Washington State Science Standards, Comparison Document
Standards Addressed in the Physical Science Course Compared to Middle School Science Standards,
OSPI Science Standards, http://www.k12.wa.us/Science/Standards.aspx

Topic	Middle School Standards	High School Standards	Math Standards
Life Cycle of a Star		ES1A Stars have "*life cycles*." During most of their "lives", stars produce heavier *elements from lighter elements* starting with the *fusion* of hydrogen to *form* helium. The heaviest *elements* are formed when massive stars "die" in massive explosions.	
Big Bang Theory		ES1B The *Big Bang theory* of the origin of the universe is based on *evidence* (e.g., red shift) that all galaxies are rushing apart from one another. As space expanded and *matter* began to cool, gravitational attraction pulled clumps of *matter* together, forming the stars and galaxies, clouds of *gas* and dust, and planetary *systems* that we see today. If we were to run time backwards, the universe gets constantly smaller, shrinking to almost zero size 13.7 billion years ago.	
Uneven heating of Earth	ES2B The Sun is the major source of *energy* for *phenomena* on Earth's surface, such as *winds*, ocean currents, and the water cycle.	ES2A *Global climate* differences result from the uneven heating of Earth's surface by the Sun. Seasonal *climate variations* are due to the tilt of Earth's axis with respect to the plane of Earth's nearly circular *orbit* around the Sun.	
Climate		ES2B *Climate* is determined by *energy transfer* from the sun at and near Earth's surface. This *energy transfer* is influenced by dynamic processes such as cloud cover and Earth's rotation, as well as static conditions such as proximity to mountain ranges and the ocean. Human activities, such as burning of *fossil fuels*, also affect the *global climate*.	
Evolution of Earth		ES3A *Interactions* among the *solid* Earth, the oceans, the *atmosphere*, and *organisms* have resulted in the ongoing *evolution* of the Earth *system*. We can observe changes such as earthquakes and volcanic eruptions on a human time scale, but many processes such as mountain building and plate movements take place over hundreds of millions of years.	

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Moon Phases and Eclipses	ES1A The *Moon*'s monthly cycle of phases can be explained by its changing relative position as it *orbits* Earth. An *eclipse* of the *Moon* occurs when the *Moon* enters Earth's shadow. An *eclipse* of the Sun occurs when the *Moon* is between the Earth and Sun, and the *Moon*'s shadow falls on the Earth.		
The Solar System	ES1B Earth is the third planet from the sun in a *system* that includes the *Moon*, the Sun, seven other major planets and their *moons*, and smaller objects such as *asteroids*, *plutoids*, *dwarf planets* and *comets*. These bodies differ in many *characteristics* (e.g., size, composition, relative position).		7.2.D Make Scale drawings and solve problems related to scale
Relative Motion of the Sun, Moon and Earth	ES1C Most objects in the *Solar System* are in regular and predictable *motion*. These *motions explain* such *phenomena* as the day, the year, *phases of the Moon*, and *eclipses*.		
Gravity and Orbits	ES1D *Gravity* is the *force* that keeps planets in *orbit* around the Sun and governs the rest of the *motion* in the *Solar System*. *Gravity* alone holds us to the Earth's surface.		
The Galaxy	ES1E Our Sun is one of hundreds of billions of stars in the Milky Way galaxy. Many of these stars have planets *orbiting* around them. The Milky Way galaxy is one of hundreds of billions of galaxies in the universe.		
Earth's Atmosphere	ES2A The *atmosphere* is a *mixture* of nitrogen, oxygen, and trace *gases* that include *water vapor*. The *atmosphere* has different *properties* at different elevations.		
Water Cycle	ES2C In the water cycle, *w*ater evaporates from Earth's surface, rises and cools, condenses to form clouds and falls as rain or snow and collects in bodies of water.		
Water as a Solvent	ES2D Water is a solvent. As it passes through the water cycle, it dissolves minerals and *gases* and carries them to the oceans.		
Layers of Earth	ES2E The *solid* Earth is composed of a relatively thin *crust*, a dense metallic *core*, and a layer called the *mantle* between the *crust* and *core* that is very hot and partially melted.		7.2.D Make Scale drawings and solve problems related to scale

