

## Chemistry-Integrated Year-at-a-Glance

### ARKANSAS STATE SCIENCE STANDARDS

FIRST SEMESTER		FIRST/SECOND	SECOND SEMESTER		
Unit 1 Motion and Matter	Unit 2 Atomic Trends and Behavior	Unit 3 Chemical Reactions	Unit 4 Solutions	Unit 5 Thermodynamics, Kinetics, and Equilibrium	Unit 4 Acids and Bases
6 weeks	6 weeks	9 weeks	5 weeks	6 weeks	4 weeks
<ul style="list-style-type: none"> <li>● CI-PS2-1</li> <li>● CI-PS2-2</li> <li>● CI-PS2-4</li> <li>● CI-ESS1-4</li> </ul>	<ul style="list-style-type: none"> <li>● CI-PS1-1</li> <li>● CI-PS1-8</li> <li>● CI-PS4-1</li> <li>● CI-PS4-3</li> <li>● CI-PS4-4</li> <li>● CI-PS4-5</li> <li>● CI-ESS1-1</li> <li>● CI-ESS1-2</li> <li>● CI-ESS1-3</li> <li>● CI-ESS1-6</li> <li>● CI-ETS1-3</li> <li>● CI-ETS1-4</li> </ul>	<ul style="list-style-type: none"> <li>● CI-PS1-1</li> <li>● CI-PS1-2</li> <li>● CI-PS1-3</li> <li>● CI-PS1-4</li> <li>● CI-PS1-7</li> <li>● CI-PS2-4</li> <li>● CI-PS3-5</li> <li>● CI-ETS1-1</li> </ul>	<ul style="list-style-type: none"> <li>● CI-PS1-3</li> <li>● CI-ESS2-5</li> <li>● CI-ESS3-4</li> <li>● CI-ETS1-2</li> </ul>	<ul style="list-style-type: none"> <li>● CI-PS1-4</li> <li>● CI-PS1-5</li> <li>● CI-PS1-6</li> <li>● CI-PS3-1</li> <li>● CI-ESS2-3</li> </ul>	<ul style="list-style-type: none"> <li>● CI-PS1-3</li> <li>● CI-ESS2-5</li> <li>● CI-ESS3-4</li> <li>● CI-ETS1-2</li> </ul>

Recurring

**RST.11-12.2** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

**RST.11-12.3** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

**RST.11-12.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

**RST.11-12.9** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**WHST.11-12.1** Write arguments focused on discipline-specific content

[Unit 1](#)

[Unit 2](#)

[Unit 3](#)

[Unit 4](#)

[Unit 5](#)

[Unit 6](#)

<b>Unit 1</b>	Motion and Matter	<b>Grade Level</b>	10-12	<b>Approx length</b>	6 weeks
---------------	-------------------	--------------------	-------	----------------------	---------

**CPSD Power Standards with Student Learning Objectives**

**CI-PS2-2** Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

- Student-Friendly Objectives:**
- I can draw and label free body diagrams.
  - 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 speed/velocity, distance, and time to solve problems.
  - I can use the relationship between velocity, time, and acceleration to solve problems.
  - I can determine whether a collision is elastic or inelastic.
  - I can use the relationship between mass, speed/velocity, and momentum to solve problems.

**Learning Indicators of Power Standards**

<p>Students will know...</p> <ul style="list-style-type: none"> <li>● Law of Conservation of Momentum</li> <li>● Newton’s Laws (First, Second, Third)</li> <li>● Types of forces</li> <li>● Motion in one dimension: speed and acceleration</li> <li>● Types of collisions: elastic and inelastic</li> </ul>	<p>And be able to...</p> <ul style="list-style-type: none"> <li>● Draw and label free body diagrams.</li> <li>● Calculate net force and use it to predict changes in motion of an object.</li> <li>● Distinguish between balanced and unbalanced forces.</li> <li>● Describe the role of each of Newton’s three laws of motion in a given scenario.</li> <li>● Calculate speed and acceleration for an object in one dimension.</li> <li>● Calculate momentum.</li> </ul>
--	---

**Additional Arkansas State Standards**

- **CI-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.
- **CI-PS2-4** Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.
- **CI-ESS1-4** Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

<b>Unit 2</b>	Atomic Trends and Behavior	<b>Grade Level</b>	10-12	<b>Approx Length</b>	6 weeks
---------------	----------------------------	--------------------	-------	----------------------	---------

**CPSD Power Standards with Student Learning Objectives**

**CI-PS1-8** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

- Student-Friendly Objectives:**
- I can distinguish between radioactive decay, fusion, and fission.
  - I can model changes in the nucleus during alpha decay.
  - I can model changes in the nucleus during beta decay.
  - I can model changes in the nucleus during gamma decay.
  - I can model changes in the nucleus during fusion.
  - I can model changes in the nucleus during fission.
  - I can predict products of a nuclear decay.
  - I can balance nuclear equations.
  - I can determine half-life from a graph or using an equation.
  - I can identify what type of decay has occurred when looking at a nuclear equation.

