Physical Science-Integrated Year-at-a-Glance

ARKANSAS STATE SCIENCE STANDARDS

FIRST SEMESTER		SECOND SEMESTER		
Unit 1 **Forces and Motion**	**Unit 2** **Energy**	**Unit 3** **Atomic Structure**	**Unit 4** **Chemical Reactions**	**Unit 5** **Human Impact**
9 weeks	10 weeks	9 weeks	3 weeks	6 weeks
• **PSI-PS2-1** • **PSI-PS2-3** • **PSI-PS3-2** • **PSI-ESS1-5** • **PSI-ETS1-1** • **PSI-ESS2-1**	• **PSI-PS2-5** • **PSI-PS3-1** • **PSI-PS3-2** • **PSI-PS3-3** • **PSI-PS3-4** • **PSI-PS4-1** • **PSI-PS4-2** • **PSI-LS2-4** • **PSI-ETS1-2**	• **PSI-PS1-1** • **PSI-PS1-2** • **PSI-PS1-3** • **PSI-PS2-6**	• **PSI-PS1-4** • **PSI-PS1-7** • **PSI-PS2-6** • **PSI-LS1-5** • **PSI-LS1-7**	• **PSI-LS2-7** • **PSI-LS4-5** • **PSI-ESS2-7** • **PSI-ESS3-1** • **PSI-ESS3-2**

Recurring

- **RST.9-10.3** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- **RST.9-10.5** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
- **RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **WHST.9-10.1** Write arguments focused on discipline-specific content.

Unit 1

Unit 2

Unit 3

Unit 4

Unit 5

Unit 1	Forces and Motion	Grade Level	9	Approx length	9 weeks

CPSD Power Standards with Student Learning Objectives

PSI-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Student-Friendly Objectives:

- I can calculate net force.
- I can predict changes in the motion of an object based on net force.
- I can describe the role of each of Newton's three laws of motion in a given scenario.
- I can use the relationship between force, mass, and acceleration to solve problems.
- I can create and analyze graphs of mass, acceleration, and force.

Learning Indicators of Power Standards

Students will know…

- Newton's Laws (First, Second, Third)
- The relationship between gravity and weight
- Types of forces

And be able to…

- Distinguish between balanced and unbalanced forces.
- Calculate net force and use it to predict changes in motion of an object.
- Describe the role of each of Newton's three laws of motion in a given scenario.
- Describe the relationships between Newton's 1st and 3rd laws to mass, acceleration, and/or force.
- Calculate mass, acceleration, and force from Newton's 2nd law.
- Calculate the acceleration due to gravity.
- Create and analyze graphs of mass, acceleration, and force.

Additional Arkansas State Standards

- **PSI-PS2-3** Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
- **PSI-PS3-2** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
- **PSI-ESS1-5** Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

- **PSI-ESS2-1** Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
- **PSI3-ETS1-1** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Unit 2	Energy	Grade Level	9	Approx Length	10 weeks

CPSD Power Standards with Student Learning Objectives

PSI-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).

Student-Friendly Objectives:

- I can use the relationships between mass, velocity, and kinetic energy to solve problems.
- I can use the relationships between mass, gravity, height, and potential energy to solve problems.
- I can use the relationships between mechanical, potential, and kinetic energies to solve problems.
- I can create a model to illustrate the relationship between kinetic, potential, and mechanical energy.

PSI-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

Student-Friendly Objectives:

- I can explain the law of conservation of energy.
- I can predict the direction of heat transfer between two objects.
- I can compare and contrast conduction, convection, and radiation.
- I can measure and record changes in temperature when two substances are combined.
- I can collect and analyze data to show a relationship between temperature, mass, and heat transfer.

Learning Indicators of Power Standards

Students will know…	And be able to…
• Forms of energy: thermal, electrical, chemical, mechanical • Energy can be transferred in a closed system, however the total amount of energy is conserved • In a closed system, kinetic energy (KE) and potential energy (PE) have an inversely proportional relationship • The relationship between mechanical energy and kinetic and potential energy • States of matter (solid, liquid, gas) and phase changes • Energy cannot be created or destroyed, but it can be transferred between systems	• Use appropriate formula to calculate KE, GPE, and ME. • Compare and contrast the behaviors of solids, liquids, and gases . • Create a model to illustrate the relationship between kinetic, potential, and mechanical energy. • Predict the direction of heat transfer between two objects. • Compare and contrast conduction, convection, and radiation. • Conduct an investigation to measure changes in thermal energy when two substances of different temperatures are combined within a closed system. • Collect and analyze data to relate how temperature and mass affect

● Systems always move towards a more stable state where energy is uniformly distributed ● The amount of energy transfer needed to change the temperature of a sample of matter would depend on the nature and size of the matter and the environment ● Thermal energy is transferred from areas of higher heat to areas of less heat ● Processes of heat transfer: conduction, convection, radiation	the amount of heat that is transferred in system.

