short)

Thermal energy transfer.

Formative Assessment

Pre-test:
Formative 1: Graphic Organizer States of Matter
Formative 2: Lab Investigation: Matter and Energy

Materials and Resources

Stemscopes:
Thermal Energy Transfer

Teacher's Resources:
State of Matter Video project
Alka Seltzer Lab
Lab Investigation: Matter and Energy

Learning Targets

PS3.A.3
Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.]

Learning Targets linked to Priority Standard = ✣

Topic: Energy Transfer and Temperature (PS3.A.4)

Duration: 2 Week(s)

Topic Description (short)
The relationships among the energy transferred, the type of matter, the mass, and the change in the temperature of the sample.

Formative Assessment
Formative 3: Solar Ovens
Post test: Solar ovens evaluations

Materials and Resources
Stemscopes:
Energy Transfer and Temperature

Teacher's Resources:
Students create a slideshow
Solar Ovens lab

Learning Targets
PS3.A.4
Plan and conduct an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the temperature of the sample. [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.]

Learning Targets linked to Priority Standard = ✙

Unit: Kinetic and Potential Energy

Duration: 5 Week(s)

Unit Description
How is energy transferred between objects or systems?
Can you differentiate between kinetic and potential energy?

Enduring Understandings (Knowledge & Skills)
How energy is transferred.
The relationship between kinetic energy and speed as a nonlinear (square) proportional relationship
The relationship between kinetic energy and mass as a linear proportional relationship
I can construct, use, and present arguments to support the claim that when the kinetic energy of an object changes energy is transferred.
I can develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
I can construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass and speed of an object.

Academic Vocabulary
Kinetic Energy
Law of conservation of Energy
Potential Energy
static electricity
Mass
Speed

Topic: Potential Energy (PS3.A.2)

Duration: 2 Week(s)

Topic Description (short)
Potential energy

Formative Assessment
Pre-test: slide/roller coaster fail videos worksheet
Formative 1: Energy of a balloon when charged worksheet

Materials and Resources
Stempscopes:
Potential Energy

Teacher's Resources:
Types of Energy slides
Types of Energy Doodle notes
Energy labeling worksheet
Static Balloon Demonstration
Phet static electricity simulation

Learning Targets

PS3.A.2
Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.]

Learning Targets linked to Priority Standard =

Topic: Kinetic Energy (PS3.A.1) **Duration:** 2 Week(s)

Topic Description (short)
Kinetic energy and the relationship to the mass of an object and speed of an object

Formative Assessment
Formative 2: Interpreting graphs of Kinetic Energy
Formative 3: Hot wheels lab notes

Materials and Resources
Stemscopes:
Kinetic Energy

Teacher's Resources:
Youtube Rollar coaster video
Carnival ride to research project
Phet Energy Skate Park
Energy Skate Park Lab Worksheet
Hot wheels Lab

Learning Targets
PS3.A.1
Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a whiffle ball versus a tennis ball.]

Learning Targets linked to Priority Standard =

Topic: Tying it together(PS3.B.1) **Duration:** 1 Week(s)

Topic Description (short)
When the kinetic energy of an object changes, energy is transferred to or from the object

Formative Assessment
Post-test: Roller coaster project

Materials and Resources
Stemscopes:

Teacher's Resources:
Roller coaster project

Learning Targets
.PS3.B.1
Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.]

Learning Targets linked to Priority Standard =

Unit: Waves **Duration:** 4 Week(s)

Unit Description
I can develop and analyze types of waves and how they are reflected, absorbed and transmitted through various materials.

Enduring Understandings (Knowledge & Skills)
Describe opaque, translucent, and transparent materials.
How do different surfaces transmit, reflect, and absorb waves
How does amplitude change depending on the energy
Classify materials as opaque, translucent, and transparent
Defend a claim that an object’s color is the result of reflection and absorption of light.
Identify the parts of a transverse and longitudinal wave: crest, trough, wavelength, amplitude, rest-position

Develop a model relating amplitude to the energy of a wave.

Academic Vocabulary

mechanical wave
opaque
electromagnetic wave
transparent
wavelength
translucent
frequency
transmission
amplitude
reflection
crest
absorption
trough
longitudinal wave
transverse wave

Topic: Introduction to Properties of Waves (PS4.A.1)

Duration: 2 Week(s)

Topic Description (short)

How the amplitude of a wave is related to the energy in a wave.

Formative Assessment

Pre-test: Waves and Their Applications in Technologies
Formative 1: Anatomy of a Wave Worksheet
Formative 2: Student's Choice Sound Waves Project

Materials and Resources

Stemscopes:
Introduction to Properties of Waves

Teacher's Resources:
Properties of Waves slides
Slinky Lab
Waves pHet Simulation
Waves pHet Simulation worksheet
Sound waves slides
Sound waves lab

Learning Targets

SC.6-8.PS4.A.1 -- Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.]

Learning Targets linked to Priority Standard = ✣

Topic: Light Waves (PS4.A.2)

Duration: 2 Week(s)

Topic Description (short)

Describe that waves are reflected, absorbed, or transmitted through various materials.

Learning Targets

Formative 3: Light Behavior Lab
Post-test: Waves and Their Applications

Materials and Resources

Stemscopes:
Modeling Light Waves
Properties of Visible Light
Modeling Waves through Various Mediums

Teacher's Resources:
Visible light slides
Comparing Light and Sound Waves
Light Behavior Lab

Learning Targets

PS4.A.2
Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.]

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Learning Targets linked to Priority Standard = ✠

Unit: Science Fair **Duration:** Ongoing

Topic: Science Fair Project **Duration:** 3 Week(s)

Learning Targets

SC.6-8.ETS1.A.1 -- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SC.6-8.ETS1.B.1 -- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SC.6-8.ETS1.B.2 -- Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SC.6-8.ETS1.B.3 -- Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Learning Targets linked to Priority Standard = ✠