* Waves were added at the strand level. At the disciplinary core level, the following topics are new or expanded: Electricity and Magnetism, Heat Transfer/Thermodynamics, Nuclear, and Momentum.
* NGSS places additional emphasis on mathematical relationships and computational models.
* Students must be able to construct, revise, and use scientific models to predict results and communicate information.
* Although Scientific Inquiry is not explicitly referenced, it is integrated throughout the content.

| NGSS PE | ORSS | Content | Practice  | CCC | Notes on Alignment |
| --- | --- | --- | --- | --- | --- |
| HS-PS1 Matter and its Interactions |
| HS-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. | H.1P.1 | S | N | N | * NGSS implies Atomic Structure.
* “Using the Periodic Table as a **model**” is now required at all levels, not just in a content specific Chemistry class.
 |
| HS-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. | H.2P.1H.3S.1H.3S.2H.3S.3 | P | PPP | N | * The NGSS explicitly that students should be able to “revise” an explanation.
* The NGSS is explicitly embedding components of the 2009 Oregon Scientific Inquiry Standards within this Content Strand to provide a richer experience.
* Unlike the Oregon Standards that implies that data to be analyzed must be “student created”; the NGSS encourages other types of data sources. See NGSS Volume 1 for clarification.
 |
| HS-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. | H.1P.2H.3S.2Core Standard H1 | S | S | S  | * 2009 standards use “bonds”; NGSS uses the term “forces” which is a better term
 |
| HS-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. | H.2P.1H.2P.3H.2P.1 & H.2P.3 | S | N | S | * Performance expectation is that students must construct the **model,** which is a new practice.
* The combination of both H.2P.1 & H.2P.3 makes a strong CCC alignment.
 |
| HS-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.  | H.2P.1H.3S.3 | S | S | P | * NGSS focuses on Kinetic Molecular Theory.
* CCC is only aligned when drawing a conclusion and examining the pattern from data.
 |
| HS-PS1-6.Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. | H.4D.2 & H.4D.3 & H.4D.4Core Standard H2 | N | S | P | * NGSS goes beyond Oregon’s Engineering Standard by specifying a modification to the design.
* Strong alignment with all Engineering Design Process Standards
 |
| HS-PS1-7.Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. | H.2P.2 | S | N | P | * While new to the science standards this IS related to the Common Core math, and supports Oregon Essential Skills to use mathematics in context.
* See NGSS Volume 1 for clarification.
* New Vocabulary and concepts at this level is specific to “proportional relationships” and “the mole”
 |
| HS-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. | H.1P.1 & H.2P.2 &H.2P.3 | P | N | P  | * Performance expectation is that students must construct the **model,** which is a new practice
* See NGSS Volume 1 for clarification for the Disciplinary Core Idea in the NGSS to find link to conservation of mass.
 |
|  |  |  |  |  |  |
| HS-PS2 Motion and Stability: Forces and Interactions |
| HS-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. | H.2P.4H.3S.3Core Standard H2 | S | S | S | * NGSS emphasis is strong on the mathematical relationship see Common Core connection.
 |
| HS-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. | H.2P.4 | P | N | N | * Supports CCSSM, and Oregon Essential Skills to use mathematics in context.
* “Momentum” is new content, while “net force” is connected to ORSS.
* Vocabulary emphasizes “momentum”, “boundary conditions” and “initial conditions”
 |
| HS-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. | H.2P.4H.4D.2 &H.4D.3 &H.4D.4 | S | S | S |  |
| HS-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. | H.2P.4 | P | N | N | * Supports CCSSM, and Oregon Essential Skills to use mathematics in context.
* Coulomb’s Law and Electrostatic Forces are new concepts.
 |
| HS-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. | No content standardH.3S.2Core Standard H2 | N | S | S  | * Vocabulary emphasized is “magnetic field” and “electric current”.
* The core idea emphasizes “electrical energy”
* The foundation for this content is 6.2P.2
 |
| HS-PS2-6.Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. | H.1P.2Core Standard H3 Core Standards H1 & H3 | P | P | S | * Communicate Scientific and Technical information (Inquiry and or ELA)
* NGSS is more focused on communication and includes a variety of formats that students can communicate their findings.
 |
| HS-PS3 Energy |
| HS-PS3-1Create 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. | H.2P.3Core Standard H2 | P | N | P | * While the practice is new to the science standards this IS related to the Common Core math, and supports Oregon Essential Skills to apply mathematics in a variety of settings.
* “Computational Model” means that students will need to explain the meaning of mathematical expressions used in the model. See NGSS Volume 1.
 |
| HS-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 positions of particles (objects).  | H.2P.3Core Standard H2 | P | N | S | * Performance expectation is that students must construct the **model,** which is a new practice
* NGSS specifies “energy transformation”, where the Oregon Standard is more general.
 |
| HS-PS3-3.Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. | H.2P.3H.4D.2 & H.4D.3 &H.4D.4H.4D.6Core Standard H2 & H4 | S | S | SS | * There are two CCC for this performance expectation.
 |
| HS-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).  | No Content StandardH.3S.2Core Standard H2 | N | S | S |  |
| HS-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.  | No Content StandardCore Standard H2 | N | N | P | * Performance expectation is that students must use a **model,** which is a new practice.
* Concerns about the clarification statement being too vague or remedial might need to look further into what is expected for student performance
* Vocabulary emphasized is “magnetic fields” & “electrical fields”
 |
| HS-PS4 Waves and their Applications in Technologies for Information Transfer |
| HS-PS4-1.Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.  | No Content StandardCore Standard H2 | N | N | P | * Supports CCSSM, and Oregon Essential Skills to use mathematics in context.
* The foundation for the core idea is linked to 6.2P.1
 |
| HS-PS4-2.Evaluate questions about the advantages of using a digital transmission and storage of information. | No Content StandardH.3S.5 & H.4D.5 | N | P | N |  |
| HS-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.  | No Content StandardH.3S.4 | N | P | N |  |
| HS-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. | No Content StandardH.3S.3 & H.4D.4Core Standard H2 | N | P | P | * Connected to Smarter Balance Assessment for CCLS and Argumentative Writing
 |
| HS-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. | No Content StandardsCore Standard H.3 & Core Standard H.4H4.D5 H4.D6Core Standard H4 | N | P | SSP | * On Communicate Scientific and Technical information (Inquiry and or ELA)
* There are three CCC –

**H4.D5** strong alignment with “Interdependence of Science Engineering and Technology” **H4.D6** strong alignment with “Influence of Engineering Technology and Science on Society” **H4** is partially aligned with Cause and Effect* NGSS is more focused on communication and includes a variety of formats that students can communicate their findings.
 |
|  |
| The following ORSS are not aligned to any NGSS: |
| H.2P.2 Explain how physical and chemical changes demonstrate the law of conservation of mass. |
| H.3S.1 Based on observations and science principles, formulate a question or hypothesis that can be investigated through the collection and analysis of relevant information. |
| H.3S.5 Explain how technological problems and advances create a demand for new scientific knowledge and how new knowledge enables the creation of new technologies. |