Washington Physics Standards Correlation

Essential Academic Learning Requirements: Science, Grade 9/10

Note: Only Grade Level Expectations for Physical Systems are listed below.
"W" indicates that the GLE is eligible for the WASL.

	Physics for Scientists and Engineers	Principles of Physics	Conceptual Physics
EALR 1 — SYSTEMS			
Component 1.1 Properties: Understand how properties are used to identify, describe, and categorize substances, materials, and objects and how characteristics are used to categorize living things.			
1.1.1 Properties of Substances			
Understand the atomic nature of matter, how it relates to physical and chemical properties and serves as the basis for the structure and use of the periodic table. W			
(10) Identify an unknown substance using the substance's physical and chemical properties.	5.19, 5.20, 12.13 - 12.15, 14.25, 17.4, 19.11, 19.14, 19.17, 19.22, 19.26, 21.12, 21.17, 27.8, 27.11, 34.3, 37.2	5.19, 5.20, 12.12 - 12.14, 14.24, 17.4, 19.9, 19.12, 19.14, 19.19, 19.23, 21.11, 21.16, 27.5, 27.7, 36.2	5.17, 5.18, 11.7 - 11.8, 18.8, 18.11, 18.12, 18.15, 18.18, 25.5, 25.6, 32.2
(10) Explain and predict the behavior of a substance based upon the substance's atomic structure, physical properties, and chemical properties.	Sections listed above and 21.15, 24.17, 34.1, 34.4, 34.5, 35.20, Chapter 42	Sections listed above and 21.14, 24.17, 30.6, 34.16, Chapter 41	Sections listed above and 23.12, 28.6, 30.7, Chapter 36
(10) Describe the properties of electrons, protons, and neutrons (i.e., electrons have negative charge and very little mass, protons have positive charge and much mass, neutrons have neutral charge and the same mass as protons).	44.3	43.3	38.3
(10) Explain how changing the number of electrons, neutrons, and protons of an atom affects that atom, including atomic name, number, and placement on the periodic table.	44.3	43.3	38.3
(10) Explain the similar properties of elements in a vertical column (groups or families) of the periodic table.	n/a	n/a	n/a
(10) Predict the properties of an element based on the element's location (groups or families) on the periodic table.	n/a	n/a	n/a

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1.1.2 Motion of Objects			
Apply an understanding of direction, speed, and acceleration when describing the linear motion of objects. W			
(9) Describe the linear motion (speed, direction, and acceleration) of an object over a given time interval relative to Earth or some other object (e.g., as a car accelerates onto a freeway the car speeds up from 30 km/hr to 90 km/hr in 10 sec.).	Chapter 2	Chapter 2	Chapter 2
(9) Determine and explain the average speed of an object over a given time interval when the object is moving in a straight line.	2.3 - 2.4	2.3 - 2.4	2.3 - 2.4
1.1.3 Wave Behavior			
Analyze sound waves, water waves, and light waves using wave properties, including frequency and energy. Understand wave interference. W			
(10) Describe the relationship between the wave properties of amplitude and frequency and the energy of a wave (e.g., loud vs. soft sound, high vs. low pitch sound, bright vs. dim light, blue light vs. red light).	16.4 - 16.6, 16.19, 17.2, 17.10, 35.1, 35.10	16.4 - 16.6, 17.2, 17.8, 34.1, 34.7	15.4 - 15.6, 16.2, 16.4, 30.1
(10) Explain the relationship between a wave's speed and the properties of the substance through which the wave travels (e.g., all sound regardless of loudness and pitch travels at the same speed in the same air; a wave changes speed only when traveling from one substance to another).	16.8, 17.4 - 17.7	16.8, 17.4 - 17.6	15.8
(10) Predict and explain what happens to the pitch of sound and color of light as the wave frequency increases or decreases.	17.2 - 17.3, 35.1	17.2 - 17.3, 34.1	16.2 - 16.3, 30.1
(10) Compare the properties of light waves, sound waves, and water waves.	Chapters 16, 17, 18, 35	Chapters 16, 17, 18, 34	Chapters 15, 16, 17, 30
(10) Describe the effects of wave interference (constructive and destructive).	Chapters 18, 39, 40	Chapters 18, 38, 39	Chapters 17 & 34
1.1.4 Forms of Energy			
Analyze the forms of energy in a system, subsystems, or parts of a system. W			
(10) Explain the forms of energy present in a system (i.e., thermal energy, sound energy, light energy, electrical energy, kinetic energy, potential energy, chemical energy, and nuclear energy).	7.7, 7.8, 7.16, 11.18, 13.28, 15.20, 17.10, 19.9, 25.1, 28.9, 32.36, 35.9, 35.10, 44.9	7.5, 7.6, 7.13, 11.13, 13.21, 15.18, 17.8, 19.7, 25.1, 28.7, 32.29, 34.6, 34.7, 43.9	6.3, 6.4, 6.10, 12.17, 16.4, 18.6, 24.1, 26.4, 38.9

