

Wright City Physical Science Curriculum

(9-12)

Grade	9-12
Unit of Study	Unit 1: Matter and Measurement
Length of Unit	2 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
What is the difference between precision and accuracy?	Accuracy is a measure of how close a measurement is to an accepted value. Precision is a measure of the consistency of measurements.
How does the molecular structure of substances affect physical and chemical properties?	Atoms, Compounds, and Mixtures vary in composition which affects physical and chemical properties.

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain how matter is structured, how its properties are determined by its structure, and how it changes during chemical reactions.	9-12.PS1.A.3

Unit 1 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS1.A.3	Classification of Matter	I can classify substances into elements, compounds, or mixtures based on molecular composition. I can evaluate if a property is physical or chemical.	Element Compound Homogeneous Mixture Heterogenous Mixture Physical Property Chemical Property
	Measurement	I can qualitatively describe the accuracy and precision of a data set. I can use measuring instruments correctly and make measurement conversions using the metric system. I can calculate percent error to determine the degree of accuracy.	Accuracy Precision Error Scientific Notation The Metric System

MLS	Learning Activities	
PS1.A.3	Density of Metals Lab	Must Do ▾
	Measurement and Unit Conversions Lab	Must Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
PS1.A.3	Unit 1 Test	Paper

Additional Resources
Phet, OpenStax, Javalab

Grade	9-12
Unit of Study	Unit 2: The Periodic Table and History of the Atom
Length of Unit	3 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
How is an atom's position on the periodic table a predictor of its physical and chemical properties?	Atoms in similar groups have similar electron configurations.
How is the quantum atom different from classical mechanics?	Electrons pop into and out of existence to create an electrostatic cloud that surrounds the nucleus. The shape of the cloud depends on the number of electrons present.

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain how matter is structured, how its properties are determined by its structure, and how it changes during chemical reactions.	9-12.PS1.A.1, 9-12.PS4.B.1, 9-12.PS4.B.2
I can explain how waves and electromagnetic radiation transfer energy and information and interact with matter.	

Unit 2 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS1.A.1, PS4.B.1., PS4.B.2	Periodic Table	I can use the periodic table to describe atoms of various elements.	Group Period Atomic Number Atomic Mass Protons, Neutrons, Electrons Periodic Law
	Atomic History	I can describe the historical models of the atom that eventually led to the current model.	Billiard Ball Model Atomic Theory The Plum Pudding Model Cathode Ray Tube The Gold Foil Experiment The Nuclear Model The Quantum Model
	Electron Configuration	I can explain why elements in a group share similar properties based on electron configuration. I can accurately describe the current quantum "electron cloud" model of the atom.	Orbital Subshell Energy Level Aufbau Principle Hund's Rule Pauli Exclusionary Principle

MLS	Learning Activities	
PS1.A.1, PS4.B.1., PS4.B.2	Phet Simulation: Atom Builder	Must Do ▾
	Atomic History Project	Must Do ▾
	Flame Test Lab	Must Do ▾
	Periodic Puzzle Activity	Can Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
<i>PS1.A.1,</i> <i>PS4.B.1,.</i> <i>PS4.B.2</i>	Unit 2 Test	Paper

Additional Resources	
Phet, OpenStax, Javalab	

Grade	9-12
Unit of Study	Unit 3: Chemical Bonding
Length of Unit	2 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
What are the fundamental differences in ionic and covalent bonds?	Ionic bonding is the transfer of electrons between two atoms. Covalent bonding is the sharing of electrons between two atoms.
Why do molecules take on different shapes?	Molecules hybridize in different shapes to maximize stability.

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain how matter is structured, how its properties are determined by its structure, and how it changes during chemical reactions.	9-12.PS1.A.4
I can explain how forces and interactions between particles affect the behavior and properties of matter.	

Unit 3 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS1.A.4	Bonding	I can predict the type of bond that will occur between atoms.	Ionic Bond Covalent Bond
	Lewis Structures	I can predict stable configurations of molecules by using Lewis Theory.	Lone Pairs Valence Electrons

MLS	Learning Activities	
PS1.A.4	Modern Molecule Brochure Project	Must Do ▾
	VSEPR Modeling Kit Activity	Can Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
PS1.A.4	Unit 3 Test	Paper

Additional Resources	
Phet, OpenStax, Javalab	

Grade	9-12
Unit of Study	Unit 4: Chemical Reactions
Length of Unit	3 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
When given reactants how can we identify the type of reaction?	Reactions can be classified as synthesis, decomposition, single replacement, or double replacement.
Why do we balance chemical equations?	Balancing is a process to ensure that the chemical equation models the ratios at which the chemical reaction actually occurs in nature. (conserves mass)

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain how matter is structured, how its properties are determined by its structure, and how it changes during chemical reactions.	9-12.PS1.A.2, 9-12.PS1.B.3, 9-12.PS1.A.5, 9-12.PS3.A.1
I can explain how energy is stored, transferred, and changed in physical and chemical systems.	

