

# Alignment of Oregon Science Standards

Crosswalk of 2009 Oregon Science Standards to  
2014 Oregon Science Standards (Next Generation Science Standards)



# Alignment of Oregon Science Standards

## *2014 Science Standards (Next Generation Science Standards) and 2009 Science Standards*

### Introduction

These pages show how the content, practices, and cross-cutting concepts (CCC) associated with the new Oregon Science Standards (NGSS) adopted in March 2014 align to the Oregon Science Standards adopted in February 2009. It is important to remember that the new Oregon Science Standards (NGSS) will be phased in so that districts can implement changes in local curriculum, provide appropriate professional development for teachers and administrators, and provide students with opportunities to learn the content, practices, and cross-cutting concepts prior to assessment. Oregon students will continue to be assessed on the Oregon 2009 Science Content Standards via OAKS Science until a new science assessment that aligns with the newly adopted standards is developed and becomes operational in 2018-2019.

### Purpose

The purpose of this document is to provide educators with a view of the alignment between the 2009 content standards currently required as part of each Oregon district's curriculum and instruction in the subject area of science, and those contained in the new 2014 Oregon Science Standards (NGSS). An examination of the content of these pages is meant to provide at least some clarification on the following issues:

- What content, practices, and cross-cutting concepts are new and have not previously been a part of Oregon's 2009 Science Standards?
- What content, practices, and cross-cutting concepts will now need to be part of the curriculum at an earlier (or later) grade level than where they are currently taught and assessed?
- In what instances are similar skills being addressed, but with a somewhat different emphasis or with different expectations regarding the degree of sophistication?

### Organization of the Alignment Tables

The rows in the table show whether there is a corresponding 2009 Oregon science standard(s) for each of the new 2014 Oregon science standards (NGSS) performance expectation (PE) in the areas of content, practices, and cross-cutting concepts (CCC). Codes designate the degree of alignment: S = Strong; P = Partial; D = Different Grade; N = New (not in any 2009 ORSS). The 2009 Oregon Science Standards that are not aligned to any new 2014 Oregon Science Standard (NGSS) are included at the end of the document. The bulleted statements at the beginning of the document provide summary information about the differences between the two sets of standards.

## Alignment of Oregon's 2014 Science Standards (NGSS) with 2009 Oregon Science Standards (2009 ORSS)

Degree of Alignment Codes: **S** = Strong; **P** = Partial; **D** = Different Grade; **N** = New (not in any 2009 ORSS)

2009 Oregon Science Standards that are not aligned to any New Oregon Science Standard (NGSS) are included at the end of the document. The bulleted statements at the beginning of the document provide summary information about the differences between the two sets of standards..

### Grade: Kindergarten

- 2009 Oregon Science Standards provide foundational skills to approach the rigor and specific content of NGSS.
- NGSS is more specific to plant and animal survival, and moves deeper into constructing an argument.
- NGSS moves beyond observation to describing patterns. Observation is an element/precursor to planning and carrying out investigations.
- NGSS shifts from exploring questions to asking questions, requires greater specificity, and expects students to obtain and communicate information.
- Temperature patterns (2009 ORSS 2<sup>nd</sup> Grade Earth/Space Science Standard) shifts to K and 3<sup>rd</sup> Grade in NGSS.
- NGSS Engineering Design Standards are K-2 grade-band specific.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>K-PS2 Motion and Stability: Forces and Interactions</i>					
K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.	K.2P.1 1.2P.1 K.3S.2 2.4D.2	P D	P D	N	Content for 2009 ORSS K-1 combined is strongly aligned. Cause and effect is newly stated and implied previously in 2009 ORSS 1.2P.1.
K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.	K.3S.1 1.3S1 1.3S.2 2.3S.1 2.3S.2 K.2P.1 1.2P.1	P D D D D	P D D D	N	
<i>K-PS3 Energy</i>					
K-PS3-1. Make observations to determine the effect of sunlight on Earth's surface.	K.1E.1 K.3S.2	S	S	N	
K-PS3-2. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.	K.1E.1 K.4D.1	S	S	N	NGSS are task specific.
<i>K-LS1 From Molecules to Organisms: Structures and Processes</i>					
K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.	K.1L.1 1.2L.1 K.3S.1 K.3S.2	S D	P P	N	Practices together are strongly aligned.
<i>K-ESS2 Earth's Systems</i>					
K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.	K.2E.1 K.3S.2 2.3S.2	P	P D	D	NGSS move beyond observation into patterns.

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### Grade: Kindergarten

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.	2.1L.1	D/P	N	N	NGSS are more specific to plant and animal survival and moves deeper into constructing an argument.
<i>K-ESS3 Earth and Human Activity</i>					
K-ESS3-1. Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.	K.1L.1 1.2L.1	P D/P	N	N	
K-ESS3-2. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.	2.2E.2 K.3S.1	D/P	P	N	NGSS shift from exploring to asking questions, requires greater specificity, and expects students to obtain and communicate information.
K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.		N	N	N	
<i>K-2-ETS1 Engineering Design</i>					
K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	K.3S.1 K.4D.1 1.4D.1 2.4D.1 2.4D.3		P P D D D	P	2009 ORSS Engineering Design K-2 content combined with Science Inquiry create a strong alignment with NGSS. All of these are partially aligned because they are based on a grade K-2 band. Structure and function is a core idea in 2009 ORSS and is also addressed in K.4D.1
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	K.4D.2 2.4D.3		P D	P	
K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	K.4D.1 2.3S.1 2.4D.3		P D D	P	
<b>2009 ORSS not aligned to any NGSS:</b>					
K.1P.1 Compare and contrast characteristics of living and non-living things.					