**CI-PS4-4** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

- Student-Friendly Objectives:**
- I can solve problems using Planck’s constant and the speed of light.
  - I can describe relationships between wavelength, frequency, and energy.
  - I can determine the color of light based on the wavelength of light that is absorbed.
  - I can evaluate the validity and reliability of claims from different sources regarding the effects of electromagnetic radiation.

**Learning Indicators of Power Standards**

<p>Students will know...</p> <ul style="list-style-type: none"> <li>● Types of radioactive decay: alpha, beta, and gamma</li> <li>● The processes of radioactive decay, fusion, and fission</li> <li>● Atomic nuclei are made of protons and neutrons</li> <li>● Isotopes are atoms of the same element with different numbers of neutrons</li> </ul>	<p>And be able to...</p> <ul style="list-style-type: none"> <li>● Distinguish between fission, fusion, and radioactive decay.</li> <li>● Predict the products of a nuclear decay.</li> <li>● Balance nuclear equations.</li> <li>● Calculate half-life using an equation.</li> <li>● Determine half-life from a graph.</li> </ul>
---	---

- The role of energy in radioactive decay, fusion, fission
- The total number of neutrons plus protons does not change in any nuclear process
- Properties and characteristics of waves
- Electromagnetic spectrum
- Relationship between wave energy and frequency
- Relationship between wavelength and energy
- Longer wavelengths have less energy; shorter wavelengths have more energy
- Shorter wavelengths can cause damage to living cells
- Types of radiation (ultraviolet, X-rays, gamma rays, background radiation)
- Strategies to evaluate a claim (validity of claim, credibility of the source, relevance of the evidence, etc.)

- Model changes in the composition of the nucleus.
- Solve problems using Planck's constant and the speed of light.
- Differentiate between wavelength and frequency.
- Relate wavelength and frequency to the energy of a wave.
- Determine the color of light based on the wavelength of light absorbed.
- Compare radiation and energy levels to determine adverse effects.
- Compare information from different sources (websites, journals, textbooks and literature works) regarding the effects of electromagnetic radiation:
  - Evaluate a claim
  - Assess the credibility of a source
  - Judge the relevance of evidence

#### Additional Arkansas State Standards

- **CI-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.
- **CI-PS4-1** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- **CI-PS4-3** Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
- **CI-PS4-5** Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
- **CI-ESS1-1** Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
- **CI-ESS1-2** Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
- **CI-ESS1-3** Communicate scientific ideas about the way stars, over their life cycle, produce elements.
- **CI-ESS1-6** Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
- **CI-ETS1-3** Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **CI-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.

<b>Unit 3</b>	Chemical Reactions	<b>Grade Level</b>	10-12	<b>Approx Length</b>	9 weeks
---------------	--------------------	--------------------	-------	----------------------	---------

### CPSD Power Standards with Student Learning Objectives

**CI-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 compare and contrast atoms, ions, and isotopes.
- I can determine the number of valence electrons in an atom.
- I can determine what type of bond will form between two elements.
- I can identify types of chemical reactions based on patterns.
- I can predict the products of a chemical reaction based on its reaction type.

**CI-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 and balance chemical equations.
- I can use mole ratios to convert between moles of one substance to moles of a different substance.
- I can use mole ratios and molar mass to convert from moles of one substance to grams of a different substance (and vice versa).
- I can determine which reactant is the limiting reactant in a chemical reaction.
- I can determine which reactant is the excess reactant in a chemical reaction.

### Learning Indicators of Power Standards

Students will know...

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

And be able to...

- Compare and contrast atoms, ions, and isotopes.
- 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.
- Predict the products of a chemical reaction.
- Balance chemical equations.
- Write chemical formulas.
- Calculate formula mass based on periodic table.
- Determine mole ratios.

does not change; mass is conserved

- Characteristics of a balanced chemical equation
- Types of chemical reactions: single displacement, double displacement, combustion, synthesis, and decomposition

- Predict the products of a chemical reaction.

#### Additional Arkansas State Standards

- **CI-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.
- **CI-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.
- **CI-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.
- **CI-PS2-4** Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
- **CI-PS3-5** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
- **CI-ETS1-1** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

<b>Unit 4</b>	Solutions	<b>Grade Level</b>	10-12	<b>Approx Length</b>	5 weeks
---------------	-----------	--------------------	-------	----------------------	---------

**Additional Arkansas State Standards**

- **CI-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.
- **CI-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- **CI-ESS3-4** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- **CI-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.

<b>Unit 5</b>	Thermodynamics, Kinetics, and Equilibrium	<b>Grade Level</b>	10-12	<b>Approx Length</b>	6 weeks
---------------	---	--------------------	-------	----------------------	---------

#### Additional Arkansas State Standards

- **CI-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.
- **CI-PS1-5** Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- **CI-PS1-6** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
- **CI-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.
- **CI-ESS2-3** Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

<b>Unit 6</b>	Acids and Bases	<b>Grade Level</b>	10-12	<b>Approx Length</b>	4 weeks
---------------	-----------------	--------------------	-------	----------------------	---------

**Additional Arkansas State Standards**

- **CI-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.
- **CI-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- **CI-ESS3-4** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- **CI-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.