Unit 4 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS1.A.2, PS1.A.3 PS1.B.3	Conservation of Mass	I can use the law of conservation of mass to explain why we balance chemical reactions. I can label the parts of a chemical equation.	Law of Conservation of Mass Reactants/Products Yields Coefficients/Subscripts
	Types of Reactions	I can classify reactions into the four fundamental categories. I can use the activity series to predict if a single replacement reaction occurs. I can use the solubility rules to determine if double replacement reactions occur.	Synthesis Decomposition Single Replacement Activity Series Double Replacement Solubility Rules
	Physical and Chemical Changes	I can use evidence to predict if an observed change is a physical or chemical. I can determine the name of common phase changes such as freezing or condensation.	Physical Change Chemical Change Sublimation Deposition
	Heat	I can predict if a reaction will absorb or release energy.	Endothermic Exothermic

MLS	Learning Activities	
<i>PS1.A.2,</i> <i>PS1.B.3</i>	Physical Chemical Changes Lab	Must Do ▾
	The Mystery Powder Lab	Must Do ▾
	Reaction Matrix Lab	Can Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
<i>PS1.A.2,</i> <i>PS1.B.3</i>	Unit 4 Test	Paper

Additional Resources
Phet, OpenStax, Javalab

Grade	9-12
Unit of Study	Unit 5: Gasses
Length of Unit	2 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
What are the different variables that can be adjusted to change the volume of a sample of ideal gas?	Pressure and volume are inversely proportional (constant temp) Temperature and volume are directly proportional (constant pressure) Moles and volume are directly proportional (const. Pressure and temp.)

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain how matter is structured, how its properties are determined by its structure, and how it changes during chemical reactions.	9-12.PS1.A.3
I can explain how forces and interactions between particles affect the behavior and properties of matter.	

Unit 5 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS1.A.3	Gas Laws	I can use gas laws to calculate gas quantities. I can recognize a direct/inverse relationship based on the graph provided.	Directly Proportional Inversely Proportional Combined Gas Law

MLS	Learning Activities	
PS1.A.3	Phet Simulation: Gas Properties	Must Do ▾
	Lab: Vapor Pressure of a Soda	Must Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
PS1.A.3	Unit 5 Test	Paper

Additional Resources	
Phet, OpenStax, Javalab	

Grade	9-12
Unit of Study	Unit 6: Motion
Length of Unit	3 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
How do we know when an object is moving?	Movement is defined based on a frame of reference. For example, a person sitting in a room is not moving in relation to the room because their position remains the same. However, that same person is moving relative to other objects in space because they are on Earth, which is rotating on its axis and orbiting the Sun. Therefore, whether an object is considered to be moving depends on the frame of reference used to observe it.
How are displacement, velocity, and acceleration related?	Displacement, velocity, and acceleration are all related to an object's motion. Displacement describes how far and in what direction an object's position changes. Velocity describes how quickly the displacement changes over time, so velocity tells us both the object's speed and direction of motion. Acceleration describes how quickly the velocity changes over time. In other words, displacement tells us where an object moves, velocity tells us how quickly and in what direction it moves, and acceleration tells us how quickly its velocity changes.

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can describe and analyze the motion of an object using displacement, speed, velocity, and acceleration.	9-12.PS2.A.1

Unit 6 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS2.A.1	Defining Motion	I can classify a measurement as a scalar or vector quantity. I can explain why a frame of reference is needed to perceive motion.	Frame of Reference Displacement Distance Vector Scalar
	Motion Quantities	I can perform calculations to determine speed and acceleration. I can explain the interrelationships between displacement, velocity, and acceleration.	Speed Velocity Acceleration
	Graphing Motion	I can describe the motion of an object based on motion-time graphs.	Rate Slope

MLS	Learning Activities	
PS2.A.1	Graph Matching (Walking) Lab	Must Do ▾
	Moving Man Phet Activity	Must Do ▾
	Ramp Lab (Acceleration)	Must Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
PS2.A.1	Unit 6 Test	Paper