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### Grade: 1

- *Waves and Their Applications in Technologies for Information Transfer* is a new concept not in the 2009 ORSS.
- The 2009 ORSS Life Science Standards partially correlate to NGSS Life Science Topic if you combine some of the Grade 1-3 Life Science Standards, but the **application** of content knowledge greatly increases the rigor for students' understanding.
- Content for 2009 ORSS Standards K-1 combined is a strong alignment to NGSS.
- NGSS Engineering Design Standards are K-2 grade-band specific.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>1-PS4 Waves and Their Applications in Technologies for Information Transfer</i>					
1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.	1.3S.1 1.3S.2	N	P	N	<i>Waves and Their Applications in Technologies for Information Transfer</i> is a new concept not in the 2009 ORSS.
1-PS4-2. Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.	1.3S.1 1.3S.2	N	P	N	
1-PS4-3. Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.	1.3S.1 1.3S.2	N	P	N	
1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.	1.4D.1 1.3S.1	N	P P	N	
<i>1-LS1 From Molecules to Organisms: Structures and Processes</i>					
1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	1.1L.1 1.2L.1 1.4D.1 1.3S.1 1.4D.2	P P	P P	S	NGSS are more specific than the 2009 ORSS.
1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	1.1L.1 3.1L.1 2.3S.2	P D	D/P	D	
<i>1-LS3 Heredity: Inheritance and Variation of Traits</i>					
1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	1.1L.1 3.1L.1 1.3S.2 2.3S.2	P D P		D	

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### Grade: 1

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>1-ESS1 Earth's Place in the Universe</i>					
1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.	K.1E.1 K.2E.1 2.2E.1 1.3S.2 2.3S.2	D/P D/P D			The observations recorded need to reflect the patterns.
1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.	2.2E.1 1.3S.2 2.3S.2	D			
<i>K-2-ETS1 Engineering Design</i>					
K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	K.3S.1 K.4D.1 1.4D.1. 2.4D.1 2.4D.3		P P D D D	P	Engineering Design content of the 2009 ORSS K-2 learning progression when combined with Science Inquiry creates a strong alignment. All of these are partially aligned, because the NGSS are based on a grade K-2 band.
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	K.4D.2 2.4D.3		P D	P	
K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	K.4D.1 2.3S.1 2.4D.3		P D D	P	
<b>2009 ORSS not aligned to any NGSS:</b>					
1.3S.3 Describe why recording accurate observations is important in science.					
1.4D.3 Show how tools are used to complete tasks every day.					

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### Grade: 2

- Structure and Function is implied in the 2009 ORSS Core Idea for grade 2.
- The 2009 Oregon Life Science Standards partially align to NGSS Life Science Topic if you combine some of the Grade 1-3 Life Science Content Standards, but the **application** of content knowledge greatly increases the rigor for students' understanding.
- NGSS Engineering Design Standards are K-2 grade-band specific.
- NGSS add new requirements for answering scientific questions using informational text/ media.
- Properties of Magnetism (2009 ORSS 2<sup>nd</sup> Grade Physical Science Standard) shifts to 3<sup>rd</sup> Grade in NGSS.
- Matter and Interactions (2009 ORSS 1<sup>st</sup>/3<sup>rd</sup>/4<sup>th</sup> Grade Physical Science Standard) shifts to 2<sup>nd</sup> Grade in NGSS.
- Patterns of the Sun and Moon (2009 ORSS 2<sup>nd</sup> Grade Earth/Space Science Standard) shifts to 1<sup>st</sup> Grade in NGSS.
- Temperature Patterns (2009 ORSS 2<sup>nd</sup> Grade Earth/Space Science Standard) shifts to K and 3<sup>rd</sup> Grade in NGSS.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>2-PS1 Matter and Its Interactions</i>					
2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.	1.P1.1 1.1E.1 3.1P.1 2.3S.2 2.3S.1	D D/P D	S S	S	
2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.	1.1P.1 3.1P.1 1.1E.1 2.4D.1 2.3S.3 3.3S.2	D D D	P P	N S	Cause and effect is newly stated and implied previously in 2009 ORSS 1.2P.1  Connections to engineering, technology, and application of science NGSS link to 2009 ORSS 2.4D.1
2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.	1.1P.1 K.4D.2 2.3S.1 2.4D.1 2.4D.3	D D	P P P	D	
2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.	1.P1.1 3.1P.1 4.2P.1 3.3S.3 4.3S.3	D D D	D D	N	Cause and effect is newly stated and implied previously in 2009 ORSS 3.1P.1 and 4.2P.1

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### Grade: 2

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>2-LS2 Ecosystems: Interactions, Energy, and Dynamics</i>					
2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.	2.1L.1 1.2L.1 3.3S.1	P D	P	N	Cause and effect is newly stated in NGSS and implied previously in 2009 ORSS.
2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.	2.1L.1 2.2L.1 2.4D.1 2.3S.2 2.3S.3	P P	S P P	N	Structure and Function is implied in the 2009 ORSS Core Idea for grade 2.
<i>2-LS4 Biological Evolution: Unity and Diversity</i>					
2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.	2.1L.1 2.3S.1 2.3S.2 2.3S.3	S	S S S	N/A	There is no crosscutting concept for this NGSS standard.
<i>2-ESS1 Earth's Place in the Universe</i>					
2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	4.2E.1 2.3S.1 2.3S.3	D	P P	N	Stability and Change are implied in 2009 ORSS.
<i>2-ESS2 Earth's Systems</i>					
2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.	2.3S.2 4.2E.1 2.4D.1 2.4D.3	D	P P	S	
2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area.	2.3S.2 4.2E.1 2.4D.1	D/P	S S	S	
2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.	2.3S.2 1.1E.1 3.1P.1 4.1E.1	D/P D/P D/P	N	N	New requirements for answering scientific questions using informational text/ media.

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### Grade: 2

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>K-2-ETS1 Engineering Design</i>					
K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	K.3S.1 K.4D.1 1.4D.1. 2.4D.1 2.4D.3		P P D D D	P	Engineering Design content of the 2009 ORSS K-2 learning progression when combined with Science Inquiry creates a strong alignment. All of these are partially aligned because they are based on the NGSS grade k-2 band. Structure and function is a core idea in 2009 ORSS, and also addressed in K.4D.1
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	K.4D.2 2.4D.3		P D	P	
K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	K.4D.1 2.3S.1 2.4D.3		P D D	P	

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### Grade: 3

- Weather and climate, forces and interactions, and life sciences (ecosystems) are more developed and rigorous in the NGSS than the 2009 ORSS.
- Study of matter in the 2009 ORSS moved to 2<sup>nd</sup> and 5<sup>th</sup> grade in the NGSS.
- Most 2009 ORSS in the 3-5 grade band remained intact, the greatest changes are the instructional approaches moving from content-based to more performance-based. In NGSS, students are asked to understand, use and apply scientific processes to a greater degree than in 2009 ORSS.
- In NGSS, the content is more integrated with scientific inquiry standards, increased rigor, and real-world connections.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>3-PS2 Motion and Stability: Forces and Interactions</i>					
3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	3.2P.1 5.2P.1 3.3S.1 3.3S.2	S D/S	S S	N	CCC changed from interaction and change to cause and effect and patterns.
3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that that a pattern can be used to predict future motion.	3.3S.1 3.3S.2 3.3S.3 3.2P.1	S	S S S	N	CCC changed from interaction and change to cause and effect and patterns.
3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.	2.2P.1 5.2P.1 3.2P.1 4.3S.1	D/S D/P S	D	N	CCC changed from interaction and change to cause and effect and patterns.
3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.	3.4D.1 2.2P.1 5.2P.1	D/S D/P	S	N	CCC changed from interaction and change to cause and effect and patterns.
<i>3-LS1 From Molecules to Organisms: Structures and Processes</i>					
3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.	3.1L.1 3.2L.1	S S		N N	CCC is patterns.
<i>3-LS2 Ecosystems: Interactions, Energy, and Dynamics</i>					
3-LS2-1. Construct an argument that some animals form groups that help members survive.	5.2L.1	D/P		N	CCC is cause and effect.