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Crustal Plates	ES2F The *crust* is composed of huge *crustal plates* on the scale of continents and oceans which move centimeters per year, pushed by *convection* in the upper *mantle*, causing earthquakes, volcanoes, and mountains.		
Landforms	ES2G Landforms are created by processes that build up structures and processes that break down and carry away material through *erosion* and *weathering*.		
Rock Cycle	ES2H The rock cycle *describes* the formation of *igneous rock* from magma or lava, *sedimentary* rock from compaction of eroded particles, and *metamorphic* rock by heating and pressure.		
Clues to Earth's Past	ES3A Our understanding of Earth history is based on the assumption that processes we see today are similar to those that occurred in the past.		6.3.B Write ratios to represent a variety of rates.
Estimating Age of Landforms	ES3B Thousands of layers of *sedimentary rock* provide *evidence* that allows us to determine the age of Earth's changing surface and to estimate the age of *fossils* found in the rocks.		
Sedimentary Rock Layers	ES3C In most locations *sedimentary* rocks are in horizontal formations with the oldest layers on the bottom. However, in some locations, rock layers are folded, tipped, or even inverted, providing *evidence* of geologic events in the distant past.		
Natural Catastrophes and Landforms	ES3D Earth has been shaped by many natural catastrophes, including earthquakes, volcanic eruptions, glaciers, floods, storms, *tsunami*, and the impacts of *asteroid*s.		
Living Organisms and Landforms	ES3E Living *organisms* have played several critical roles in shaping landforms that we see today.		
Speed	PS1A *Average speed* is defined as the distance traveled in a given period of time.		6.1.F Fluidly and accurately multiply and divide non-negative decimals. 6.2.E Solve one-step equations and verify the

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			solutions. 6.2.F Solve word problems using mathematical expressions and equations, and verify the solutions. 6.3.B Write ratios to represent a variety of rates. 6.3.D Solve single- and multi-step word problems involving ratios, rates, and percentages, and verify the solutions. 5.5.C Construct and interpret line graphs. 7.5.A Graph ordered pairs of rational numbers and determine the coordinates of a point in the coordinate plane.
Velocity		PS1A *Average velocity* is defined as a change in position with respect to time. *Velocity* includes both *speed* and direction.	7.2.E Represent proportional relationships using graphs, tables, and equations, and make connections among the representations. 7.2.F Determine the slope of a line corresponding to the graph of a proportional relationship, and relate slope to similar triangles. A1.3.B Represent a function with a symbolic expression, as a graph, in a table, and using words, and make connections among these representations. A1.4.C Identify and interpret the slopes and intercepts of a linear function, including equations for parallel and

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			perpendicular lines. A1.2.B Recognize the multiple uses of variables, determine all possible values of variables that satisfy prescribed conditions, and evaluate algebraic expressions that involve variables. A1.8.A Analyze a problem situation and represent it mathematically.
Acceleration		PS1B *Average acceleration* is defined as a change in *velocity* with respect to time. *Acceleration* indicates a change in *speed* and/or a change in direction.	Math standards listed for PS1A plus: A1.4.C Identify and interpret the slopes and intercepts of a linear function, including equations for parallel and perpendicular lines. A1.2.B Recognize the multiple uses of variables, determine all possible values of variables that satisfy prescribed conditions, and evaluate algebraic expressions that involve variables.
Frictional Forces	PS1B *Friction* is a *force* that can help objects start moving, stop moving, slow down or can change the direction of the object's *motion*.		
Balanced and Unbalanced Forces	PS1C Unbalanced *forces* will cause changes in the *speed* or direction of an object's *motion*. The *motion* of an object will stay the same when forces are balanced.		7.2.H Determine whether or not a relationship is proportional and explain your reasoning.