Additional Resources
Phet, OpenStax, Javalab

Grade	9-12
Unit of Study	Unit 7: Forces
Length of Unit	3 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
What are examples of common forces that cause changes in motion?	Common forces that can cause changes in motion include gravity, friction, air resistance, applied force, tension, and magnetic force.
How does net force affect the overall motion of an object?	Balanced forces on an object create zero net force and thus zero acceleration by Newton's 2nd law. Unbalanced forces applied upon an object do create acceleration (change in velocity)
If action-reaction forces are equal and opposite, why don't they cancel out?	Balanced forces acting on an object result in a zero net force, which means the object has zero acceleration according to Newton's Second Law. The object will either remain at rest or continue moving at a constant velocity. In contrast, unbalanced forces produce a nonzero net force, causing the object to accelerate, or change its velocity. Acceleration can involve an object speeding up, slowing down, or changing direction.

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain and predict how forces and interactions affect the motion and stability of objects and systems.	9-12.PS2.A.2, 9-12.PS2.A.3, 9-12.PS2.B.1, 9-12.PS2.B.2

Unit 7 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS2.A.2 PS2.A.3 PS2.B.1 PS2.B.2	Forces	I can provide examples of common forces. I can explain how simple machines allow us to use less force to complete the same amount of work. I can calculate and explain the mechanical quantities of work, power, mechanical advantage and efficiency.	Gravity Static Friction Kinetic Friction Tension Thrust Normal Force Force Simple Machines Work Power Efficiency
	Newton's 1st and Second Laws	I can explain the motion of objects in terms of Newton's First and Second Laws. I can predict the motion of an object based on net force applied.	Inertia Unbalanced Forces Balanced Forces Newton's 1st Law Newton's 2nd Law
	Newton's 3rd Law and Momentum	I can explain and provide examples of Newton's Third Law.	Momentum Action-Reaction Pair Newton's Third Law
	Gravity	I can calculate the gravitational force between two bodies of inertia. I can qualitatively estimate the gravitational force between two bodies of inertia.	Centripetal Force Universal Law of Gravitation

MLS	Learning Activities	
PS2.A.2, PS2.A.3, PS2.B.1, PS2.B.2	Simple Machines Stations Lab	Must Do ▾
	Newton's Laws Stations Lab	Must Do ▾
	Friction Lab (Determining the Coefficient)	Must Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
PS2.A.2, PS2.A.3, PS2.B.1, PS2.B.2	Unit 7 Test	Paper

Additional Resources
Phet, OpenStax, Javalab

Grade	9-12
Unit of Study	Unit 8: Energy
Length of Unit	4 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
If energy is conserved, why do moving objects frequently come to a stop?	Energy is conserved, so when a moving object comes to a stop, its kinetic energy does not disappear. Instead, the kinetic energy is transferred or transformed into other forms of energy. For example, when a rolling ball stops because of friction, some of its kinetic energy is transformed into thermal energy (heat) in the ball and the surface.
How is energy transferred and conserved?	Energy is transferred when it moves from one object or system to another, and it is transformed when it changes from one form to another.
What are the pros/cons of various types of electrical energy? (wind, solar, etc)	The general consensus is that fossil fuels are harmful to the environment, while renewable energy resources are generally considered more environmentally friendly. Renewable resources, such as solar, wind, and hydropower, can be naturally replenished, but they can be costly to develop and install.

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain how energy is stored, transferred, transformed, and conserved in physical systems.	9-12.PS3.A.1, 9-12.PS3.A.2, 9-12.PS3.A.3, 9-12.PS3.B.1,

Unit 8 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS3.A.1 PS3.A.2 PS3.A.3 PS3.B.1	Energy	I can explain and provide examples of various types of energy.	Kinetic Gravitational Potential Thermal Sound Elastic Potential Rotational Electrical Potential Electromagnetic
	Conservation of Energy	I can explain how energy is transferred through a system and is conserved. I can use the conservation of energy to calculate quantities such as max speed or height.	Conservation of Energy
	Renewable Energy	I can describe various sources of electrical energy and their advantages and disadvantages.	Renewable Energy Fossil Fuels Efficiency

MLS	Learning Activities	
PS3.A.1	Rube Goldberg Project	Must Do ▾
PS3.A.2	Alternative Energy Project	Must Do ▾
PS3.A.3 PS3.B.1	Energy Skatepark Phet Activity	Can Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
PS3.A.1 PS3.A.2 PS3.A.3 PS3.B.1	Unit 8 Test	Paper

Additional Resources	
Phet, OpenStax, Javalab	

Grade	9-12
Unit of Study	Unit 9: Waves
Length of Unit	3 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
What do waves transport?	Waves transport energy; they do not transport matter.
How are sound waves similar/different from light waves?	Sound waves are longitudinal waves that require a medium, such as air, water, or a solid, to travel through. In contrast, electromagnetic waves are transverse waves that do not require a medium and can travel through the vacuum of space.
What are the properties of waves that affect the energy of the wave?	The properties of waves that affect the energy of a wave include amplitude, frequency, and wavelength. Amplitude is related to the amount of energy carried by a wave; a wave with greater amplitude generally carries more energy. Frequency is the number of waves that pass a point each second, and higher-frequency waves generally carry more energy.