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### Grade: 3

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>3-LS3 Heredity: Inheritance and Variation of Traits</i>					
3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.	3.1L.1 3.3S.2	S	S	N	Moved to a higher level of thinking. CCC are cause and effect and patterns.
3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.	4.2L.1	D/S		N	CCC are cause and effect and patterns
<i>3-LS4 Biological Evolution: Unity and Diversity</i>					
3-LS4-1. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.	4.1L.1 4.2L.1	D/S D/P		N	Moved to a higher level of thinking CCC are cause and effect; scale, proportion, and quantity; and systems and system models.
3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.	3.1L.1	P		N	CCC are cause and effect; scale, proportion, and quantity; and systems and system models.
3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.	4.2L.1 5.2L.1	D/P D/S		N	CCC are cause and effect; scale, proportion, and quantity; and systems and system models.
3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.	4.3S.3		D/S	N	CCC are cause and effect; scale, proportion, and quantity; and systems and system models.
<i>3-ESS2 Earth's Systems</i>					
3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	3.2E.1	S		N	Deeper thinking. CCC is patterns.
3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.	3.2E.1	P		N	CCC is patterns.

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### Grade: 3

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>3-ESS3 Earth and Human Activity</i>					
3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.		N	N	N	No connection to a 2009 ORSS.
<i>3-5-ETS1 Engineering Design</i>					
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	3.4D.1		S	N	CCC is influence of engineering, technology, and science on society and the natural world.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	5.4D.1		D/P	N	CCC is influence of engineering, technology, and science on society and the natural world.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	3.4D.1		P	N	CCC is influence of engineering, technology, and science on society and the natural world.
<b>2009 ORSS not aligned to any NGSS:</b>					
3.4D.2 Describe how recent inventions have significantly changed the way people live.					
3.4D.3 Give examples of inventions that enable scientists to observe things that are too small or too far away.					

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### Grade: 4

- Energy, Earth Systems and Life Sciences are more developed and rigorous in the NGSS than in the 2009 ORSS.
- The study of waves is new to 4th grade in NGSS.
- Study of matter has moved to 2nd and 5th grade.
- Most standards in the 2009 ORSS 3-5 grade band remained intact, the greatest changes are the instructional approaches moving from content based to more performance based. In NGSS, students are asked to understand, use and apply scientific processes to a greater degree than in 2009 ORSS.
- In the NGSS, the content is more integrated with scientific inquiry standards, increased rigor and real-world connections.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<b>4-PS3 Energy</b>					
4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.	4.1P.1	S		N	CCC is energy and matter.
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	4.1P.1 4.3S.1	S	P	N	CCC is energy and matter.
4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.	3.2P.1 4.3S.1	D/P	P	N	CCC is energy and matter.
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	4.4D.2		S	N	CCC is energy and matter.
<b>4-PS4 Waves and Their Applications in Technologies for Information Transfer</b>					
4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	6.2P.1	D/S		N	CCC is patterns.
4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	4.1P.1	S		N	CCC is patterns.
4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.		N		N	CCC is patterns.
<b>4-LS1 From Molecules to Organisms: Structures and Processes</b>					
4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	5.1L.1	D/S		N	CCC is systems and system models.

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### Grade: 4

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.	4.2L.1 5.2L.1	P P		N	CCC is systems and system models.
<i>4-ESS1 Earth's Place in the Universe</i>					
4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers for changes in a landscape over time to support an explanation for changes in a landscape over time.	4.1L.1 4.2E.1	P S		N N	CCC is patterns.
<i>4-ESS2 Earth's Systems</i>					
4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	4.2E.1	S		N	CCC are patterns and cause and effect.
4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.	5.3S.2		D/S	N	CCC are patterns and cause and effect.
<i>4-ESS3 Earth and Human Activity</i>					
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	4.1E.1	S		N	CCC is cause and effect.
4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	4.4D.2 4.3S.3		S P	N N	CCC is cause and effect.
<i>3-5-ETS1 Engineering Design</i>					
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	4.4D.1		S	N	CCC is influence of engineering, technology, and science on society and the natural world.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	5.4D.1		D/P	N	CCC is influence of engineering, technology, and science on society and the natural world.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	4.4D.2 4.4D.3		S P	N	CCC is influence of engineering, technology, and science on society and the natural world.
<b>2009 ORSS not aligned to any NGSS:</b>					
4.3S.2 Summarize the results from a scientific investigation and use the results to respond to the question being tested.					

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### Grade: 5

- Earth Systems and Life Sciences are more developed and rigorous in the NGSS than the 2009 ORSS.
- 2009 ORSS 5.2E.1 moves to middle school at a more rigorous level in NGSS and is partially addressed in 4<sup>th</sup> grade.
- Study of matter has moved to 5th grade from 3<sup>rd</sup> and 6<sup>th</sup> grade.
- Most standards in the 2009 ORSS 3-5 grade band remain intact, the greatest changes are the instructional approaches moving from content-based to more performance-based. In NGSS, students are asked to understand, use, and apply scientific processes to a greater degree than the 2009 ORSS.
- In the NGSS, content is more integrated with scientific inquiry standards, increased rigor and real-world connections.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<b>5-PS1 Matter and Its Interactions</b>					
5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.	6.1P.1	D/P		P	CCC are cause and effect; and scale, proportion, and quantity.
5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.	6.1P.1 4.2P.1	D/P D/P		P P	CCC are cause and effect; and scale, proportion, and quantity.
5-PS1-3. Make observations and measurements to identify materials based on their properties.	5.3S.1 5.3S.2		P S	P P	CCC are cause and effect; and scale, proportion, and quantity.
5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	5.3S.1		S	P	CCC are cause and effect; and scale, proportion, and quantity.
<b>5-PS2 Motion and Stability: Forces and Interactions</b>					
5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.	5.2P.1	S		P	CCC is cause and effect.
<b>5-PS3 Energy</b>					
5-PS3-1. Use models to describe that that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.	5.2L.1	P		N	CCC is energy and matter.
<b>5-LS1 From Molecules to Organisms: Structures and Processes</b>					
5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.	7.2L.2	D/S		N	CCC is energy and matter.
<b>5-LS2 Ecosystems: Interactions, Energy, and Dynamics</b>					
5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	5.2L.1 6.2L.2	S D/P		N N	CCC is systems and system models.