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Force and Mass	PS1D The same unbalanced *force* will change the *motion* of an object with more *mass* more slowly than an object with less *mass*.		
Newton's 1st Law		PS1C An object at rest will remain at rest unless acted on by an unbalanced *force*. An object in *motion* at constant *velocity* will continue at the same *velocity* unless acted on by an unbalanced *force*. (Newton's First Law of Motion, the Law of Inertia)	
Newton's 2nd Law		PS1D A net *force* will cause an object to *accelerate* or change direction. A less massive object will *speed* up more quickly than a more massive object subjected to the same *force*. (Newton's Second Law of Motion, F=ma)	7.2.E Represent proportional relationships, using graphs, tables, and equations, and make connections among the representations. A1.6.B Make valid inferences and draw conclusions based on data. A1.2.B Recognize the multiple uses of variables, determine all possible values of variables that satisfy prescribed conditions, and evaluate algebraic expressions that involve variables. A1.7.D Solve an equation involving several variables by expressing one variable in terms of the others.
Newton's 3rd Law		PS1E Whenever one object exerts a *force* on another object, a *force* of equal magnitude is exerted on the first object in the opposite direction. (Newton's Third Law of Motion)	
Universal Gravitation		PS1F *Gravitation* is a universal attractive *force* by which objects with *mass* attract one another. The gravitational *force* between two objects is proportional to their *masses* and inversely proportional to the square of the distance between the objects. (Newton's *Law* of Universal Gravitation)	A1.3.B Represent a function with a symbolic expression, as a graph, in a table, and using words, and make connections among these representations.

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			A1.6.B Make valid inferences and draw conclusions based on data. A1.7.D Solve an equation involving several variables by expressing one variable in terms of the others.
Atomic Structure		PS2A *Atoms* are composed of *protons*, *neutrons*, and *electrons*. The *nucleus* of an *atom* takes up very little of the *atom*'s volume but makes up almost all of the *mass*. The *nucleus* contains *protons* and *neutrons*, which are much more massive than the *electrons* surrounding the *nucleus*. *Protons* have a positive charge, *electrons* are negative in charge, and *neutrons* have no net charge.	
Electron Structures		PS2B *Atoms* of the same *element* have the same number of *protons*. The number and arrangement of *electrons* determines how the *atom* interacts with other *atoms* to *form molecules* and *ionic crystals*.	
Periodic Table		PS2C When *elements* are listed in order according to the number of *protons*, repeating *patterns* of physical and *chemical properties* identify families of *elements* with similar *properties*. This Periodic Table is a consequence of the repeating *pattern* of outermost *electrons*.	
Ions (Introduced)		PS2D *Ions* are produced when *atoms* or *molecules* lose or gain *electrons*, thereby gaining a positive or negative electrical charge. *Ions* of opposite charge are attracted to each other, forming *ionic bonds*. Chemical formulas for *ionic compounds* represent the proportion of *ion* of each *element* in the *ionic crystal*.	

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Molecular Compounds (Introduced)		PS2E *Molecular compounds* are composed of two or more *elements* bonded together in a fixed proportion by sharing *electrons* between *atoms*, forming *covalent bond*s. Such *compounds* consist of well-defined *molecules*. Formulas of *covalent compounds* represent the types and number of *atoms* of each *element* in each *molecule*.	G.3.J Describe prisms, pyramids, parallelepipeds, tetrahedra, and regular polyhedra in terms of their faces, edges, vertices, and properties.
Chemical Reactions (Introduced)		PS2G *Chemical reactions* change the arrangement of *atoms* in the *molecules* of substances. *Chemical reactions* release or acquire *energy* from their surroundings and result in the formation of new substances.	
Characteristic Intrinsic Properties	PS2A Substances have *characteristic intrinsic properties* such as *density*, *solubility*, *boiling point*, and *melting point*, all of which are independent of the amount of the sample.		
Compounds and Mixtures	PS2B *Mixtures* are combinations of substances whose *chemical properties* are preserved. *Compounds* are substances that are chemically formed and have different physical and *chemical properties* from the reacting substances.		
Atoms and Elements	PS2C All *matter* is made of *atoms*. *Matter* made of only one type of *atom* is called an *element*.		
Molecules and Compounds	PS2D *Compounds* are composed of two or more kinds of *atoms*, which are bound together in well-defined *molecules* or crystals.		
States of Matter	PS2E *Solids*, *liquids*, and *gases* differ in the *motion* of individual particles. In *solids*, particles are packed in a nearly rigid structure; in *liquids*, particles move around one another; and in *gases*, particles move almost independently.		
Conservation of Mass	PS2F When substances within a *closed system* interact, the total *mass* of the *system* remains the same. This *concept*, called *conservation of mass*, applies to all physical and *chemical changes*.		6.1.F Solve word problems, using mathematical expressions and equations, and verify solutions. 7.1.E Solve two-step linear

