

# Middle School

## OREGON State Standards

### Grades 6,7,8

#### Science

#### Earth & Space Science

#### 6.ESS2 Earth's Systems

6.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.**  
[Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.]

6.ESS2.5 **Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. ^**  
[Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).]

6.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. ^** [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.]

#### 7.ESS2 Earth's Systems

7.ESS2.1 **Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.]

## 7.ESS2 Earth's Systems (cont)

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| 7.ESS2.2 | <b>Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.</b> [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.] |
| 7.ESS2.3 | <b>Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.</b> [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).]                                                                                                                                                                                                                                                                                                                                                          |

## 8.ESS1 Earth's Place in the Universe

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| 8.ESS1.1 | <b>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.</b> [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]                                                                                                                                                                                                                                                                                                                            |
| 8.ESS1.2 | <b>Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.</b> [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them.]                                                                                                                                                                                                                                                                        |
| 8.ESS1.3 | <b>Analyze and interpret data to determine scale properties of objects in the solar system.</b> [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius.]                                                                                                    |
| 8.ESS1.4 | <b>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.</b> [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life).] |

# Middle School Engineering, Technology, and the Application of Science

## MS.ETS1 Engineering Design

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| 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. ^ |
| MS.ETS1.2 | Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.                                                                                                                            |
| 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                                         |
| 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.                                                                                                            |

# Life Science

## 6.LS1 From Molecules to Organisms: Structures and Processes

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| 6.LS1.1  | <b>Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.</b> [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]                                                                                                                                                                                                                                                       |
| 6.LS1.2  | <b>Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.</b> [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.]                                                                                                                                                                                                                                                                                                   |
| 6.LS1.3† | <b>Construct an explanation supported by evidence for how the body is composed of interacting systems consisting of cells, tissues, and organs working together to maintain homeostasis.</b> [Clarification Statement: Emphasis should be on the function and interactions of the major body systems (e.g. circulatory, respiratory, nervous, musculoskeletal).] [Assessment Boundary: Assessment is focused on the interactions between systems not on the functions of individual systems.]                                                                                                                                                                 |
| 6.LS1.4  | <b>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.</b> [Clarification Statement: Emphasis is on both animals and plants (behaviors and structures). Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding.                           |
| 6.LS1.5  | <b>Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</b> Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds. |
| 6.LS1.8  | <b>Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## 6.LS3 Heredity: Inheritance and Variation of Traits

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| 6.LS3.2 | <b>Develop and use models to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.</b> [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.] |
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## 7.LS1 From Molecules to Organisms: Structures and Processes

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| 7.LS1.6 | <b>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.</b> ^ [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.]                                                                                            |
| 7.LS1.7 | <b>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.</b> [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] |

## 7.LS2 Ecosystems: Interactions, Energy, and Dynamics

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| 7.LS2.1 | <b>Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.</b> ^ [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]                                                  |
| 7.LS2.2 | <b>Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.</b> ^ [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.] |
| 7.LS2.3 | <b>Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.</b> [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.]                                                                                                                     |

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| 7.LS2.4 | <b>Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.</b> ^ [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.] |
| 7.LS2.5 | <b>Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*</b> ^ [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion.Examples of design solution constraints could include scientific, economic, and social considerations.]                         |

## 8.LS3 Heredity: Inheritance and Variation of Traits

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| 8.LS3.1 | <b>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.</b> [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.] |
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## 8.LS4 Biological Evolution: Unity and Diversity

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| 8.LS4.1 | <b>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.</b> [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] |
| 8.LS4.2 | <b>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.</b> [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]                                                            |
| 8.LS4.3 | <b>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.</b> [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.]                                                                       |

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| 8.LS4.4 | <b>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.</b> [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]                                                                                                                                                                      |
| 8.LS4.5 | <b>Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.</b> [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.] |
| 8.LS4.6 | <b>Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.</b> [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.]                                                                                                                                                  |

## Physical Science

### 6.PS3 Energy

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| 6.PS3.3 | <b>Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.*</b> [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.]                                                                                                                                                                                                                                                                                                                                                                                              |
| 6.PS3.4 | <b>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. ^</b> [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] |
| 6.PS3.5 | <b>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.</b> [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.]                                                                                                                                                                                                                                                     |

# Physical Science(cont)

## 7.PS1 Matter and Its Interactions

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| 7.PS1.1  | <b>Develop models to describe the atomic composition of simple molecules and extended structures.</b> [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.]                                                                                      |
| 7.PS1.2  | <b>Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.</b> [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.]                                                                                                                                                                                                                                                                                     |
| 7.PS1.3  | <b>Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.</b> [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.]                                                                                                                                                                                                                                                                         |
| 7.PS1.4. | <b>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.</b> ^ [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.] |
| 7.PS1.5  | <b>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.</b> [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.]                                                                                                                                                                                                                                                                                                                    |
| 7.PS1.6  | <b>Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*</b> [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.]                                                                                                                                                   |



# Physical Science(cont)

## 8.PS2 Motion and Stability: Forces and Interactions

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| 8.PS2.1 | <b>Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.*</b> [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.]                                                                                                                                                                |
| 8.PS2.2 | <b>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.</b> [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.]                                                                   |
| 8.PS2.3 | <b>Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.</b> [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor. |
| 8.PS2.4 | <b>Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.</b> [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.]                                        |
| 8.PS2.5 | <b>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.</b> [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.]                    |

## 8.PS3 Energy

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| 8.PS3.1 | <b>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.</b> [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.] |
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# Physical Science(cont)

## 8.PS3 Energy

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| 8.PS3.2 | <b>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. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.]</b> |
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## 8.PS4 Waves and Their Applications in Technologies for Information Transfer

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| 8.PS4.1 | <b>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.</b> [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.]                                                                                                                                                                                                                                          |
| 8.PS4.2 | <b>Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.</b> Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.                                                                                                                                                                                                                             |
| 8.PS4.3 | <b>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.</b> Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen. |