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### Grade: 5

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>5-ESS1 Earth's Place in the Universe</i>					
5-ESS1-1. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.	5.1E.1 6.1E.2	P D/S		N N	CCC are patterns and scale, proportion, and quantity.
5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	5.1E.1	P		N	CCC are patterns and scale, proportion, and quantity.
<i>5-ESS2 Earth's Systems</i>					
5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	6.1E.1 5.2E.1	D/P P		N	CCC are scale, proportion, and quantity and system and system models.
5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.	6.2E.1	D/P		N	CCC are scale, proportion, and quantity and system and system models.
<i>5-ESS3 Earth and Human Activity</i>					
5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.	4.1E.1 6.2L.2	D/P D/P		N N	CCC is system and system models.
<i>3-5-ETS1 Engineering Design</i>					
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	5.4D.1		S	N	CCC is influence of engineering, technology, and science on society and the natural world.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	5.4D.1 5.4D.2 4.4D.3 6.4D.1		P P D/P D/S	N N N N	CCC is influence of engineering, technology, and science on society and the natural world.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	5.4D.2		S	N	CCC is influence of engineering, technology, and science on society and the natural world.
<b>2009 ORSS not aligned to any NGSS:</b>					
5.3S.3 Explain the reasons why similar investigations may have different results.					
5.4D.3 Explain that inventions may lead to other inventions and once an invention exists, people may think of novel ways of using it.					

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### Grade: 6

- There is general alignment in the NGSS practices and the 2009 ORSS. The NGSS add evidence-based argumentation, developing and using models, and mathematical and computational thinking which align with the CCSS.
- Teaching and learning shifts from content-based to practice-based instruction that integrates core content.
- The NGSS PEs identify limitations and boundaries. It is essential to read the NGSS foundation boxes.
- Some 2009 ORSS high school standards have moved to the middle school level increasing the level of rigor at both levels.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>MS-PS3 Energy</i>					
MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.	6.1P.2 8.2P.2 6-8.4D.2	P D/P	S	P S	CCC is energy and matter. 2009 ORSS does not specifically mention thermal energy.
MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	6.1P.1 6.1P.2 8.1P.1 8.1P.3 8.2P.2 6-8.3S.1	P P D/P D/P D/S	S	P N N S N	CCC is scale, proportion, and quantity; and energy and matter.
MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.	6.1P.2 8.2P.2 7.2P.1 H.2P.3	P D/S D/P D/P	N N N N	S S S S	CCC is energy and matter The practice is new, but the content is covered in the 2009 ORSS.
<i>MS-LS1 From Molecules to Organisms: Structures and Processes</i>					
MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	6.1L.1 6-8.3S.1 6-8.3S.2	P	S P	N	CCC is compare/contrast in 2009 ORSS. Assumes evidence-based explanation. CCC is scale, proportion, and quantity.
MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.	6.1L.1 6.2L.1 7.2L.1	P P D/P	N	P	Combination of three 2009 ORSS is strongly aligned. Modeling component of this NGSS is new CCC is structure and function.
MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.	6.2L.1 6-8.3S.2	S	P	N	2009 ORSS implies the concept of systems. Evidence not used for argumentation in 2009 ORSS. CCC is systems and system models.

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### Grade: 6

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.	6.2L.2 7.1L.1 7.1L.2 8.2L.1 6-8.3S.2	P D/P D/P D/P	P/N	P/N	Behavior not strongly emphasized in 2009 ORSS. Argumentation is new; evidence should come from a variety of sources, not just a controlled investigation. CCC cause and effect is implied in 2009 ORSS.
MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	6.2L.2 7.1L.2 7.2L.2 6-8.3S.2	P/N D/P D/P	P	N	Very weak alignment; focus is on growth of organisms and the factors that affect it. CCC cause and effect is implied in 2009 ORSS.
MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.	6.1L.1 6.2L.1 6-8.3S.1 6-8.3S.2	P/N P/N	P/N P/N	N	New content, new CCC, and new practice. CCC is cause and effect.
<i>MS-LS3 Heredity: Inheritance and Variation of Traits</i>					
MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.	7.1L.1 7.1L.2	P P	N	N	Shift from compare and contrast to model. Developing and using models is not language contained in 2009 ORSS and is new in NGSS. CCC is cause and effect.
<i>MS-ESS2 Earth's Systems</i>					
MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.	6.2E.1 H.1E.2	S D/P	N	N	Developing and using models is not language contained in 2009 ORSS and is new in NGSS.
MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	8.2E.3 6.2E.1 6-8.3S.1 H.1E.2	D/S P D/P	P	N	Collecting and providing evidence does not necessarily come from a designed and conducted investigation. The 2009 ORSS include many facets of scientific inquiry that are not fully connected to a singular NGSS PE.
MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	8.2E.3 8.1P.3 H.1E.2	D/S D/P D/P	N	N	Loose connection to motion and spacing of particles. Developing and using models is not language contained in 2009 ORSS and is new in NGSS.

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### Grade: 6

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	7.2E.1-3 6-8.3S.1 6-8.4D.2 H.2E.4	D/S  D/S	P P	N	The 2009 ORSS include many facets of scientific inquiry that are not fully connected to a singular NGSS PE.
MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	7.2E.2 7.2E.3 6-8.3S.1	D/S D/S	P	N	The 2009 ORSS include many facets of scientific inquiry that are not fully connected to a singular NGSS PE.
<i>MS-ETS1 Engineering Design</i>					
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	6.4D.1 7.4D.1 8.4D.1 8.4D.3		S D/S D/S D/S	N N N	2009 ORSS is contained within NGSS, but NGSS PE takes it further. 2009 ORSS does not specifically address environmental impacts (but adding 8.4D.3 to 8.4D.1 is a strong match).
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	6.4D.2 7.4D.2 8.4D.2		P D/P D/P		Evaluation implies the collection and use of evidence, which makes a stronger alignment. Oregon scoring guide for ED includes evaluating competing solutions.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	6.4D.2 7.4D.2 8.4D.2		N D/P D/P		NGSS PE includes optimization.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	8.4D.2		N		
<b>2009 ORSS not aligned to any NGSS:</b>					
6.1E.1 Layers of Earth are implied but not an explicit PE in NGSS.					
6.3S.3 focus is on characteristics of controlled experiments and how theories change over time that are not addressed explicitly in NGSS.					