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(10) Compare the potential and/or kinetic energy of parts of systems at various locations or times (i.e., kinetic energy is an object's energy of motion; potential energy is an object's energy of position).	7.22 - 7.26, 13.28, 15.21	7.19 - 7.22, 13.21, 15.19	6.16 - 6.19, 12.17
(10) Measure and describe the thermal energy of a system, subsystem, and/or parts of a system in terms of molecular motion (temperature) and energy from a phase change (e.g., observe, measure, and record temperature changes over time while heating ice to boiling water).	Chapter 19	Chapter 19	Chapter 18
Component 1.2 Structures: Understand how components, structures, organizations, and interconnections describe systems.			
1.2.2 Energy Transfer and Transformation			
Analyze energy transfers and transformations within a system, including energy conservation. W			
(9) Describe and determine the energy inputted to an object as work (i.e., work on an object is the product of the force acting on the object and the distance the object moves as the force acts).	7.1	7.1	6.1
(9) Describe how a machine transfers work and transforms force and distance through a force-distance tradeoff (e.g., a small force acting over a long distance can be transformed to a large force acting over a short distance).	11.1 - 11.2	11.1 - 11.2	10.1
(9) Examine and explain how energy is transferred within and among systems.	7.7, 7.29, 11.19, 15.35, 17.10, 19.25 - 19.31, 21.1, 25.15, 32.36, 33.4, 33.33, 35.9 - 35.10, 35.17	7.5, 7.23, 11.14, 15.28, 17.8, 19.22 - 19.28, 21.1, 25.12, 32.29, 33.24, 34.6 - 34.7, 34.13	6.3, 6.20, 10.7, 14.14, 16.4, 18.17 - 18.20, 20.1, 24.7
(10) Distinguish conditions likely to result in transfers or transformations of energy from one part of a system to another (e.g., a temperature difference may result in the flow of thermal energy from a hot area to a cold area).	19.7, 25.15	19.5, 25.12	18.5, 24.7

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(10) Describe what happens in terms of energy conservation to a system's total energy as energy is transferred or transformed (e.g., energy is never "lost," the sum of kinetic and potential energy remains somewhat constant).	7.22, 15.21, 33.4	7.19, 15.19	6.16
(10) Explain the relationship between the motion of particles in a substance and the transfer or transformation of thermal and electrical energy (e.g., conduction of thermal and electrical energy as particles collide or interact, convection of thermal energy as groups of particles move from one place to another, and light waves transforming into thermal energy).	19.25 - 19.30	19.22 - 19.27	18.17 - 18.20
(10) Explain how or whether a phase change, a chemical reaction, or a nuclear reaction absorbs or releases energy in a system (e.g., water vapor forming rain or snow releases energy; water molecules speed up as they absorb energy until the molecules gain enough energy to become water vapor).	19.21 - 19.24, 44.9 - 44.15	19.18 - 19.21, 43.9 - 43.15	18.14 - 18.16, 38.9 - 38.15
1.2.3 Structure of Matter			
Understand the structure of atoms, how atoms bond to form molecules, and that molecules form solutions. W			
(10) Describe molecules forming a solution (e.g., salt added to water dissolves, forming a salt water solution, until saturation when no more salt will dissolve).	n/a	n/a	n/a
(10) Describe how to separate mixtures and or solutions of several different kinds of substances (e.g., sand, sugar, iron filings).	n/a	n/a	n/a
(10) Describe the structure of atoms in terms of protons and neutrons forming the nucleus, which is surrounded by electrons (e.g., a helium atom usually has a nucleus formed by 2 protons and 2 neutrons, which is surrounded by 2 electrons).	44.1, 44.3	43.1, 43.3	38.1, 38.3
(10) Describe how atoms bond to form molecules in terms of transferring and/or sharing electrons (e.g., sodium atoms transfer an electron to chlorine atoms to form salt).	n/a	n/a	n/a