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain how waves and electromagnetic radiation transfer energy and information and interact with matter.	9-12.PS4.A.1, 9-12.PS4.A.2

Unit 9 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS4.A.1, PS4.A.2	Properties of Waves	I can predict if a wave interaction will be constructive or destructive. I can qualitatively describe the energy of a wave based on its frequency and amplitude.	Frequency Amplitude Wavelength Constructive Interference Destructive Interference Longitudinal Wave Transverse Wave
	Sound	I model sound waves based on their pitch and loudness. I can explain apparent changes in pitch by the Doppler Effect. I can use Resonance to explain the fundamental way in which musical instruments are tuned.	Medium Pitch Loudness Doppler Effect Resonance Threshold of Hearing
	Light	I can explain why we observe rainbows and why the sky is blue. I can provide examples of the electromagnetic waves within the EM Spectrum.	Reflection Refraction Diffraction Electromagnetic Spectrum Red Shift Scattering

MLS	Learning Activities	
PS4.A.1, PS4.A.2	Slinky Lab (Wave Properties)	Must Do ▾
	Tuning Fork Activity (Sound Properties)	Must Do ▾
	Electromagnetic Spectrum Project	Must Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
<i>PS4.A.1,</i> <i>PS4.A.2</i>	Unit 9 Test	Paper

Additional Resources	
Phet, OpenStax, Javalab	

Grade	9-12
Unit of Study	Unit 10: Electricity and Magnetism
Length of Unit	3 weeks
Sample Essential Questions	Sample Corresponding Big Ideas
How are electricity and magnetism related?	A magnet moving through a coil of wire can induce an electrical current in the wire. Conversely, an electric current moving through a coil of wire creates a magnetic field around the coil. These principles demonstrate the relationship between electricity and magnetism and are the basis for devices such as electric generators and motors.
How are series and parallel circuits similar/different?	Series and parallel circuits are both types of electrical circuits that allow electric current to flow through connected components, such as bulbs, batteries, and switches. In a series circuit, the components are connected along a single path, so the same current flows through each component. If one component is disconnected or fails, the entire circuit is broken. In a parallel circuit, the components are connected along multiple paths, allowing current to flow through more than one branch. If one component fails, current can continue flowing through the other branches.
How are voltage, current, and resistance related?	Voltage, current, and resistance are related by Ohm's Law. Voltage is the electrical potential difference that pushes electric charges through a circuit, current is the flow of electric charge, and resistance is the opposition to that flow. When voltage increases, current generally increases if resistance stays the same.

Missouri Learning Standards	
Priority Standard(s)	Supporting Standards(s)
I can explain how energy is stored, transferred, transformed, and conserved in physical systems.	9-12.PS3.C.1, 9-12.PS4.B.1, 9-12.PS4.B.2

Unit 10 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
PS3.C.1 PS4.B.1 PS4.B.2	Electrostatics	I can explain where lightning comes from. I can evaluate if a substance is a conductor or an insulator. I can use Coulomb's Law to calculate the potential energy between two charged particles.	Conductor Insulator Static Electricity Charge Coulomb's Law
	Electromagnetism	I can explain the interrelationship between electricity and magnetism. I can explain why Aurora Borealis mostly occurs at the Northern Pole.	Electric Field Magnetic Field Induced Charge Electromagnetism Aurora Borealis Generator Motor
	Circuits	I can explain why a parallel circuit is preferred in home wiring. I can use Ohm's Law to calculate voltage, current, and resistance.	Series Circuit Parallel Circuit Voltage Current Resistance

MLS	Learning Activities	
<i>PS3.C.1</i>	Conductivity Lab (Electrostatics)	Must Do ▾
<i>PS4.B.1</i>	Electric Motor Lab	Must Do ▾
<i>PS4.B.2</i>	Circuits Lab	Must Do ▾

Assessments		
MLS	Description or Location	Rubric/Location
<i>PS3.C.1</i> <i>PS4.B.1</i> <i>PS4.B.2</i>	Unit 10 Test	Paper

Additional Resources
Phet, OpenStax, Javalab