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### Grade: 7

- There is general alignment in the NGSS practices and the 2009 ORSS. The NGSS add evidence-based argumentation, developing and using models, and mathematical and computational thinking which align with the CCSS.
- Teaching and learning shifts from content-based to practice-based instruction that integrates core content.
- The NGSS PEs identify limitations and boundaries. It is essential to read the NGSS foundation boxes.
- Some 2009 ORSS high school standards have moved to the middle school level, increasing the level of rigor at both levels.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>MS-PS1 Matter and its Interactions</i>					
MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.	8.1P.1 7.1P.1	D/S P	D/P P	N N	CCC is scale, proportion, and quantity. 2009 ORSS focuses on describing a model. The NGSS focuses on creating a model.
MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	8.2P.1 8.1P.1 6.1P.1 8.3S.2	D/P D/P P	N N P D/S	D/P D/P N D/P	CCC is patterns. The 2009 ORSS combined are strongly aligned.
MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.	7.1P.1 7.2E.1 7.4D.3 8.4D.3	P S	P S S D/S	P N P N	CCC is structure and function. The concept of synthetic materials coming from natural resources is new.
MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.	6.1P.2 8.1P.1 8.1P.3 8.2P.2	P D/P D/S D/P	N D/P D/P D/P	N N D/S D/S	CCC is cause and effect. NGSS asks students to develop a model. The NGSS PE content is aligned to the 2009 ORSS, but the practice is new.
MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	8.2P.1	D/S	D/P	D/S	CCC is energy and matter. The NGSS PE content is aligned to the 2009 ORSS, but the practice is new.
MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.	8.2P.2 6-8.4D.1 6-8.4D.2	D/S	N P S	D/S	CCC is energy and matter. This combination of practice and content is new.

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### Grade: 7

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>MS-LS1 From Molecules to Organisms: Structures and Processes</i>					
MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.	6.2L.2 7.2L.1 7.2L.2 8.2P.2 6-8.3S.2	D/P P P D/P		N    P/N	Conceptual understanding of photosynthesis is emphasized, not just formula memorization. Energy is implied in 2009 ORSS, but not explicit. CCC is energy and matter.
MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.	6.2L.1 7.2L.1 7.2L.2 8.2P.2	P P P P	N	N	Modeling is not in 2009 ORSS. CCC is energy and matter.
<i>MS-LS2 Ecosystems: Interactions, Energy, and Dynamics</i>					
MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.	6.2L.2 6-8.3S.2	P	P	N	CCC is cause and effect.
MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.	6.2L.2 H.2L.2 6-8.3S.2	D/P D/P	P  S	N	2009 ORSS 6.2L.2 Does not entirely capture essence of this PE and H.2L.2 goes beyond the PE. CCC is patterns.
MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	6.2L.2 7.2L.2 8.2P.1 H.2L.1	D/P P D/P D/P	N	N	Modeling is not in 2009 ORSS. CCC is energy and matter. Some of this content is aligned to 2009 ORSS at the high school level
MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	6.2L.2 8.2L.1 6-8.3S.2	D/P D/P		N  P/N	Practice includes argumentation. CCC is stability and change.
MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.	7.2E.1 7.2E.3 6-8.4D.2	P P		N  P	7.2E.1 Could support/set the context for MS-LS2-5 CCC is stability and change.

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### Grade: 7

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>MS-ESS2 Earth's Systems</i>					
MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	6.1E.1 7.2E.4 8.2E.2 8.2P.2 H.1E.2 H.2E.1	D/P P D/P D/P D/P D/P	N	N	Developing and using models is not specifically included in 2009 ORSS. 2009 ORSS H.1E.2 + H.2E.1 are strongly aligned.
MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	8.2E.2 7.2E.4 6-8.3S.2 H.1E.2 H.2E.2	D/S S  D/P D/S	P	N	The 2009 ORSS include many facets of scientific inquiry that are not fully connected to a singular NGSS PE.
MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.	8.2E.2 8.2E.4 8.1L.1 8.2L.1 7-8.3S.2 H.2E.2	D/S D/S D/P D/P  D/P	P	N	Aligns to evidence for evolution, natural selection, geologic change in 2009 ORSS. The 2009 ORSS include many facets of scientific inquiry that are not fully connected to a singular NGSS PE. Aligned to 2009 ORSS "elucidate the history of events on Earth"
<i>MS-ESS3 Earth and Human Activity</i>					
MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	7.2E.1 6-8.3S.2	P/N	P	N	The 2009 ORSS include many facets of scientific inquiry that are not fully connected to a singular NGSS PE.
MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.	8.2E.2 6-8.4D.3 7-8.3S.2	D/P/N	P P	N	"Inform the development of technologies" is new. The 2009 ORSS include many facets of scientific inquiry that are not fully connected to a singular NGSS PE. Connection to engineering design.

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### Grade: 7

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>MS-ETS1 Engineering Design</i>					
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	6.4D.1 7.4D.1 8.4D.1 8.4D.3		S S S S	N N N	2009 ORSS is contained within NGSS, but NGSS PE takes it further. 2009 ORSS does not specifically address environmental impacts (but adding 8.4D.3 to 8.4D.1 is a strong match).
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	6.4D.2 7.4D.2 8.4D.2		P P P		Evaluation implies the collection and use of evidence, which makes a stronger alignment. Oregon scoring guide for ED includes evaluating competing solutions.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	6.4D.2 7.4D.2 8.4D.2		N P P		NGSS PE includes optimization.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	8.4D.2		N		
<b>2009 ORSS not aligned to any NGSS:</b>					
7.3S.3 focus is on characteristics of controlled experiments and how theories change over time that are not addressed explicitly in NGSS.					