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			equations.
Conservation of Energy		PS3A Although *energy* can be *transferred* from one object to another and can be *transformed* from one form of *energy* to another *form*, the total *energy* in a *closed system* remains the same. The *concept* of *conservation of energy*, applies to all physical and chemical changes.	G.6.F Solve problems involving measurement conversions within and between systems, including those involving derived units, and analyze solutions in terms of reasonableness of solutions and appropriate units.
Kinetic Energy		PS3B *Kinetic energy* is the *energy* of *motion*. The kinetic *energy* of an object is defined by the equation: $E_k = ½ mv^2$	A1.2.B Recognize the multiple uses of variables, determine all possible values of variables that satisfy prescribed conditions, and evaluate algebraic expressions that involve variables. A1.7.D Solve an equation involving several variables by expressing one variable in terms of the others.
Gravitational Potential Energy		PS3C *Gravitational potential energy* is due to the separation of mutually attracting *masses*. *Transformations* can occur between *gravitational potential energy* and *kinetic energy*, but the total amount of *energy* remains constant.	
Waves	PS3F *Energy* can be *transferred* from one place to another through *waves*. *Waves* include vibrations in materials. Sound and earthquake *waves* are examples. These and other *waves* move at different *speeds* in different materials.	PS3D *Waves* (including sound, seismic, light, and water *waves*) *transfer energy* when they interact with *matter*. *Waves* can have different *wavelengths*, *frequencies*, and *amplitudes*, and travel at different *speeds*.	A1.2.B Recognize the multiple uses of variables, determine all possible values of variables that satisfy prescribed conditions, and evaluate algebraic expressions that involve variables. A1.7.D Solve an equation involving several variables by expressing one variable in terms of the others.

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Electromagnetic Waves		PS3E *Electromagnetic waves* differ from physical *waves* because they do not require a medium and they all travel at the same *speed* in a vacuum. This is the maximum *speed* that any object or *wave* can travel. Forms of *electromagnetic waves* include X-rays, ultraviolet, visible light, infrared, and radio.	
Energy Forms, Transfers, and Transformations	PS3A *Energy* exists in many forms which include: *heat*, light, chemical, electrical, *motion* of objects, and sound. *Energy* can be *transformed* from one *form* to another and *transferred* from one place to another.		
Heat (Thermal) Energy Transfer	PS3B *Heat* (thermal *energy*) flows from warmer to cooler objects until both reach the same *temperature*. *Conduction*, *radiation*, and *convection*, or *mechanical mixing*, are means of *energy transfer*.		
Molecular Motion and Temperature	PS3C *Heat* (thermal *energy*) consists of random *motion* and the vibrations of *atoms* and *molecules*. The higher the *temperature*, the greater the atomic or molecular *motion*. Thermal *insulators* are materials that resist the flow of *heat*.		
Light Energy	PS3D Visible light from the Sun is made up of a mixture of all colors of light. To see an object, light emitted or reflected by that object must enter the eye.		
Electrical Energy	PS3E *Energy* from a variety of sources can be transformed into electrical *energy*, and then to almost any other *form* of *energy*. Electricity can also be distributed quickly to distant locations.		