

# Chemistry II: Grades 9, 10, 11, 12

Adopted 2018

## Structure of Matter

**CII1-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. [CII1-PS1-1](#)

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**CII-PS1-1AR.** Obtain, evaluate, and communicate information on the evolution of atomic models over time. [CII-PS1-1AR](#)

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**CII-PS1-2AR.** Obtain, evaluate, and communicate information using Coulomb's law to describe and predict patterns of electrostatic forces between particles. [CII-PS1-2AR](#)

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**CII-PS1-3AR.** Use mathematical representations and computational thinking to support a claim that patterns exist among the frequency, wavelength, and speed of waves. [CII-PS1-3AR](#)

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**CII-PS1-4AR.** Analyze and interpret data of absorption and emission of energy in the form of electromagnetic radiation and models of the atom. [CII-PS1-4AR](#)

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**CII-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. [CII-PS1-8](#)

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**CII-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. [CII-PS4-3](#)

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**CII1-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. [CII1-ETS1-3](#)

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## Properties of Matter

**CII2-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. [CII2-PS1-1](#)

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**CII-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. CII-PS1-3

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**CII-PS2-1AR.** Develop and use models to explain the differences between chemical compounds using patterns as a method for identification. CII-PS2-1AR

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**CII-PS2-2AR.** Use mathematics and computational thinking to apply Coulomb's law to determine scale, proportion, and quantity of forces between particles. CII-PS2-2AR

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**CII-PS2-3AR.** Use mathematical representations to quantify matter through the analysis of patterns in chemical compounds. CII-PS2-3AR

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**CII-PS2-4AR.** Develop and use a model of two particles interacting through electric fields to illustrate forces between particles and the changes in energy due to the interaction. CII-PS2-4AR

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**CII2-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. CII2-ETS1-2

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## Reactions

**CII-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. CII-PS1-2

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

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**CII-PS3-1AR.** Use mathematical representations to analyze the proportion and quantity of particles in solution. CII-PS3-1AR

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**CII-PS3-2AR.** Construct an explanation of the relationship between energy and the behavior of particles. CII-PS3-2AR

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**CII-PS3-3AR.** Plan and carry out an investigation to predict the outcome of a chemical reaction based on patterns of chemical properties. CII-PS3-3AR

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**CII3-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. CII3-ETS1-3

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## Kinetics and Kinetic Molecular Theory

**CII-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. CII-PS1-5

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**CII-PS4-1AR.** Plan and carry out investigations to examine stability and change exhibited by gas particles in a closed system. CII-PS4-1AR

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**CII-PS4-2AR.** Argue from evidence cause and effect relationships of factors influencing behavior of gas particles. CII-PS4-2AR

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**CII4-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. CII4-ETS1-4

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## Thermochemistry

**CII-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. CII-PS1-4

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**CII-PS5-1AR.** Analyze and interpret data to explain energy (enthalpy) changes of a reaction. CII-PS5-1AR

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**CII-PS5-2AR.** Plan and conduct an investigation to calculate changes in energy within a system and/or energy flows in and out of a system. CII-PS5-2AR

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**CII5-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. CII5-ETS1-4

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## Equilibrium

**CII-PS1-6.** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. CII-PS1-6

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**CII-PS6-1AR.** Analyze and interpret data to explain the change in concentration of products and reactants, and the stable state achieved under reversible conditions. CII-PS6-1AR

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**CII6-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. CII6-ETS1-2

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## Organic Chemistry

**CII-PS7-1AR.** Obtain and combine information to describe differences between alkanes, alkenes, and alkynes. CII-PS7-1AR

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**CII-PS7-2AR.** Obtain and combine information to describe differences between various functional groups. CII-PS7-2AR

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**CII7-ETS1-1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. CII7-ETS1-1