## Alignment of Oregon's 2014 Science Standards (NGSS) with 2009 Oregon Science Standards (2009 ORSS)

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### Grade: 8

- There is general alignment in the NGSS practices and the 2009 ORSS. The NGSS add evidence-based argumentation, developing and using models, and mathematical and computational thinking which align with the CCSS.
- Teaching and learning shifts from content-based to practice-based instruction that integrates core content.
- The NGSS PEs identify limitations and boundaries. It is essential to read the NGSS foundation boxes.
- Some 2009 ORSS high school standards have moved to the middle school level, increasing the level of rigor at both levels.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>MS-PS2 Motion and Stability: Forces and Interactions</i>					
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.	7.2P.1 8.2P.2 6-8.4D.1 6-8.4D.2	D/S P	N N P S	N N P P	CCC is systems and system models. Energy is explicitly mentioned in the 2009 ORSS, but not in the NGSS.
MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.	7.2P.1 8.2P.2 6-8S.1 6-8S.2	D/S P	N N S P	P S P S	CCC is stability and change. Energy is explicitly mentioned in the 2009 ORSS, but not in the NGSS.
MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	6.2P.2 6-8.3S.1 6-8.3S.2	D/P	N S P	N P P	CCC is cause and effect. The 2009 ORSS focus is on the relationship between electricity and magnetism, whereas the NGSS focus is on factors that affect the strength of those two forces.
MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.	7.2P.1 8.2E.1 7.3S.3	D/P P	N P D/P	N S N	CCC is systems and system models. The 2009 ORSS does not include gravity as related to mass.
MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	6.2P.2 7.2P.1 6-8.3S.1 6-8.3S.2 H.2P.4	D/P D/P D	N N S S	P S P P	CCC is cause and effect. The scope of the NGSS PE is larger than the 2009 ORSS.
<i>MS-PS3 Energy</i>					
MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.	7.2P.1 8.2P.2 7-8.3S.2	D/P P	N N S	D/P P S	CCC is scale, proportion and quantity. The 2009 ORSS does not include calculations of energy.

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### Grade: 8

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.	8.2.P.2 H.2P.4	P D	N N	N N	CCC is systems and system models. Model development and model of stored energy is new.
<i>MS-PS4 Waves and their Applications in Technologies for Information Transfer</i>					
MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	6.1P.2 6.2P.1	D/P D/S	N D/P	N D/S	CCC is patterns. The practice of using a mathematical representation is new.
MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.	6.2.P.1	D/S	N	N	CCC is structure and function. NGSS specifies specific properties.
MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	6.2P.1 6-8.4D.3	D/P	N N	D/P P	CCC is structure and function. This is fundamentally different content than what is in the 2009 ORSS.
<i>MS-LS3 Heredity: Inheritance and Variation of Traits</i>					
MS-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.	7.1L.2 8.2L.1 H.1L.2	D/P P D/P	N	D/P	Mutations and proteins are not explicitly addressed in 2009 ORSS. Protein synthesis is not included in this PE. CCC is structure and function.
<i>MS-LS4 Biological Evolution: Unity and Diversity</i>					
MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.	8.1L.1 8.2L.1 8.2E.4 6-8.3S.2	P P P	P	N	2009 ORSS 8.2E.4 includes geologic, climatic, environmental changes over time, but the NGSS PE does not. CCC is patterns.
MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.	8.1L.1 8.2L.1 8.2E.4 6-8.3S.2	P P P	P	N	CCC is patterns.

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NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.	8.1L.1 8.2L.1 6-8.3S.2	P/N P	P/N	N	Embryology not explicitly stated in 2009 ORSS. CCC is patterns.
MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.	8.2L.1 6-8.3S.2	P	P/N	N	Population genetics is not stated in 2009 ORSS. CCC is cause and effect.
MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.	6-8.4D.3	N	P/N	N	CCC is cause and effect. NGSS clarification provides guidance. Practice is partially similar, content is new.
MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	8.2L.1 6-8.3S.2	P	P/N	N	Mathematical representation is not in 2009 ORSS. CCC is cause and effect.
<i>MS-ESS1 Earth's Place in the Universe</i>					
MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.	8.2E.1 6.1E.2 5.1E.1	S D/P D/P	N	N	Developing and using models is not specifically included in 2009 ORSS. 2009 ORSS 5 <sup>th</sup> and 6 <sup>th</sup> provide background for the NGSS PE.
MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.	8.2E.1 7.2P.1	S D/P	N	N	2009 ORSS does not include "galaxy." Developing and using models is not specifically included in 2009 ORSS.
MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.	6.1E.2 7-8.3S.2 H.1E.1	D/P D/P	P	N	NGSS does not include "galaxy" and "universe." 2009 ORSS includes properties, NGSS includes scale. Position of sun not included in NGSS. 2009 ORSS include many facets of the scientific inquiry that are not fully connected to a singular NGSS PE.
MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.	8.2E.4 7.2E.4 8.2L.1 8.1L.1 6-8.3.2	S D/P P P	P	N	Rock strata include the climatic and life form changes included in 2009 ORSS. 2009 ORSS include many facets of the scientific inquiry that are not fully connected to a singular NGSS PE.

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### Grade: 8

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>MS-ESS3 Earth and Human Activity</i>					
MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.	6.2E.1 H.1E.2	D/S D/P	N	N	Developing and using models is not specifically included in 2009 ORSS.
<i>MS-ETS1 Engineering Design</i>					
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	6.4D.1 7.4D.1 8.4D.1 8.4D.3		S S S S	N N N	2009 ORSS is contained within NGSS, but NGSS PE takes it further. 2009 ORSS does not specifically address environmental impacts (but adding 8.4D.3 to 8.4D.1 is a strong match).
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	6.4D.2 7.4D.2 8.4D.2		P P P		Evaluation implies the collection and use of evidence, which makes a stronger alignment. Oregon scoring guide for ED includes evaluating competing solutions.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	6.4D.2 7.4D.2 8.4D.2		N P P		NGSS PE includes optimization.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	8.4D.2		N		
<b>2009 ORSS not aligned to any NGSS:</b>					
8.1P.2 has been moved to HS PS1-1.(Periodic table)					
8.3S.3 – NGSS does not specifically discuss how theories evolve as new information becomes available. Content included in the “Connections to Nature of Science” (found in Appendix H).					

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### Grade: High School Physical Science

- 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.
- In the NGSS, 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 NGSS.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>HS-PS1 Matter and its Interactions</i>					
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 new.
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.1 H.3S.1 H.3S.2 H.3S.3	P	P P P	N	NGSS explicitly includes revision of an explanation. NGSS encourages other types of data sources beyond student generated.
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.2 H.3S.2 H1	S	S	S	2009 ORSS use "bonds"; NGSS uses the term "forces".
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.1 H.2P.3	S	N	S	Develop a model is a new practice. The combination of 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.1 H.3S.3	S	S	P	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.2-4 H2	N	S	P	NGSS goes beyond 2009 ORSS by specifying a modification to the design. Strong alignment with all engineering design 2009 ORSS.
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	Supports Common Core math and Oregon Essential Skills to use mathematics in context.