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Component 1.3 Changes: Understand how interactions within and among systems cause changes in matter and energy.			
1.3.1 Nature of Force			
Analyze the forces acting on objects. W			
(9) Describe how machines transform forces (e.g., a long lever allows a small downward input force to be transformed into a large upward output force).	11.1 - 11.2	11.1 - 11.2	10.1
(9) Describe the strength (in newtons [N]) and direction of forces acting on an object.	Chapters 5, 6	Chapters 5, 6	Chapter 5
(9) Measure and describe the sum of all the forces acting on an object.	Chapters 5, 6	Chapters 5, 6	Chapter 5
(9) Describe how forces between objects occur, both when the objects are touching and when the objects are apart.	5.11, 5.12, 5.18, 5.30, 13.1, 13.10, 24.1, 30.2	5.11, 5.12, 5.18, 5.30, 13.1, 24.1, 30.2	5.11, 5.12, 5.16, 5.24, 12.1, 23.1, 28.2
(9) Explain that the strength of a gravitational force between two objects depends on the mass of the objects and the distance between the objects.	13.1	13.1	12.1
1.3.2 Forces to Explain Motion			
Analyze the effects of balanced and unbalanced forces on the motion of an object. W			
(9) Describe the balanced forces acting on an object moving at a constant speed along a straight line, 1st Law of Motion (e.g., a car traveling at a constant speed of 60 mph on a straight freeway has a force pushing it forward balanced by frictional forces acting in the opposite direction).	5.1, 5.2, Chapters 5 & 6	5.1, 5.2, Chapters 5 & 6	5.1, 5.2, Chapter 5
(9) Explain how unbalanced forces change the speed and/or direction of motion of different objects moving along a straight line, 2nd Law of Motion (e.g., a 2-kg object needs twice the unbalanced force to speed up the same amount as a 1-kg object).	5.5, 9.7, Chapters 5 & 6	5.5, 9.6, Chapters 5 & 6	5.5, 8.5, Chapter 5
(9) Investigate and describe that forces always come in pairs, 3rd Law of Motion (e.g., pull a spring scale against another spring scale, as water blasts out of a bottle rocket two forces act — a force on the water and an equal force on the rocket).	5.10, 5.13, Chapters 5 & 6	5.10, 5.13, Chapters 5 & 6	5.10, 5.13, Chapter 5
1.3.3 Conservation of Matter and Energy			
Analyze the factors that affect physical, chemical, and nuclear changes and understand that matter and energy are conserved. W			

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(9) Investigate and analyze the effect of different factors on the rate of a physical and chemical change (e.g., temperature, surface area, pressure, catalysts).	19.26	19.23	18.18
(9) Explain how chemical changes produce substances with different chemical properties and the same total mass.	n/a	n/a	n/a
(9) Describe the products of radioactive decay in terms of the conservation of matter and energy (e.g., a radioactive nucleus decays into a new nucleus and emits particles and rays).	44.15 - 44.16	43.15 - 43.16	38.15
(9) Recognize and explain that the rate of radioactive decay of a substance is constant, not affected by any factors (e.g., the half-life of a radioactive substance is constant over a long time and a wide range of conditions found on Earth).	44.18 - 44.19	43.18 - 43.19	38.17