Additional Arkansas State Standards

- **PSI-PS2-5** Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
- **PSI-PS3-1** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- **PSI-PS3-3** Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
- **PSI-PS4-1** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- **PSI-PS4-2** Evaluate questions about the advantages of using a digital transmission and storage of information.
- **PSI-LS2-4** Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
- **PSI-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit 3	Atomic Structure	**Grade Level**	9	**Approx Length**	9 weeks

CPSD Power Standards with Student Learning Objectives

PSI-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

Student-Friendly Objectives:

- I can identify types of chemical reactions based on patterns.
- I can determine what type of bond will form between two elements.
- I can compare and contrast atoms and ions.
- I can determine the number of valence electrons in an atom.
- I can compare and contrast characteristics of metals, nonmetals, and metalloids.

Learning Indicators of Power Standards

Students will know…

- Outcomes of chemical reactions
- Chemical properties
- Characteristics of atoms and ions
- The periodic table sequences elements horizontally by atomic number and vertically based on similar chemical properties
- Trends of the periodic table: electronegativity and atomic radius
- Types of chemical reactions: single displacement, double displacement, combustion, synthesis, and decomposition
- Types of bonds: ionic, covalent, metallic

And be able to…

- Identify types of chemical bonds from chemical formulas.
- Predict ion formation from valence electrons.
- Identify metals, nonmetals, metalloids.
- Compare and contrast atoms and ions.
- Determine the number of valence electrons.
- Identify patterns based on valence electrons.
- Use patterns of the periodic table to predict element characteristics in a particular group or period.
- Predict what type of bond will form between two given elements.

Additional Arkansas State Standards

- **PSI-PS1-1** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- **PSI-PS1-3** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- **PSI-PS2-6** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit 4	Chemical Reactions	**Grade Level**	9	**Approx Length**	3 weeks

CPSD Power Standards with Student Learning Objectives

PSI-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Student-Friendly Objectives:

- I can write balanced chemical equations.

Learning Indicators of Power Standards

Students will know…	And be able to…
● During a chemical reaction, atoms from reactants are combined and rearranged to form new substances ● During a chemical reaction, the total number of each type of atom does not change; mass is conserved ● Characteristics of a balanced chemical equation	● Balance chemical equations. ● Use coefficients and subscripts to determine the number of atoms and mass of each substance.

Additional Arkansas State Standards

- **PSI-PS1-4** Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- **PSI-PS2-6** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- **PSI-LS1-5** Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
- **PSI-LS1-7** Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

Unit 5	Human Impact	Grade Level	9	Approx Length	6 weeks

CPSD Power Standards with Student Learning Objectives

PSI-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Student-Friendly Objectives:

- I can provide examples of human activities that impact the environment and biodiversity positively or negatively.
- I can design a potential solution for optimizing the impact of human activity on the environment and biodiversity.
- I can evaluate and provide feedback on a potential solution for optimizing the impact of human activity on the environment and biodiversity.
- I can use feedback from others to refine my potential solution to optimize the impact of human activity on the environment and biodiversity.

Learning Indicators of Power Standards

Students will know…

- Definition of biodiversity with examples
- Current examples of local, state, and national solutions for reducing human activities on the environment; ie mobile homeless shelter units and business parks
- Some human effects are reversible with informed and responsible management

And be able to…

- Identify human activities that impact the environment and biodiversity.
- Differentiate between positive & negative outcomes of human impact.
- When given a scenario, design a potential solution for reducing the negative or enhancing the positive impact of human activity on the environment and biodiversity.
- Evaluate and provide feedback on a potential solution aimed at affecting impacts of human activities.
- Use feedback to refine a potential solution for affecting the impacts of human activities on the environment and biodiversity.

Additional Arkansas State Standards

- **PSI-LS4-5** Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
- **PSI-ESS2-7** Construct an argument based on evidence about the simultaneous coevolution of Earth's Systems and life on Earth.
- **PSI-ESS3-1** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **PSI-ESS3-2** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- **PSI-ETS1-3** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

- **PSI-ETS1-4** Use a computer simulation to model the impact of proposed solutions to a complex real- world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.