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### Grade: High School Physical Science

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
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 P P	N	P	Develop a model 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.
<i>HS-PS2 Motion and Stability: Forces and Interactions</i>					
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.4 H.3S.3 H2	S	S	S	NGSS emphasis is strong on the mathematical relationship which is a 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 Common Core math, and Oregon Essential Skills to use mathematics in context. "Momentum" is new content, while "net force" is connected to 2009 ORSS.
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.4 H.4D.2-4	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.	H.3S.2 H2	N	S	S	The foundation for this content is 2009 ORSS 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.2 H3 H1+H3	P	P	S	NGSS is more focused on communication and includes a variety of formats that students can communicate their findings.
<i>HS-PS3 Energy</i>					
HS-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.	H.2P.3 H2	P	N	P	Supports Common Core math, and Oregon Essential Skills to use mathematics in context. Develop a model is a new practice.

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### Grade: High School Physical Science

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
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.3 H2	P	N	S	Develop a model is a new practice. NGSS specifies "energy transformation", where the 2009 ORSS 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.3 H.4D.2-4 H.4D.6	S	S	S	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).	H.3S.2 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.	H2	N	N	P	Develop a model is a new practice.
<i>HS-PS4 Waves and their Applications in Technologies for Information Transfer</i>					
HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.		N	N		Supports Common Core math, and Oregon Essential Skills to use mathematics in context.
HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information.	H.3S.5 H.4D.5	N	P 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.	H.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.	H.3S.3 H.4D.4 H2	N	P P	P	

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### Grade: High School Physical Science

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
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.	H4.D5 H4.D6 H3+H4 H4	N	P P P	S S P	NGSS includes a variety of formats that students can use to communicate their findings.
<i>HS-ETS1 Engineering Design</i>					
HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	H.4D.1 H.4D.3	S P/N	P/N P/N	P P	NGSS is more contextualized, rigorous, and includes global perspective.
HS-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.	H.4D.2 H.4D.4 H.4D.6	P P P	P P P		Combination of these three 2009 ORSS provides a strong alignment.
HS-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.	H.4D.1 H.4D.3 H.4D.4 H.4D.5 H.4D.6	P P S P S	P N S P S	P P S P P	Combination of these three 2009 ORSS provides a strong alignment.
HS-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.	H.4D.1 H.4D.3 H.4D.4	P P P	N N N	P P P	2009 ORSS are loosely tied to modeling but not explicitly stated.
<b>2009 ORSS not aligned to any NGSS:</b>					
H.3.S.5. Explain how technological problems and advances create a demand for new scientific knowledge and how new knowledge enables the creation of new technologies.					
H.4.D.5 Describe how new technologies enable new lines of scientific inquiry and are largely responsible for changes in how people live and work.					
H.4.D.6 Evaluate ways that ethics, public opinion, and government policy influence the work of engineers and scientists, and how the results of their work impact human society and the environment.					

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### Grade: High School Life Science

- A road map for integration between content and practice can be found on page 261 of the NGSS book.
- The boundaries of each NGSS PE provide guidance to adequately teach the depth and breadth of each standard.
- Models are not limited to physical models, but can also include illustrations, mathematical representations, simulations, etc.
- Asking questions can refer to a way of obtaining, evaluating, and communicating information (students' show their thinking process) as a means of deriving a response.
- Applying concepts of statistics and probability is a skill that can be utilized in numerous standards, not just those standards where explicitly stated.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>HS-LS1 From Molecules to Organisms: Structures and Processes</i>					
HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.	H.1.L.2 H.1.L.3 H.3.S.3	S P	P	S S P	These 2009 ORSS combined cover this standard as long as the practices and CCC are included. CCC is structure and function.
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.	5.1.L.1 6.1.L.1 6.2.L.1 H.1	P P P	N	N  P	These 2009 ORSS combined result in a strong alignment. CCC is systems and system models.
HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.	H.1.L.4 H.3.S.2	P	S	N S	These 2009 ORSS combined result in a strong alignment. CCC is stability and change.
HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.	H.1.L.4 H.2.L.3	P P	N	N	These 2009 ORSS combined result in a strong alignment. CCC is systems and system models.
HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.	8.2.P.2 H.2.L.1	P P	N	N P	CCC is energy and matter.
HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.	H.1.L.1 H.2.L.1 H.3.S.3	P P	P	N P	CCC is energy and matter.
HS-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.	H.1.L.1 H.1.P.2 H.2.P.1	P P P	N	N	CCC is energy and matter.

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### Grade: High School Life Science

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>HS-LS2 Ecosystems: Interactions, Energy, and Dynamics</i>					
HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.	6.2.L.2 H.2.L.2	P P	N	N	CCC is scale, proportion, and quantity.
HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.	H.2.L.2 H.3.S.3	P	N P	N	CCC is scale, proportion, and quantity.
HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.	H.2.L.1 H.1.L.4 H.3.S.3	P P	P	N P	OR Standards are nearly identical to NGSS. NGSS includes the addition of aerobic/anaerobic conditions. CCC is energy and matter.
HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.	H.2.L.1 H.2.P.3	P P	N	N	CCC is energy and matter.
HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.	H.2.L.1 7.2.L.2	P P	N	N	CCC is systems and system models.
HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.	H.2.L.2 H.2.E.4 H.3.S.3	P P	P	P P	CCC is stability and change.  The "reasoning" component of this standard is new.
HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.	H.2.E.4 H.3 H.4.D.1-4	P	P S	S	CCC are stability and change and cause and effect. Biodiversity is a new component.
HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.	H.3.S.3	N	P	N	CCC is cause and effect.

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### Grade: High School Life Science

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>HS-LS3 Heredity: Inheritance and Variation of Traits</i>					
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.	H.1.L.2 H.1.L.3 H.3.S.1	P S	P	P	CCC are cause and effect and structure and function.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.	H.2.L.3 H.2.L.4 H.3.S.1 H.3.S.3	P P	P P N	P	CCC is cause and effect.  Engaging in argument from evidence is new.
HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	H.1.L.3 H.3.S.3	N P	P	N	CCC is scale, proportion, and quantity.
<i>HS-LS4 Biological Evolution: Unity and Diversity</i>					
HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.	H.2.L.5 H.3.S.4	S P	N	N	CCC is patterns.
HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.	H.2.L.4 H.2.L.3 H.3.S.3 H.1.L.4 H.2.L.2	P P P P	P	N	CCC is cause and effect.
HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.		N	N	N	CCC is patterns. Practices of mathematics and computational thinking and argumentation from evidence are new.
HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	H.2.L.4 H.3.S.3 H.2.L.2	P P	P	N	CCC is cause and effect.

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### Grade: High School Life Science

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
HS-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.	H.2.L.2 H.2.L.4 H.3.S.3	P P	P	N	CCC are cause and effect and stability and change. This standard offers a strong example of an opportunity to include H.3.S.4 as a historical background to the content.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.	H.4.D.1-4	N	S	N	CCC is cause and effect.
<i>HS-ETS1 Engineering Design</i>					
HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	H.4D.1 H.4D.3	S P/N	P/N P/N	P P	NGSS is more contextualized, rigorous, and includes global perspective.
HS-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.	H.4D.2 H.4D.4 H.4D.6	P P P	P P P		Combination of these three 2009 ORSS provides a strong alignment.
HS-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.	H.4D.1 H.4D.3 H.4D.4 H.4D.5 H.4D.6	P P S P S	P N S P S	P P S P P	Combination of these three 2009 ORSS provides a strong alignment.
HS-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.	H.4D.1 H.4D.3 H.4D.4	P P P	N N N	P P P	2009 ORSS are loosely tied to modeling but not explicitly stated.
<b>2009 ORSS not aligned to any NGSS:</b>					
H.3.S.5. Explain how technological problems and advances create a demand for new scientific knowledge and how new knowledge enables the creation of new technologies.					
H.4.D.5 Describe how new technologies enable new lines of scientific inquiry and are largely responsible for changes in how people live and work.					
H.4.D.6 Evaluate ways that ethics, public opinion, and government policy influence the work of engineers and scientists, and how the results of their work impact human society and the environment.					

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### Grade: High School Earth and Space Science

- The teaching and learning needs to be engaging hands-on with connections to employers and real world contexts.
- NGSS include more higher level expectations.
- Earth science is a life skill important to all students and their science literacy, citizenship, and connects science to student's own environmental well-being.

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>HS-ESS1 Earth's Place in the Universe</i>					
HS-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 in the form of radiation.	H.2E.3 H.1P.1 H.2P.3	P P S	N N N	N N N	
HS-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.	H.2E.3 H.2P.3	P	N	N P	No explicit mention in the 2009 ORSS of Big Bang theory.
HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.	H.1E.1 H.2E.3	P S	N S	N N	Content is strongly aligned when both 2009 ORSS are combined.
HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.	H.2P.4	P	N	N	
HS-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.	H.1E.2 H.2E.1 H.2E.2 H.3S.3	S S S	N N N	S	NGSS is more specific than the 2009 ORSS. Evaluation of evidence is new.
HS-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.	H.3S.1 H.2E.2 H.2E.3 H.3S.4	S P P	N N N	S	Earth's early history is new. Evaluation of evidence is new.
<i>HS-ESS2 Earth's Systems</i>					
HS-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.	H.1E.2 H.2E.1 H.2E.2	P S S	N N P	P	Develop a model is new.

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### Grade: High School Earth and Space Science

NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.	H.2E.1 H.2E.4 H.2L.2 H.3S.3 H.3S.5	S S S	N S N S	P    P	Feedback loops and stability are new. Cost benefit analysis is new.
HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.	H.2E.1 H.2E.2 H.2P.3 H.4D.5	S S S	N N N	S   P	Develop a model is new.
HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.	H.2E.1 H.2E.2 H.2P.3 H.3S.3	S S S	N N N	   S	Use a model is new.
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	All H.3 H.1E.2 H.1P.2 H.2E.1-2 H.2E.4 H.2P.1 H.4D.6	P P P N	S N N N N	 P  P	
HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.	H.1E.2 H.2E.1 H.2L.1 H.2E.2 H.2P.2 H.2P.3	P S P P P	N N N N	    S S	
HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.	H.2L.4 H.2L.5 H.2E.2-4 H.3S.1 H.3S.4 H.1L.4 H.2L.2 H.1L.3 H.2L.1	P P S  P P P P	N N N N N N N N	P P P  P P P	This addresses both how the Earth system impacts biology and how biology impacts the Earth system.

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NGSS PE	2009 ORSS	NGSS Content	NGSS Practice	NGSS CCC	Notes on Alignment
<i>HS-ESS3 Earth and Human Activity</i>					
HS-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.	H.2E.4 H.3S.3 H.1P.1 H.2L.2 H.4D.5	S  P P	P N N	P S P  P	2009 ORSS H.1P.1 nuclear energy to mitigate greenhouse gasses creates hazards.
HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.	H.4D.4 H.4D.6 H.2E.4 H.2P.3	  S P	S N N N	S S	2009 ORSS H.4D.6 doesn't explicitly address macro-economics.
HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.	H.2L.2 H.2E.2 H.2E.4 H.4D.5	P P P	N N N	P P N P	Creating a computational simulation is new. STEM and CCSS math connection.
HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.	H.4D.4 H.4D.5 H.4D.6 H.2E.4 H.3S.5	   S	S P N N	P N N N P	
HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.	H.1E.2 H.2E.1-3 H.2E.4 H.3S.2	P P P	N N N P	  P	Use of models is new.
HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.	H.2E.4 H.3S.2 H.4D.1	S	N	N P P	Use of computational representation is new.
<i>HS-ETS1 Engineering Design</i>					
HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	H.4D.1 H.4D.3	S P/N	P/N P/N	P P	NGSS is more contextualized, rigorous, and includes global perspective.
HS-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.	H.4D.2 H.4D.4 H.4D.6	P P P	P P P		Combination of these three 2009 ORSS provides a strong alignment.

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HS-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.	H.4D.1 H.4D.3 H.4D.4 H.4D.5 H.4D.6	P P S P S	P N S P S	P P S P P	Combination of these three 2009 ORSS provides a strong alignment.
HS-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.	H.4D.1 H.4D.3 H.4D.4	P P P	N N N	P P P	2009 ORSS are loosely tied to modeling but not explicitly stated.
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H.4.D.6 Evaluate ways that ethics, public opinion, and government policy influence the work of engineers and scientists, and how the results of their work impact human society and the environment.					